Undergraduate Study

Graduate Study
and Research

General Catalog

University of Washington
Bulletin 1984-86

Undergraduate Study
Graduate Study and Research

GENERAL CATALOG 1984-86

University
of Washington
Bulletin

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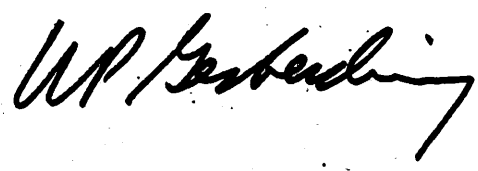
A university is a community of scholars, a place where faculty and students pursue truth and enrich human understanding. Universities have been regarded as essential attributes of civilized societies for hundreds of years, providing training for the professions and more general educational opportunities in scientific and humanistic studies.

The University of Washington has become one of the finest universities in the country, richly combining its research, instructional, and public service missions. It is an exciting place to be, and its contributions to the state and the nation will continue to grow as we all face the formidable challenges of the late twentieth century.



William P. Gerberding
President

ACADEMIC CALENDAR

1984-85

Summer Quarter 1984

Application closing date for all new and former students	May 15
Regular quarter and Term *a* classes begin	June 18
Independence Day holiday	July 4
Term *a* classes end	July 18
Term *b* classes begin	July 19
Regular quarter and Term *b* classes end	August 17

Autumn Quarter 1984

Application closing date for all new students entering from high school	May 1*
Application closing date for all other new and former students	July 1*
Classes begin	October 1
Veterans Day holiday	November 12
Thanksgiving recess	November 22, 23
Last day of instruction	December 12
Final examinations	December 13-20

Winter Quarter 1985

Application closing date for all new and former students	November 1*
Classes begin	January 7
Washington's Birthday holiday	February 18
Last day of instruction	March 15
Final examinations	March 18-22

Spring Quarter 1985

Application closing date for all new and former students	February 1*
Classes begin	April 1
Memorial Day holiday	May 27
Last day of instruction	June 7
Final examinations	June 10-14
Commencement	June 15

Dates in this calendar are subject to change without notice. A detailed calendar with the lastest information on registration is printed in each issue of the *Time Schedule*.

1985-86

Summer Quarter 1985

Application closing date for all new and former students	May 15
Regular quarter and Term *a* classes begin	June 24
Independence Day holiday	July 4
Term *a* classes end	July 24
Term *b* classes begin	July 25
Regular quarter and Term *b* classes end	August 23

Autumn Quarter 1985

Application closing date for all new students entering from high school	May 1*
Application closing date for all other new and former students	July 1*
Classes begin	September 30
Veterans Day holiday	November 11
Thanksgiving recess	November 21, 22
Last day of instruction	December 11
Final examinations	December 12-19

Winter Quarter 1986

Application closing date for all new and former students	November 1*
Classes begin	January 6
Washington's Birthday holiday	February 17
Last day of instruction	March 14
Final examinations	March 17-21

Spring Quarter 1986

Application closing date for all new and former students	February 1*
Classes begin	March 31
Memorial Day holiday	May 26
Last day of instruction	June 6
Final examinations	June 9-13
Commencement	June 14

* If University undergraduate enrollment quotas are filled before the application closing date, it may not be possible to offer enrollment, although an applicant may be scholastically eligible for admission.

The University of Washington, as a standing policy, does not discriminate against individuals because of their race, color, religion, creed, age, sex, sexual orientation, national origin, handicap, or status as a disabled veteran or Vietnam era veteran. Any discriminatory action can be a cause for disciplinary action. This policy applies to all University programs and facilities, including, but not limited to, admissions, educational programs, and employment. Such discrimination is prohibited by Titles VI and VII of the Civil Rights Act of 1964, and Title IX of the Education Amendments of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973, Age Discrimination in Employment Act Amendments of 1978, Vietnam Era Veterans' Readjustment Assistance Act of 1974, and other federal and state statutes and regulations. Coordination of the compliance efforts of the University of Washington with respect to all of these laws and regulations is under the direction of the Equal Employment Officer, Dr. Helen Remick, 101 Lewis, DW-08, Seattle, Washington 98195, telephone (206) 543-1830.

Additional information concerning equality of opportunity and affirmative action policies and procedures including grievance procedures are in the *Operations Manual*, D 45.4, and the *UW Handbook*, Vol. IV, p. 44.

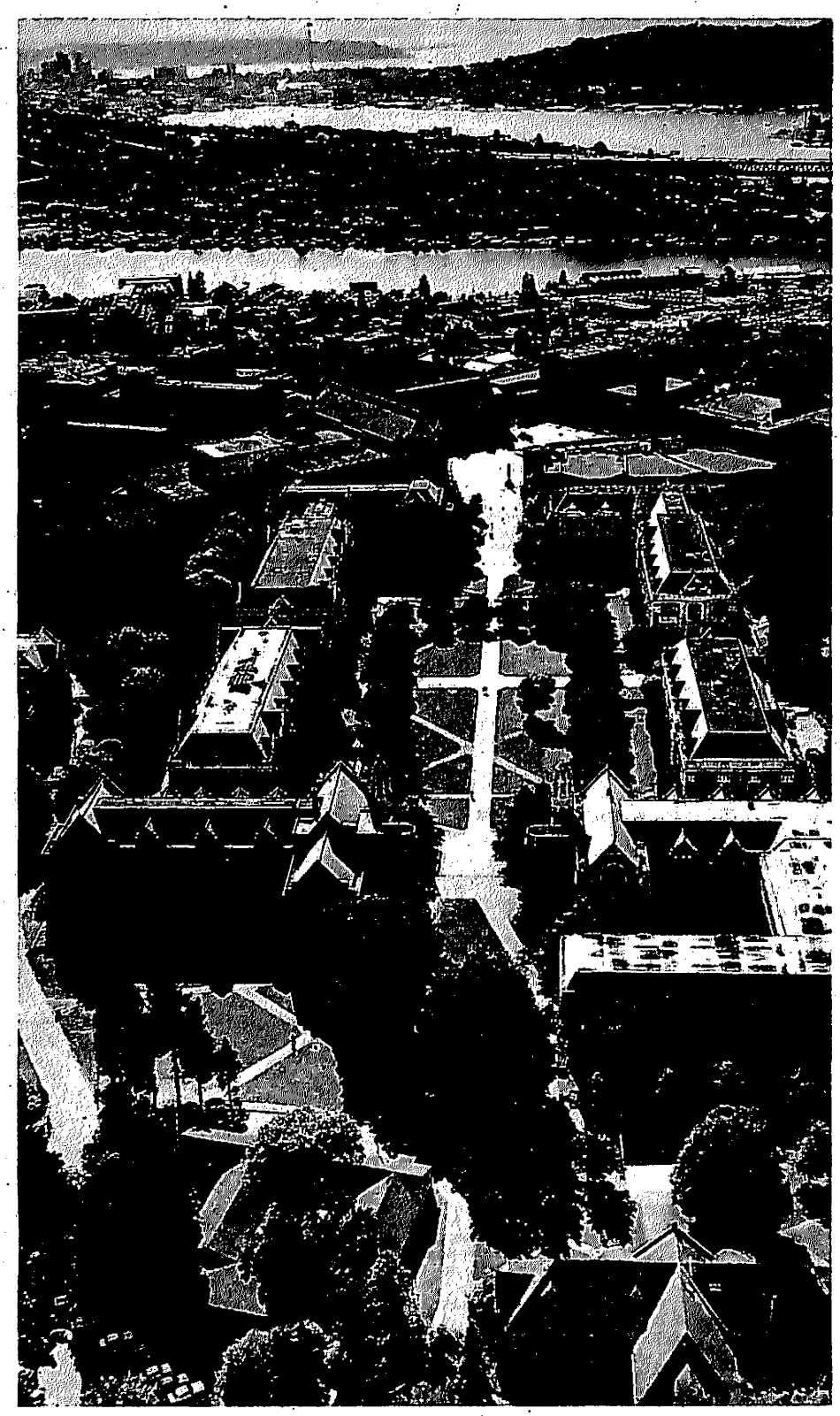
Using the General Catalog

The material in this catalog has been compiled and organized to provide the reader with a comprehensive overall view of the University's programs and courses. It includes academic requirements and procedures necessary for admission and graduation. Information on programs, faculty, and courses is arranged in alphabetical order following departmental structure within each school or college.

Because curriculum revisions and program changes usually occur during the two-year period the *General Catalog* is in circulation, students should assume the responsibility of consulting the appropriate academic unit or adviser for more current or specific information. The quarterly *Time Schedule* gives information on courses offered, class hours, and classroom locations, and has the latest calendar dates, fees, and details on registration.

All announcements in the *General Catalog* are subject to change without notice and do not constitute an agreement between the University of Washington and the student.

THE UNIVERSITY



Founded in 1861, the University of Washington is the oldest state-assisted institution of higher education on the Pacific coast. From its original site on a ten-acre tract of wooded wilderness that is now downtown Seattle, the campus has grown to comprise 680 acres of trees, landscape, and buildings. Located between the shores of Lake Washington and Lake Union, it is in a residential section of the city that has long been considered one of the most attractive in the nation.

Enrollment at the University in Autumn Quarter 1983 was 34,308, of which 25,787 were undergraduates and the balance were in professional and graduate programs. More than three-fourths of the undergraduates enter as freshmen from Washington high schools or as transfer students from Washington community colleges or other colleges and universities in the state. The majority of students who enter the University as freshmen are from the top one-third to one-fifth of their high school graduating class. The grade-point average for the regularly admitted freshman class entering in Autumn Quarter 1983 was 3.42. In 1983-84, the full-time teaching faculty of the University numbered 2,600 members.

The University recognizes as one of its highest educational priorities the need to increase the number of qualified minorities and women in certain academic fields and professions in which they have been historically denied access or traditionally underrepresented in higher education. Through its admission policies, the University attempts to bring in more minorities and women at all levels of its educational programs. In addition, special educational support services are provided through the Office of Minority Affairs and the Graduate School's Minority Education Division to facilitate the entry of persons from underrepresented minorities and to enhance their likelihood of success while attending the University.

Accreditation

The University is accredited by the Northwest Association of Schools and Colleges and is a member of the Association of American Universities. Individual schools and colleges are members of the various accrediting associations in their respective fields.

Academic Sessions

University instruction is offered during Autumn, Winter, and Spring quarters, each lasting approximately eleven weeks. The nine-week Summer Quarter is divided into two 4½-week terms.

Evening Classes

Opportunities for evening study at the University are varied to serve individual students' interests and academic goals. Because day and evening credit classes are integrated, students may enroll in courses during the day or night or in a combination of the two. Extension credit classes and noncredit evening programs, which do not require formal admission to the University, are described in the Continuing Education section of this catalog.

Summer Quarter

During Summer Quarter, a wide selection of courses in most major fields is available to graduate and undergraduate students pursuing degree programs on a year-round basis as well as to summer-only students seeking to broaden, intensify, or refresh their subject-matter competence. Freshman students entering from high school are encouraged to begin their college work in the summer. Through the Office of Admissions, enrollment in summer courses may be arranged for specifically qualified students who have not yet completed high school.

Admission requirements for Summer Quarter are the same as for any other quarter; credits earned are evaluated as residence credits; and, with the exception of separate fee schedules for medical and dental students, Summer Quarter fees closely parallel those of the other quarters. Nonresidents pay the same fees as residents during the summer.

A complete listing of Summer Quarter courses is published in the Summer Quarter bulletin, available on request from the University of Washington, Office of Summer Quarter, DW-40, Seattle, Washington 98195, telephone (206) 543-2320.

University Libraries

The University Libraries, with almost 4,200,000 volumes, consists of the Suzzallo Library, the Odegaard Undergraduate Library, the Health Sciences Library, and seventeen branch libraries. The libraries' holdings include archival materials and manuscripts, maps, newspapers, microforms, research reports, media materials, and government publications. Services offered by the library system include photocopying facilities; the Central Serials Record of all cataloged serials in the library system; and Computer-Based Reference Services, with access to over 250 data bases in business, in the sciences, and in the humanities and social sciences. Most special facilities and equipment for persons who are disabled are provided in the Suzzallo and Odegaard Undergraduate libraries.

The Suzzallo (main) Library is the central acquisitions, administrative, and book-processing unit for the library system and houses the

system's major humanities and social sciences collections. It contains many specialized collection areas, such as Government Publications, University Archives and Manuscripts, the Microforms-Newspapers Section, and the Pacific Northwest Collection. The Natural Sciences Library, also located in Suzzallo Library, maintains the library system's general sciences and history-of-science collections in addition to materials on atmospheric sciences; geology and geophysics; biology, botany, and zoology; agriculture; nutrition; physical health and education; and textile sciences.

The Odegaard Undergraduate Library (OUGL) collection supports the undergraduate curriculum and is interdisciplinary, with the emphasis on undergraduate materials in the social sciences and humanities. OUGL Reserve is the primary reserve unit in the library system for non-health sciences subjects. The OUGL Media Center provides media services and materials for the library system with both course-related and recreational programs. Almost all study materials needed by undergraduates may be found in this library.

The Health Sciences Library collection includes materials on medicine, dentistry, nursing, pharmacy, public health, and related biological, quantitative, and behavioral sciences. The Health Sciences Library is a Medline Center, serves as the collection and operations base for the Pacific Northwest Regional Health Sciences Library, and houses the King County Medical Society Library Services and the Drug Information Services.

Henry Art Gallery

The Henry Art Gallery, the art museum of the University, brings to the campus and the community special exhibitions of contemporary and historical work in all media. The offerings include lectures, demonstrations; symposia, and an active publishing program. The small, but distinguished, collection includes European and American paintings and prints as well as contemporary American and Japanese ceramics. The Henry Gallery Association offers membership to students, faculty, and the community for the purpose of supporting this multifaceted program. Open six days a week, the gallery is closed Mondays and University holidays. Students are admitted without charge on Thursdays.

Museum

The Thomas Burke Memorial Washington State Museum is an educational and cultural center whose function is to collect, preserve, research, exhibit, and interpret the natural and cultural objects of the human environment, particularly the Pacific Ocean, its islands, and mainland shores. Museum divisions are anthropology, education, exhibition, geology, and zoology.

Graduate training in the museum includes a program that leads to a Master of Arts degree in anthropology with a specialization in museology. The museum is accredited by the American Association of Museums.

The museum is celebrating its centennial in 1985.

University Theatres

The School of Drama operates three theatres: the Glenn Hughes Playhouse, with a thrust stage; the Penthouse Theatre, the first theatre-in-the-round built in America; and the Showboat Theatre, fashioned after a turn-of-the-century floating showboat with a proscenium stage. Faculty- and student-directed plays drawn from the full range of world dramatic literature are presented throughout the year.

The school also mounts annual productions in the two theatres of Meany Hall, and it gives technical and design support to opera and dance productions of the School of Music.

Language Learning Center

The Language Learning Center is a pooled resource within the College of Arts and Sciences that provides support in areas related to the teaching and learning of languages. Services directly available to students include listening facilities, individual recording and replay, provision of cassette copies of laboratory exercises, and a tutoring service for occasional use in study of the major foreign languages taught on campus.

English as a Second Language Center

The English as a Second Language Center offers a variety of courses to nonnative speakers of English from many different countries. Additional information is in the Continuing Education section of this catalog.

Academic Computing Center

The Academic Computing Center provides information-processing facilities to the campus for instruction and research. Computing facilities available at the center include Digital Equipment VAX 11/780s, used exclusively for instruction, and a Control Data Cyber 750, used for both instruction and research. These mainframes are supplemented with a range of peripheral equipment, including several types of graphics terminals and plotters. For users' convenience, several public terminal sites are available. These sites are connected via a switched data network and are located at 143 Savery, 326 Sieg, 407 Balmer, and D208 Health Sciences. Software support includes the major programming languages and more than a hundred application packages, including statistical analysis, data base management, graphics, and document preparation. In addition to the hardware and software, the center provides a full range of services. These services are described in detail in document A200: University of Washington Academic Computer Center Resource Directory. Some of the services provided by the center include consultation, contract programming, and noncredit classes on topics related to computing. A new microcomputer laboratory, located in 308 Parrington, provides opportunity to use various types of hardware and software for the purposes of familiarization, comparison, utilization, and selection. The center also operates the Computing Information Center library, which contains thousands of publications that deal with computing. For more information about the Academic Computing Center, telephone (206) 543-5970 or visit the center, located at 3737 Brooklyn Avenue Northeast.

University Research Facilities

In addition to the campus facilities described above, the University has numerous educational and cultural resource centers. Academic or research activities and facilities that are of general significance in all or many fields of knowledge throughout the University are listed in the Graduate School section of this catalog; others are described in school or college sections.

Student Services and Facilities

Student Housing

Students are free to make their own housing arrangements. They are urged to select the types that best serve their academic and personal needs. The University of Washington provides three categories of housing for students: residence halls, apartments for single students, and housing for student families.

Residence Halls

Residence hall accommodations for single men and women at the University are available in a variety of types, in six different buildings. All are located within walking distance of campus classrooms and laboratory buildings. The residence halls operate with active student government organizations in "houses" of from fifty to one hundred twenty students each. Preference in assignment to the east wing of Mercer Hall is given to graduate students. There is a very active and professionally run Student Development Program that enhances the college experience for students who live in the residence halls.

Apartments for Single Students

Stevens Court Apartments opened in autumn of 1983. Three hundred students are housed in four- and six-person apartments, consisting of single bedrooms and a common kitchen, living room, and bath. The University also has a number of studio apartments available. All Single Student Apartment units give priority to graduate students with financial need. Residents in these apartments must be full-time students at the University of Washington.

For an application or additional information, write to the University of Washington, Housing and Food Services Office, 301 Schmitz, PC-50, 1400 Northeast Campus Parkway, Seattle, Washington 98195.

University Housing for Student Families

The University operates a variety of one-, two-, and three-bedroom housing accommodations, though limited in number, for student families with or without children. Students with limited financial resources have initial priority in assignment to vacancies as they occur. Residents of family housing must be full-time students at the University of Washington.

For additional information about housing facilities, financial eligibility, and application procedures, write to Housing Assignments Office, 301 Schmitz, PC-50, 1400 Northeast Campus Parkway, Seattle, Washington 98195.

Privately Operated Accommodations

Listings of off-campus rental properties, such as rooming and boarding houses, housekeeping rooms, apartments, and houses, are maintained at the Student Union Building (HUB) for the convenience of single and married students. The University does not inspect these accommodations, and, therefore, students and parents must accept full responsibility for making a selection. Because these listings change frequently, they cannot be mailed out and must be consulted in person.

Fraternities and Sororities

Twenty-eight fraternities and twenty sororities own and operate complete living facilities near the University campus. Members either live in the chapter houses or, as commuters living at home, have use of the facilities. These living groups conduct educational, social, recreational, and cultural activities, placing particular emphasis on study programs for new students.

Fraternities and sororities are self-governing student organizations. Through the Office of Student Affairs, however, the University makes available staff members to advise house leaders on all phases of chapter life and operation. Activities of the fraternities and sororities are coordinated and governed by the student Interfraternity Council and Panhellenic Association, respectively. These organizations also coordinate and supervise the membership recruitment programs for the fraternities and sororities.

Additional information is available from University of Washington, Panhellenic Association (or Interfraternity Council), Student Union Building, FK-10, Seattle, Washington 98195.

Religious Living Groups

Faith and Life Community (Interfaith), University Christian Union Women's House, and University Christian Union Men's House (Protestant), Maranatha, and other religious living groups provide housing for students at the University. Their primary purposes are to offer an environment consistent with religious ideals and to encourage maximum scholastic achievement.

Special Living Groups

Russian House is a living group for both men and women interested in learning the Russian language. Because Russian is spoken at all times among residents, the student should have some familiarity with the language before applying for admission to the house program.

In cooperation with language departments, living-language programs in French, German, and Spanish are conducted in coeducational residence halls by students. Members are grouped according to lan-

guage interests and eat meals together. Additional information may be obtained from the departments concerned.

Expenses and Financial Aid

The cost of a student's education at the University varies, the amount depending on his or her classification, status as resident or nonresident, and field of study. In computing college costs, a student should consider such additional expenses as insurance coverage, books, and laboratory supplies. Personal expenses (clothing, laundry, recreation, and transportation), which vary with each individual, as well as between-quarter expenses, should not be overlooked.

Prepared by the Office of Student Financial Aid, the following figures reflect modest, but adequate, costs for students attending the University during the nine-month academic year. They should be used only as a guide in determining the year's expenses.

ESTIMATED EXPENSES

	Lives with parents	*Lives in dormitory or off campus*	*Married student (no dependents)*	*Single parent (one dependent)*
Books	$ 399	$ 399	$ 399	$ 399
Room and board	1,101	2,805	5,325	4,314
Transportation	555	555	855	660
Miscellaneous personal expenses	999	1,158	2,004	1,158
Dependent allowance (per child)				1,542
Totals	$3,054	$4,917	$8,583	$8,703

* Maintenance allowance of $1,470 should be added for each additional dependent.

TUITION*

	Resident Tuition and fees	*Nonresident Tuition and fees*
Undergraduates	$1,308	$3,624
Graduate students	1,890	4,692
Medical and dental students	3,054	7,734

* Tuition and fees are subject to change.

FINANCIAL AID

The University's Office of Student Financial Aid, 105 Schmitz, administers several federal, state, and institutional financial aid programs created to help students pay for their educations. Assistance is offered in the form of grant aid, scholarships, long-term loans that must be repaid after leaving school, and work opportunities. A complete information packet describing the different programs, eligibility criteria, and application procedures is available from the office and may be requested by telephone, (206) 543-6101.

Both undergraduate and graduate students may apply for aid through the Office of Student Financial Aid; graduate student assistance is generally limited to long-term loans and work opportunities. Information on graduate fellowships, scholarships, and teaching and research assistantships may be obtained from the graduate program adviser in the individual department or program (see Graduate School section of this catalog).

In order to be eligible for financial aid, an individual must be a citizen or permanent resident of the United States and be admitted to the University as a matriculated, degree-seeking student. First consideration is given to full-time applicants who are pursuing their first degree at any level (first baccalaureate, first master's, etc.). Priority consideration is also given to students who apply before the University's financial aid application deadline, which is generally March 1 of the preceding year (e.g., March 1, 1984, for the year beginning in September, 1984).

The Office of Student Financial Aid also administers the Student Employment Service, 180 Schmitz, telephone (206) 545-1985, an employment referral service that lists a wide variety of part-time jobs on and off campus throughout the year. The office also administers short-term emergency loan programs for full-time students who find themselves in temporary, severe financial difficulty. University students may take advantage of the Student Employment Service and of the short-term emergency loan programs without applying for financial aid.

Student Health Insurance

Medical-surgical-hospital insurance is available to regularly enrolled University students and their dependents on a voluntary basis. A student may enroll in the plan at the time of registration each quarter by completing the insurance section on the registration form and paying the appropriate premium by the quarterly tuition due date. The plan provides coverage for accidents and for illnesses that require treatment or hospitalization. Brochures describing this insurance coverage and costs are available at the Office of Student Affairs, 459 Schmitz, and at Hall Health Center, HUB, and information window in Schmitz Hall.

The University also sponsors a field-trip sickness and accident insurance plan. Applications may be requested from the Risk Management Office, 280 Administration, AG-76, telephone (206) 543-0183.

Insurance for Foreign Students

The University requires that all students from foreign countries have a health-and-accident insurance policy in force while registered at the University. This may be achieved by purchasing either the Student Health and Accident Insurance offered through the University or other coverage, of which proof must be furnished to the International Services Office and an insurance waiver obtained. To avoid registration cancellation, the Cashier's Office must have full payment of tuition/fees and an insurance waiver on file or full payment of tuition/fees and insurance by the tuition due date.

Hall Health Center

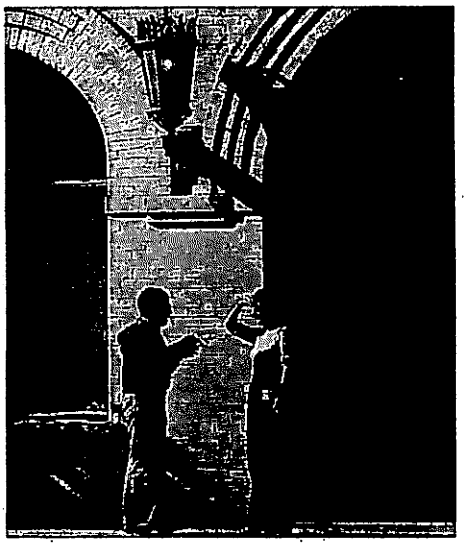
The University provides outpatient health and medical care for students through the Hall Health Center. Located on campus, the center is staffed by physicians and nurse practitioners.

The following specialties are represented: cardiology, chest disease, endocrinology, dermatology, family planning, general practice, general and hand surgery, gynecology, integral medicine, optometry, orthopedics, physical therapy, and psychiatry. Common conditions in other specialties also may be treated.

All graduate and undergraduate students, registered for full- or part-time courses *and* paying student fees, are eligible for health service upon *presentation of a current University student identification card.*

Students must pay for pharmacy prescriptions, mental-health services, vision-care services, physical examinations, and outside laboratory and medical services.

The student health insurance, available through the University of Washington, *should not be confused* with Hall Health Center. A student may use Hall Health Center services without having student insurance. For major surgery and the occasional illness of exceptional severity that require treatment elsewhere, the student should protect himself or herself against the expense by obtaining student health insurance. A low-cost medical-surgical-hospital policy, designed to meet these specific needs, may be purchased at the time of registration.



The Hall Health Center is open from 8:00 a.m. to 5:00 p.m., Monday through Friday, during Autumn, Winter and Spring quarters. Summer Quarter hours are 8:30 a.m. to 5:00 p.m. Emergency service is available in the Urgent Problem Clinic on Saturdays, Sundays, and holidays during the regular school year.

Additional information may be obtained from University of Washington, Hall Health Center, GS-10, Seattle, Washington 98195.

Student Services Offices

Student Union Facilities

The Student Union facilities, the Student Union Building and the South Campus Center, are the principal centers of student activities and programs on the campus.

STUDENT UNION BUILDING

The Student Union Building, known as the HUB, houses a variety of facilities and services for students, faculty, and staff. These include a 478-seat auditorium; a multipurpose ballroom, a barber and hair styling shop, a branch of the University Book Store, several retail food operations, a recreation and amusement games area, a lost-and-found office, a ticket sales office, a newsstand, a self-service post office, and a branch of Peoples Bank. Meeting rooms accommodating 10-175 persons are available for registered student organizations.

SOUTH CAMPUS CENTER

The South Campus Center offers services and activities similar to those in the HUB primarily to students in the health and marine sciences. In addition to student offices, conference rooms, a student art gallery, and recreation facilities, the center has facilities for indoor and outdoor dining. A ticket office, a newsstand, a University Book Store branch, a full-service bank, and a 24-hour cash machine are also available.

Office of Student Affairs

The Office of Student Affairs is concerned with the general welfare of University students in their campus extracurricular life and activities. The Vice President for Student Affairs is responsible for providing assistance to students with personal, social, and other scholastic adjustments problems, as well as to advocate to the President and other University administrators issues and concerns of general student interest. Services operated by the Office of Student Affairs to assist students include the Counseling Center, Placement Center, Student Activities Office, South Campus Center, Husky Union Building, Office of Student Publications, Financial Aid Office, Recreational Sports Programs, Registration and Admissions, Educational Assessment Center, Sports Facilities Maintenance, and Housing and Food Services.

Students are encouraged to contact the vice president's office or members of the student affairs staff, telephone 543-4972, if they need any information concerning their out-of-classroom life at the University.

Educational Assessment Center

Testing and educational evaluative services for University departments and individual students are available at the Educational Assessment Center. Of particular interest to prospective and entering

students are the center's programs for admissions testing, including the Washington Pre-College Testing Program, and for placement testing in mathematics and chemistry. For the University student approaching graduation, the center administers tests required for admission to graduate, law, medical, and other professional schools, as well as those tests often requested by prospective governmental or private employers. The center has its offices on the fourth floor of Schmitz Hall.

Counseling Center

All full-time students at the University may make use of the services of the Counseling Center and its staff of psychologists and vocational counselors to discuss educational progress, personal adjustment, or career goals. Psychological tests, when necessary, are provided as part of the center's counseling service. A library of reference materials on occupations and career opportunities is available for student use. Also available is a computer-assisted career guidance system with which students can work independently.

Other services of the center include the provision of various group programs directed toward concerns and skills of interest to students in their efforts to adapt to the University.

Students are not charged for the first appointment, which is to determine if the Counseling Center's services are needed. Individual appointments after the first visit cost $6 each. Fees for entrance to group programs range from $11 to $25. For students financially unable to pay the fee, efforts are made to find other alternatives. The center is located on the fourth floor of Schmitz Hall.

Placement Center

The University's Placement Center, which includes a Minority Placement Program, offers career information and assists undergraduates, graduate students, and degree- or certificate-holding alumni (1) to make a viable connection between their academic backgrounds and their career or long-range employment objectives, (2) to develop effective job-seeking campaigns, and (3) to find suitable employment upon leaving the University or to change employment thereafter.

International Services Office

The International Services Office provides assistance to international students, including such matters as general orientation of new students to the campus and community; advice and counsel for educational, financial, and personal problems; dissemination of important information through newsletters; and assistance in meeting United States Immigration and Naturalization Service regulations on such matters as extensions of stay, change of status, transfer of schools, and work permits. The office is located in 461 Schmitz, telephone 543-0840.

Foreign Study Office

The Foreign Study Office, 572 Schmitz, provides information and counseling service in connection with study at foreign institutions, foreign-study programs sponsored by the University of Washington (academic year or Summer Quarter), and those sponsored by other U.S. colleges and institutions.

Early Entrance Program

A unique UW program provides early entry to exceptionally bright, highly motivated adolescents who are ready for college-level work by age fourteen, the usual age of entering high school. A transition school provides an intensive, one-year bridge to regular, full-time UW enrollment; counseling support and a "home base" are also provided to full-time students. Information is available from the Child Development Research Group, Guthrie Annex II, 543-4160.

Disabled Student Services

The University provides program access to students with both permanent and temporary disabilities through a variety of services, equipment, and publications. Disabled Student Services (DSS) coordinates many of these special services. To the maximum extent possible, disabled students are integrated into the general student population and their problems are solved through usual channels.

In those instances when a person requires a special accommodation as a result of a disability, DSS works with individuals to define and coordinate specific adaptation. Services available include preadmission interviews, counseling and referrals, priority registration, classroom relocation, classroom testing accommodations, tape-recording and reader referral service for print-handicapped students, mediation when necessary, and other services for mobility-limited or sensory-impaired students, which are arranged on an individual basis. Specialized equipment of many types is available for on-campus use or checkout; equipment lists may be obtained from DSS. Publications include *Access: UW* (a guidebook showing classroom access, ramps, curb cuts, parking, accessible restrooms, etc.), a wheelchair map or a braille map of campus, *Faculty Guide for Working With Disabled Students*, a brochure entitled "When You Meet a Disabled Person," and a newsletter entitled *ACCESSory*.

Various other departments offer additional services. Transportation Department provides free on-campus transportation on Dial-a-Ride, a van with a wheelchair lift (telephone 545-1511), and Parking Division offers disability parking permits and a battery recharge station for electric wheelchairs (telephone 545-1555). Other departments that might be of particular interest include: Housing and Food Services (telephone 543-4059), Hall Health Center (telephone 545-1011), and an ASUW-affiliated student group, the Disabled Students Commission, 302A HUB (telephone 543-7503 or TTY 543-8725).

Additional information is available from Disabled Student Services, 482 Schmitz, PB-07, telephone 543-8924 (Voice/TTY).

Office of Veterans Affairs/Special Services

The Office of Veterans Affairs/Special Services, 460 Schmitz, assists veterans, their dependents, and service personnel in obtaining educational benefits from the Veterans Administration.

The office arranges for tutorial assistance, part- and full-time employment, and fee reductions for qualifying students. In addition, the office certifies enrollment for students receiving Social Security benefits and advises students required to take English as a Second Language courses.

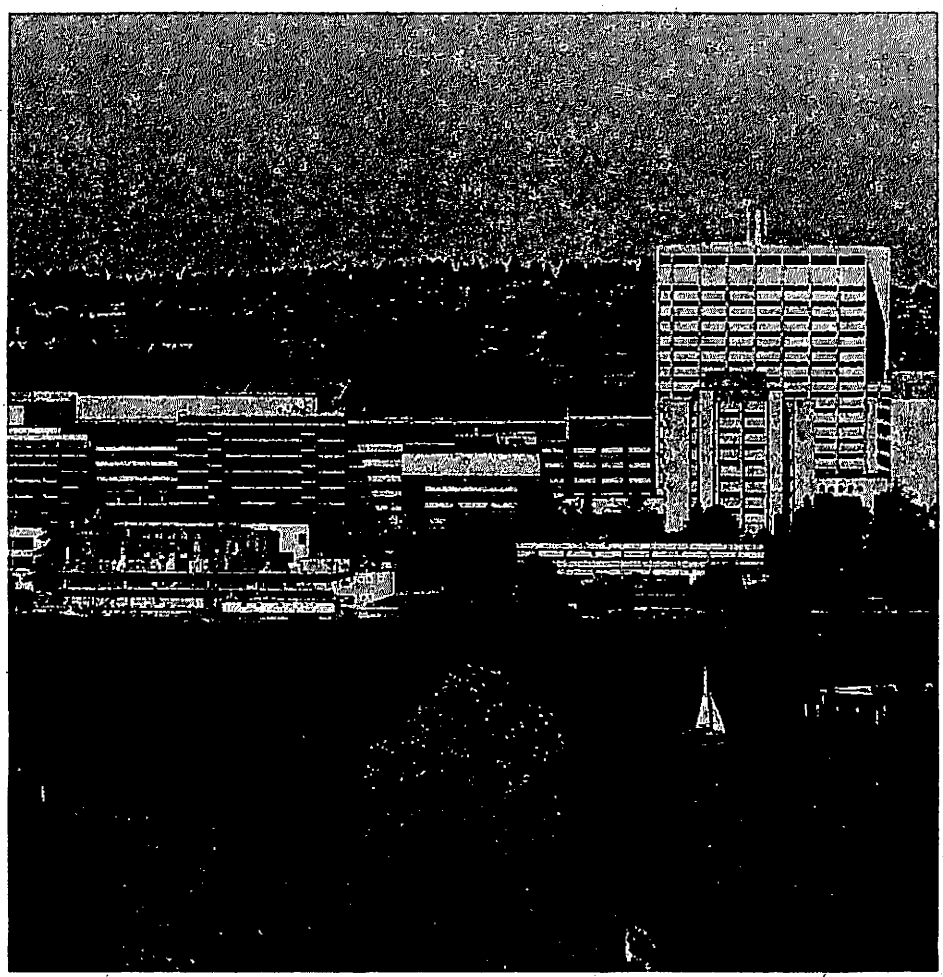
Office of Minority Affairs

The Educational Opportunity Program, administered by the Office of Minority Affairs, provides a variety of services to students from minority and economically disadvantaged backgrounds. These services include recruitment, admissions, academic advising, tutoring, personal and career counseling, housing and financial aid advising, and other assistance.

The Office of Minority Affairs operates the Instructional Center, which provides assistance in reading, composition, mathematics, sciences, and basic study skills as well as tutorial support for courses offered at the University.

The Ethnic Cultural Center and Theatre offer a variety of educational, cultural, and performing arts programs that allow for student and community participation.

The Office of Minority Affairs is located on the third floor of Schmitz Hall.



Student Activities and Organizations

Student Activities Office

The services provided by the Student Activities Office (SAO) staff include assisting students in understanding University policies and procedures, providing technical help in the planning and conduct of student events, and furnishing information and assistance to student groups or organizations in order that they may represent themselves and their interests in an effective manner. Advisers are available to assist students involved in group activities with budget and program planning, advertising, orientation to campus resources, and leadership and organizational skill development. Underlying the SAO service functions is a desire to provide an environment in which students can learn from their experiences in extracurricular activities as a supplement to their classroom experience. Additional information about the services is available from the Student Activities Office, 207 HUB, telephone 543-2380.

Student Organizations

Students at the University are encouraged to become active in at least one of the campus's approximately three hundred fifty voluntary student organizations, which include honorary, professional, and social organizations; service and coordinating clubs; activity groups; and religious and fraternal organizations. Voluntary student organizations that register with the University receive various benefits and services to assist their respective activities. Additional information is available from the Student Activities Office, 207 HUB, telephone 543-2380.

Associated Students, University of Washington

The Associated Students, University of Washington (ASUW), is a voluntary, nonprofit association of students designated by the Uni-

versity Board of Regents to carry out a variety of student activities. In order to vote in ASUW elections, hold ASUW office, or be employed by the ASUW, a student must be a member of the ASUW by indicating an affirmative answer on the University registration form each quarter.

The ASUW has an annual budget of approximately $1 million, allocated from the services and activities fee paid as part of tuition and supported from program revenue. The government of the ASUW is headed by a president, three other officers, a seven-member board of control elected by the student body each year, and one representative from the Graduate and Professional Student Senate. The ASUW maintains agencies, commissions, and service groups to provide students with a varied program of activities during the school year. Other ASUW services include lecture notes, poster printing service, Experimental College, and a bicycle repair shop. Questions regarding the ASUW and its services should be directed to either the Student Activities Office, 207 HUB, telephone 543-2380, or the ASUW office, 204L HUB, telephone 543-2380.

Graduate and Professional Student Senate

The Graduate and Professional Student Senate serves primarily as an advocate for the academic welfare of graduate and professional students. Composed of representatives elected from each graduate and professional degree-granting unit, GPSS works through issue oriented *ad hoc* committees, in which any graduate or professional student may participate. Funded from student activities fees, GPSS dedicates a portion of its budget each year to direct allocations for departmental student groups and for special programs benefiting students from many departments.

Student Publications

Student publications at the University include the *Daily* and the *Student Directory*. The *Daily* is published Tuesday through Friday mornings throughout the academic year and is distributed on campus without charge. During Summer Quarter, the *Daily* is published once a week. Any student with an interest in journalism may serve on the *Daily* staff.

Intercollegiate Athletics

The Department of Intercollegiate Athletics operates an integrated program for men and women. Intercollegiate competition is limited to full-time students.

There are nine women's teams: cross-country, volleyball, gymnastics, basketball, swimming, track and field, tennis, golf, and crew. Women's competition is in the ten-team Northern Pacific Athletic Conference (NorPac) and is affiliated with the National Collegiate Athletic Association (NCAA).

Ten sports are offered for men's competition: baseball, basketball, crew, cross-country, football, golf, soccer, swimming, tennis, and track and field. Men's teams compete on a full Pacific-10 Conference schedule, as well as with other institutions locally, regionally, and nationally. The University is a member of the National Collegiate Athletic Association.

Facilities available to intercollegiate athletic teams are Hec Edmundson Pavilion, Husky Stadium, Graves Baseball Field, Chavelle Track and Field Complex, Conibear Shellhouse and other crew facilities on Lake Washington at the eastern boundary of the campus, the Quilliam Memorial Tennis Courts, and a variety of golf courses throughout the greater Seattle area.

Recreational Sports

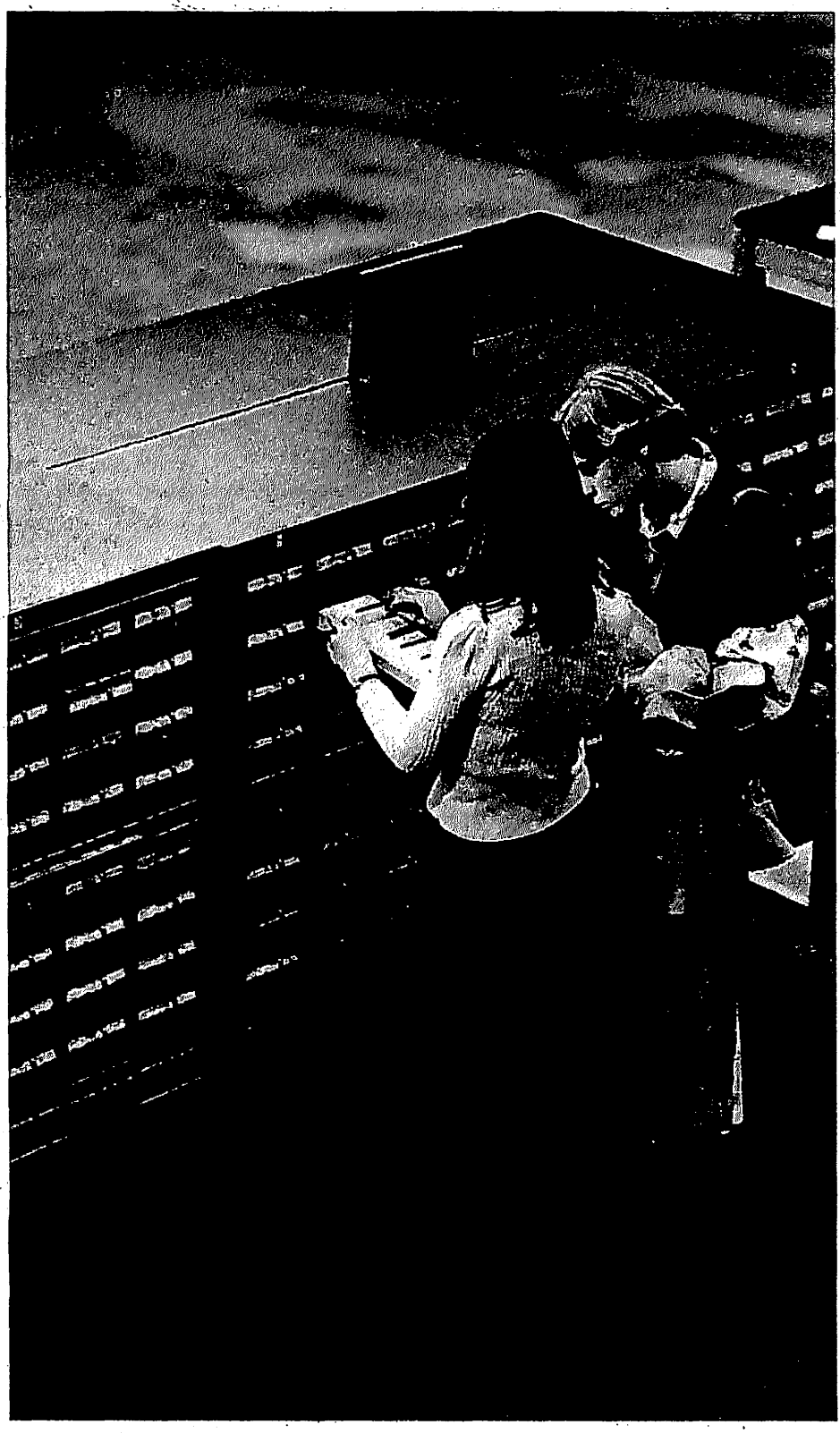
The Department of Recreational Sports Programs provides a comprehensive program of sports activities designed to meet the diverse needs and interests of students. To provide this service, the department manages recreation facilities, including the Intramural Activities (IMA) Building, Golf Driving Range, Waterfront Activities Center, and Practice Climbing Rock. A varied program of intramural sports, corecreational activities, sports skill classes, sports clubs, special events, and general recreation is open to every student (modifications available for disabled participants as needed) with a valid student identification card.

Instruction is offered in aerobic dance and exercise, archery, badminton, basketball, canoeing, conditioning, fencing, fitness, golf, gymnastics, handball, judo, mountaineering, pickleball, racquetball, roller skating, ski conditioning, skin and SCUBA diving, soccer, softball, springboard diving, squash, swimming, tae kwon do, tennis, volleyball, and weight training.

Sports clubs exist for aikido, archery, badminton, bicycling, boxing, canoeing, climbing, fencing, handball, ice hockey, judo, karate, kendo, kung fu, lacrosse, racquetball, rifle and pistol, rowing, rugby, sailing, synchronized swimming, skiing, skin and SCUBA diving, skydiving, soccer for men and women, squash, tae kwon do, volleyball, water polo, and weight lifting.

Intramural sports are offered for men, women, and men and women combined (Co-Rec), in a variety of activities, including basketball, bowling, flag football, floor hockey, handball, innertube basketball, racquetball, skiing, soccer, softball, squash, swimming, tennis, track and field, and volleyball. In addition to a variety of special events. More information regarding these programs may be obtained by telephoning Intramural Sports, 543-8558; Sports Clubs, 543-9499; Instruction, 543-2571; IMA Building, 543-4590, Waterfront Activities Center, 543-9433; or the Golf Range, 543-8759.

REGULATIONS AND PROCEDURES



The University and its colleges and schools reserve the right to change the fees, the rules, and the calendar regulating admission and registration; the instruction in, and the graduation from, the University and its various divisions; and any other regulations affecting the student. The University also reserves the right to withdraw courses and programs at any time.

It is the University's expectation that all students will follow the University regulations and procedures as they are stated in the *General Catalog*. Appeals may be filed with the student's Dean or with the Vice President for Student Affairs in nonacademic matters.

Registration and Withdrawal

Detailed information and procedures pertaining to registration and withdrawal are outlined in the quarterly *Time Schedule*. Specific information on Summer Quarter policies appears in the *Summer Quarter Bulletin*.

Preregistration

Preregistration is designed to accommodate currently registered matriculated students. Preregistration occurs on specified days during the latter half of the quarter preceding that for which the student is registering, except that currently enrolled students registering for Autumn Quarter preregister in Spring Quarter.

In-person Registration

In-person registration occurs just prior to the beginning of the quarter and is intended primarily to accommodate new and returning students, as well as continuing students who fail to turn in programs during preregistration. Students are provided appointment dates to register.

Faculty-Staff Tuition Exemption

Eligible faculty and staff may enroll for up to 6 credits each quarter under the tuition exemption program. Because such students are registered on a space-available basis, they must register after other students. The quarterly *Time Schedule* lists registration dates and hours during which the faculty and staff members may register. Eligibility information may be obtained from either the Staff Personnel Office or the Registration Office.

"Access" Program for Older Adults

The University of Washington waives tuition for Washington residents sixty years or older who wish to attend classes as auditing students on a space-available basis. Students who attend the University under the Access program are limited to two courses per quarter. The fee is $5, whether one or two courses are attended. As auditors, students do not receive credit and are not expected to do laboratory work or to take examinations.

Change of Program to Drop or Add Classes

1. Preregistered students may add and drop classes during an early change period before the quarter begins. Appointments are necessary. Information on dates and procedures appears on posters placed throughout the campus and in the quarterly *Time Schedule*.

2. All students may add and drop courses during the first week of school by following instructions in the quarterly *Time Schedule*.

Late Registration

Students who have been admitted may register late, but are charged a $25 fee after the official registration period and through the tenth day of the quarter. The fee is $75 after the tenth day of the quarter.

Change of Address

The student is held responsible for keeping his or her address up-to-date in the Registrar's Office by filling out a change of address form at the Registration Office. *The mailing of notices to the last address on record constitutes official notification.*

Withdrawal From the University

Once an eligible student turns in a registration form, he or she is considered to be registered and must officially withdraw if he or she later chooses not to attend. Official withdrawal must be made by the fifth day of the quarter for the student to avoid further financial obligation (see Tuition, Fees, and Special Charges for refund information on withdrawals).

1. To be official, a withdrawal from the University must be turned in at the Withdrawal Office, 264 Schmitz. Withdrawal forms are available at advising offices and the Withdrawal Office. An official withdrawal is effective the day it is received in the Withdrawal Office.

2. Submission of a graduate On-Leave application does not constitute official withdrawal from the University.

3. Refer to Grading System, Grading Options, and Scholarship for information on grades and withdrawal.

4. A recipient of veterans' benefits should immediately notify the Office of Veterans Affairs/Special Services of withdrawal.

5. A student with a scholarship or loan awarded through the University should notify the Student Accounts and Scholarships Office or the Student Loan Office.

Restrictions on Attending Classes

No person, other than a faculty member attending informally with the approval of the instructor, may attend a University course in which that person has not been registered.

An instructor may allow a student to attend his or her class only if the student's name is on the official class list from the Registrar's Office.

Student Identification

Each student is issued a quarterly identification card at the time of registration at the University. This card is the student's means of establishing entitlement to the rights and privileges that normally accrue to students.

Students whose identification cards are either lost or destroyed can have them replaced by paying a nonrefundable fee at the University Student Accounts and Scholarships Office. Replacement of cards made invalid by changes in students' names or of cards rendered unusable by normal wear and tear is done without charge upon return of the original card to the Registrar's Office.

Cards that have been tampered with or misused may be confiscated by the University agency or department involved. The incident may be referred to the Office of Student Affairs for appropriate University action.

Grading System, Grading Options, and Scholarship

Grading System

The University of Washington uses a numerical grading system with certain exceptions in the schools of Dentistry, Law, and Medicine. Instructors may report grades from 4.0 to 0.7 in 0.1 increments and the grade 0.0. The number 0.0 is assigned for failing work or unofficial withdrawal. Grades in the range 0.6 to 0.1 may not be assigned. Grades reported in this range will be converted by the Registrar's Office to 0.0. For graduate students, grades reported in the range 1.6-0.1 will be converted to 0.0. Numerical grades may be considered equivalent to letter grades as follows:

UNDERGRADUATE/GRADUATE*

A	4.0–3.9	
A–	3.8–3.5	
B+	3.4–3.2	
B	3.1–2.9	
B–	2.8–2.5	
C+	2.4–2.2	
C	2.1–1.9	
C–	1.8–1.5	*Lowest grade earning credit for graduate students is 1.7.
D+	1.4–1.2	
D	1.1–0.9	
D–	0.8–0.7	Lowest passing grade for undergraduates.
E	0.0	Failure or Unofficial Withdrawal. No credit earned.

Additional information on grades and scholarship rules may be obtained from the Grade Information Office, 248 Schmitz.

The following letter grades also may be used:

N No grade. Used only for hyphenated courses and courses numbered 600, 601, 700, 750 and 800.

I Incomplete. An Incomplete is given only in case the student has been in attendance and has done satisfactory work until within two weeks of the end of the quarter and has furnished proof satisfactory to the instructor that the work cannot be completed because of illness or other circumstances beyond the student's control. To obtain credit for the course, an undergraduate student must convert an Incomplete into a passing grade no later than the last day of the next quarter. An Incomplete grade not made up by the end of the next quarter will be converted to the grade of 0.0 by the Registrar unless the instructor has indicated, when assigning the Incomplete grade, that a grade other than 0.0 should be recorded if the incomplete work is not completed. The original Incomplete grade is not removed.

An instructor may approve an extension of the Incomplete removal deadline. Such an extension must be received, in writing, at the Grade Recording Office no later than the last day of the quarter following the quarter in which the Incomplete grade was assigned. Extensions, which may be granted for up to three additional quarters, must be received before the Incomplete has been converted into a failing grade.

In no case can an Incomplete received by an undergraduate be converted to a passing grade after a lapse of one year.

A graduate student must convert an Incomplete into a passing grade by the last day of the next quarter *in residence*. This rule may be waived by the Dean of the college in which the course was offered only if the nature of the uncompleted work is such as to make the fulfillment of this requirement impossible. In no case can an Incomplete be converted to a passing grade after a lapse of two years. An Incomplete received by a graduate student does not automatically convert to a 0.0 but remains an Incomplete.

S Satisfactory grade for courses taken on a satisfactory/not satisfactory basis. An *S* grade is automatically converted from a numerical grade of 2.0 or above for undergraduates and a numerical grade of 2.7 for graduates. The grade *S* may not be assigned directly by the instructor, but is a grade conversion by the Registrar's Office.*

NS Not-satisfactory grade for courses taken on a satisfactory/not satisfactory basis. A grade less than 2.0 for undergraduates, or less than 2.7 for graduates, will be converted to *NS*. *NS* is not included in the grade-point-average calculation. No credit is awarded for courses in which an *NS* grade is received.*

CR Credit awarded in a course offered on a credit/no credit basis only or in courses numbered 600, 601, 700, 750, and 800. The minimum performance level required for a *CR* grade is determined, and the grade is awarded directly by the instructor.

NC Credit not awarded in a course offered on a credit/no credit basis only or in courses numbered 600, 601, 700, 750, and 800. The grade is awarded directly by the instructor and is not included in a grade-point-average calculation.

W Official withdrawal or drop during the third and fourth weeks of the quarter for undergraduates and through the seventh week for graduates. It is not computed in grade-point-average calculation.

**W* Grade assigned when an undergraduate uses an uncontested drop privilege to withdraw from a course during the fifth and sixth week of the quarter. It is not computed in grade-point-average calculation.

HW Grade assigned when an undergraduate is allowed a hardship withdrawal from a course after the fourth week of the quarter (seventh week for graduate students). It is not computed in grade-point-average calculation.

DROPPING A COURSE

Undergraduates and Postbaccalaureate Students

Undergraduates dropping a course during the first two weeks of a quarter shall have no entry on their permanent academic record except notice of University withdrawal if all courses are dropped. During the third and fourth weeks, a dropped course is recorded as *W*. During the Summer Quarter, no entry will be made on the student's record for drops made during the first week of an *a* term course, or the first week of a *b* term course. During the second week of either term, the grade *W* will be recorded. Drops require that a student process a Change of Program card through the Registrar's Office (see Tuition, Fees, and Special Charges for information on fee forfeiture and charges).

Students cannot drop courses after the fourth week of the quarter through the last day of instruction, with the following exceptions:

* Certain provisions subject to approval. See quarterly *Time Schedule* for current policy.

(a) A student may drop all courses by withdrawing from the University through the last day of instruction.

(b) A student is allowed a limited number of uncontested (peremptory) course drops during the fifth and sixth week in accordance with the following schedule:

No. of Credits Earned at UW at Time of Course Drop	*No. of Uncontested Course Drops Permitted*
0-44	3
45-89	1
90-134	1
135-179	1
180-224	1
etc.	1

An entry of **W* will be made for each uncontested (peremptory) drop.

The three uncontested (peremptory) course drops that are allowed to students who have earned 0-44 University of Washington credits may not be accumulated for use after 44 credits are earned. Subsequent uncontested course drop privileges, however, may be so accumulated and used as the student sees fit.

(c) A student may petition the Registrar in writing to drop a course. Such a petition will be granted if, in the Registrar's judgment, (1) the student is unable to complete the course in question due to a severe mental or physical disability, or (2) unusual and extenuating circumstances beyond the student's control prevented him or her from dropping the course by the end of the fourth week, if an undergraduate, or by the end of the seventh week, if a graduate student. A petition must be filed in 209 Schmitz immediately after the student discovers it necessary to drop the course. This does not affect tuition charges.

The Registrar shall enter the grade of *HW* (Hardship Withdrawal) for all courses approved for drop by petition.

No drops or withdrawals may be made after the last day of instruction (i.e., no drops are permitted during or after the final examination period). During Summer Quarter, an undergraduate student may not drop a course (*a* term, *b* term, or full term) or withdraw from the University during the last five days of instruction.

Graduate Students

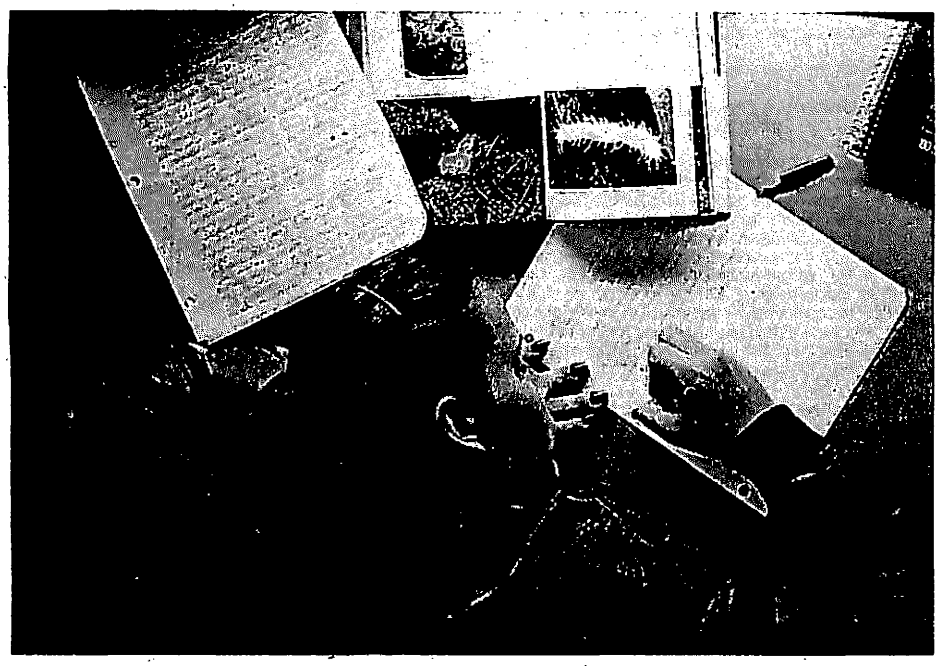
Graduate students withdrawing officially from a course during the first two weeks of a quarter shall have no entry on their permanent academic record. The grade *W* shall be recorded by the Registrar's Office after the first two weeks of a quarter. No drops are permitted after the seventh week of the quarter except through petition to the Registrar in accordance with criteria noted in paragraph c, 1 and 2 above (see also Summer Quarter exceptions above).

A student who drops a class unofficially (i.e., without the proper approvals and without processing an add/drop card through Sections) will be given a grade of 0.0.

REPEATING COURSES

All Schools and Colleges, Except Dentistry, Law, and Medicine

Undergraduate courses (100-400) may be repeated only once and only if the original grade was lower than a 2.0. The last grade will not cancel the first grade. For example, if a student earns a 1.0 the first time and a 2.0 the second, both grades are counted and, if the course is 5 credits, the cumulative effect on the grade-point average is 10 credits of 1.5. Credits will count toward the degree only once.



Graduate students may repeat any course. The first and second grades will be included in the cumulative grade-point average. Subsequent grades will not be included, but will appear on the permanent record. Credits count toward the degree only once.

School of Dentistry

A student in the School of Dentistry who receives the grade of 0.0 in a course may, with the permission of the Dean, the instructor of the course, and the Student Progress Committee, be permitted to perform additional work and to take such exercises and examinations, including a final examination, as the department may prescribe. If the student completes such exercises and examinations successfully and satisfies the department and the Student Progress Committee that he or she has a reasonable knowledge of the subject in question, the grade earned by the repetition may be awarded. The original grade of 0.0 will remain on the student's official transcript.

School of Law

A student in the School of Law in good standing who has failed a required course must repeat the course or take, with the approval of the Dean, a second examination without registration at the time a regular examination for the course is offered. Upon reexamination, if successful, the student receives the same credit for the course that it carried at the time the student was first examined. The previous grade will remain on the record, but only the new grade will be used in computing the student's grade-point average.

School of Medicine

The faculty of the School of Medicine does not usually recommend repetition of courses in cases of low scholarship and does not permit a student to repeat a year of work, except when illness or some other extenuating circumstance justifies an exception.

Veterans

Prior approval must be obtained from the Office of Veterans Affairs/Special Services before a course is repeated.

GRADE-POINT AVERAGE

The cumulative grade-point average is based solely on courses taken in residence at the University of Washington and specifically excludes transfer and extension credits and credits earned by examination.

COMPUTATION OF GRADE-POINT AVERAGE

The grade-point average (GPA) for graduation is computed by dividing the total cumulative grade points by the total credits attempted (TCA) for courses taken in residence at the University of Washington. Grade points are calculated by multiplying the number of credits by the numeric value of the grade for each course. The sum of the grade points is then divided by the total credits attempted. Courses elected on an *S/NS* basis are counted as follows: Satisfactory grades are printed on the permanent record as an *S* and do not count in the quarterly or cumulative grade-point average, but they do count as credits earned toward graduation. Not-satisfactory grades, *NS*, do not count in the quarterly and cumulative grade-point averages and do not count as credits earned toward graduation.

A graduate student's grade-point average is calculated entirely on the basis of number grades in 400- and 500-level courses. The grades of *S, NS, CR, NC,* and *N* are excluded, as are all grades in courses numbered 600, 601, 700, 750, and 800, and at the 100, 200, and 300 levels.

EXAMPLE 1

Course	*Credits*	*Grade*		*Grade Points*
CLAS 205	3	*CR*		
OCEAN 101	5	2.7	=	13.5
HST 111	5	4.0	=	20.0
SCAND 100	2	3.3	=	6.6
Total credits earned toward graduation	15			
Total graded credits attempted (TCA)	12			40.1

Grade-point average = 40.1 ÷ 12 = 3.34

The total graded credits attempted, not the credits earned toward graduation, are used in computing the grade-point average.

EXAMPLE 2

Course	*Credits*	*Grade*		*Grade Points*
ENGL 121	5	2.3	=	11.5
OCEAN 101	5	0.0	=	0.0
SPHSC 100	3	2.7	=	8.1
ART 105	3	*I*	=	0.0
Total credits earned toward graduation	8			
Total graded credits attempted (TCA)	13			19.6

Grade-point average = 19.6 ÷ 13 = 1.51

The student attempted 16 credits, but only 13 are graded, because the *I* is not computed in the grade-point average. The 0.0 for OCEAN 101 is computed in the grade-point average, but no credit is awarded toward graduation.

If the work in ART 105 is not made up by the end of the next quarter, the *I* will convert to a numeric grade and the grade-point average will be recomputed.

CHANGE OF GRADE

Except in cases of error, no instructor may change a grade that he or she has turned in to the Registrar. A student who finds administrative omissions or errors in a grade report must make application to the Registrar for a review not later than the last day of the student's next quarter in residence, but in no case after a lapse of two years. Time spent in military service is not counted as part of the two-year limitation. Students are not automatically notified of grade changes posted after the first of the quarter.

GRADE APPEAL PROCEDURE

A student who believes he or she has been improperly graded first discusses the matter with the instructor. If the student is not satisfied with the instructor's explanation, the student may submit a written appeal to the Chairperson of the department, or in a nondepartmental college, to the Dean, with a copy of the appeal sent to the instructor. The Chairperson, or Dean, consults with the instructor to ensure that the evaluation of the student's performance has not been arbitrary or capricious.

Once a student submits a written appeal, this document and all subsequent actions on this appeal are recorded in written form for deposit in a department or college file.

GRADE REPORTS

Grade reports are mailed to all students, except those in the School of Medicine, at the close of the quarter. The grade reports are sent to the mailing address supplied by the student at the time of registration. To ensure delivery of grades, changes in this permanent mailing address should be reported to the Registration Office by the last day of instruction. Copies of the quarterly grade reports are also sent to each student's Dean and major department.

Nontraditional Grading Options

It should be noted that the possibility of future objective evaluation of the student's total academic record is reduced by the extent to which the record includes course work that is evaluated by a grading system other than the numerical system. A student should be aware that he or she may jeopardize future educational opportunities, particularly for graduate or postbaccalaureate study, when other systems of performance evaluation are used.

CREDIT/NO CREDIT-ONLY AS A COURSE OPTION

With appropriate departmental review and approval, a course may be offered on a credit/no credit-only basis. The standard for granting credit in credit/no credit-only courses under this option is the demonstration of competence in the material of the course to the instructor's satisfaction.

SATISFACTORY/NOT SATISFACTORY GRADING OPTION*

Certain students are eligible to choose that a limited number of their courses be graded satisfactory/not satisfactory rather than with regular numerical grades. Any student who wishes to register for a course on a satisfactory/not-satisfactory basis should check first with his or her adviser to determine restrictions and eligibility; because colleges and departments vary in their rules concerning this grading option (e.g., students in the College of Arts and Sciences may not take courses *S/NS* until they have earned 45 or more college credits). In no case is a student allowed to register for more than 6 credits (or for one course, if that course is offered for more than 6 credits) on a satisfactory/not-satisfactory basis in a given quarter. No more than 25 satisfactory/not-satisfactory credits may be applied to a four-year undergraduate degree. Such courses may not be used to satisfy University, college, or departmental course requirements (i.e., may be applied only to the elective component of a degree).

Under no circumstance may a student switch to or from satisfactory/not-satisfactory grading for a particular course after the first week of the quarter. Only students in good academic standing (i.e., not on academic warning or probation) are eligible for the *S/NS* grading option. Veterans should check with the Office of Veterans Affairs before requesting these courses.

Scholarship

SCHOLARSHIP AND GRADES IN PROFESSIONAL SCHOOLS

The School of Dentistry uses the following numerical grading system: 4.0 (Honor), 3.7, 3.3, 3.0 (Good), 2.7, 2.3, 2.0 (Low pass), 0.0 (Failure). The following letter grades are also used: *CR, NC, I, N,* and *W*. The grade-point average is calculated by multiplying the grade points received in a course by the number of credits earned in the course, totaling these values, and dividing by the total number of credits earned.

Students are notified of their grades at the end of each quarter.

A student who has an academic deficiency in a course for which he or she is registered during any given quarter is referred to the Student Progress Committee of the school.

In the School of Law, grades are awarded in 1/10 increments from 4.0 to 1.4. Credit is awarded for grades of 2.3 or better. The highest grade is 4.0, and the lowest grade is 1.4. A 2.70 cumulative grade-point average is required for graduation.

The School of Medicine maintains a record of each medical student's performance and reports to the Registrar's Office grades of *H* (honors), *S* (satisfactory), or *NS* (not satisfactory).

* Certain provisions subject to approval. See quarterly *Time Schedule* for current policy.

Each department keeps careful records of student work. At the end of each academic year, or more frequently, the Academic Affairs Committee of the School of Medicine evaluates the accomplishment of the student. When general academic achievement is unsatisfactory, the student is subject to dismissal from the school. Although a student who has been dismissed from the School of Medicine may succeed in passing a medical school course he or she has previously failed by taking it as part of his or her course in another school or college, this is not regarded as evidence that a student's abilities justify readmission to the School of Medicine. A student who has been dismissed because of low scholarship can be readmitted only by action of the Academic Affairs Committee, and one who is readmitted must maintain a quality of work consistently above the minimum requirements. The faculty of the School of Medicine does not usually recommend repetition of courses in cases of low scholarship and does not permit a student to repeat a year of work, except when illness or some other extenuating circumstance justifies an exception.

Undergraduate Low Scholarship

ACADEMIC WARNING

An undergraduate student whose grade-point average falls below 2.00 in his or her first quarter at the University receives an academic warning. If a cumulative grade-point average of at least 2.00 for courses earned in residence at UW is not achieved by the end of the next quarter, he or she is placed on academic probation.

PROBATION AND DISMISSAL FOR LOW SCHOLARSHIP

An undergraduate student is placed on academic probation at the end of any quarter (except for the first quarter at the University, when an academic warning is issued) in which his or her cumulative grade-point average falls below 2.00. Once on probation, the student must attain at least a 2.50 for each succeeding quarter's work until the cumulative grade-point average is raised to a 2.00, or the student is dropped for low scholarship.

REINSTATEMENT

Only under exceptional circumstances is a student who has been dropped under low-scholarship rules readmitted to the University. Such a student is readmitted only at the discretion of the Dean of the school or college to which readmission is sought. A student readmitted after being dropped under these rules reenters on academic probation. The student's grade-point average is the same as when dropped from the University, and the student may not use grades from other colleges or universities or extension credit to raise his or her University of Washington grade-point average. A readmitted student is dropped if he or she fails to attain either a 2.50 grade-point average for the following quarter's work or a cumulative University of Washington grade-point average of 2.00 at the end of that quarter. The student is removed from probation at the end of the quarter in which a cumulative grade-point average of 2.00 or better is reached.

SENIOR IN FINAL QUARTER

A senior who has completed the required number of credits for graduation, but whose work in what would normally be his or her final quarter places him or her on probation, does not receive a degree until removed from probation. A senior who has completed the required number of credits for graduation, but whose work in his or her last quarter results in his or her being dropped for low scholarship, does not receive a degree until readmitted and removed from probation.

Undergraduate High Scholarship

QUARTERLY HIGH-SCHOLARSHIP LIST

The quarterly high-scholarship list includes the names of matriculated undergraduate students who have attained a quarterly grade-point average of 3.50 in the final grades for at least twelve graded hours, exclusive of lower-division ROTC courses. Appropriate high-scholarship entries are made on the student's permanent academic record.

YEARLY UNDERGRADUATE HONORS

The yearly award for high scholarship is recorded on the academic transcript of students who have achieved the following:

A cumulative grade-point average of 3.50 in at least three quarters of the academic year (Summer, Autumn, Winter, Spring)

12 graded credits or more for each of the three quarters, exclusive of Satisfactory/Not Satisfactory (S/NS) and Credit/No Credit Only (C/NC) courses

Students who have attended the University of Washington four quarters of the school year (Summer through Spring) must have a GPA of 3.50 for each of any three quarters, a minimum of 12 graded credits (exclusive of S/NS and C/NC courses) for each of the three quarters, and a cumulative GPA of 3.50 for the four quarters.

CERTIFICATES OF HIGH SCHOLARSHIP

Certificates of high scholarship are awarded to students in the sophomore, junior, and senior classes who have high scholastic records for their freshman, sophomore, or junior years, respectively. The Honors Committee determines the grade-point average required for certificates.

BACCALAUREATE HONORS

Baccalaureate honors (*summa cum laude, magna cum laude, cum laude*) are awarded to recipients of a first baccalaureate degree. These honors are awarded to those students who have completed no fewer than 90 residence credits at this institution. At least 60 of the 90 credits must be on a graded basis.

The University's Honors Committee determines annually the grade-point requirement for each baccalaureate honor. Credits earned by correspondence courses are not counted toward honors.

SOPHOMORE MEDAL, JUNIOR MEDAL, PRESIDENT'S MEDAL

Annually, the junior having the most distinguished academic record for the first two years of his or her program receives the sophomore medal from the President of the University. The senior having the most distinguished academic record for the first three years of his or her program receives the junior medal from the President of the University.

The President's Medal, which is conferred at commencement, recognizes the graduating senior who has the most distinguished academic record. Only students who have earned at least 90 residence credits at the University of Washington may be considered.

Academic Credit

Credit

The basic rule for determining academic credit is: 1 credit represents a total time commitment of three hours each week in a ten-week quarter, or a total of thirty hours in a single quarter, required of the typical student. Total time includes time spent in class, if any; time devoted to individual conferences with instructors, time devoted to reading or other study, problem solving, writing, laboratory work, exercises, or any other activity required of students. A specified number of credits must be earned for a degree.

QUARTER CREDIT VS. SEMESTER CREDIT

Colleges and universities that operate on a semester basis (i.e., divide the academic year into two parts, exclusive of a summer session) give semester credit. Quarter credits multiplied by two-thirds equal semester credits. Semester credits multiplied by one and one-half equal quarter credits. For example, a student attending the University of Washington who earns 45 quarter credits during an academic year would have earned 30 semester credits at an institution operating on the semester plan.

There are three basic types of credit:

Residence credit is that academic credit associated with those courses offered by the University through the quarterly *Time Schedule* and certain other approved courses. To gain residence credit, students must register for such courses during the official registration period.

Extension credit or credit earned through examination is credit earned by completing courses offered as extension courses or credit earned through special examinations. Such courses are not included in the UW grade-point average, although grades are recorded.

No more than 90 extension credits may be counted toward the baccalaureate degree. No more than 45 credits earned in extension courses at other institutions may be counted toward the baccalaureate degree. Ordinarily, extension and independent study (correspondence) credits may not be applied toward the final year.

Transfer credit is credit earned at another institution that is accepted by the University as being applicable toward satisfaction of degree requirements.

Acceptance of Transfer Credit

The University of Washington reserves the right to accept or reject credits earned at other collegiate institutions. In general, it is the University's policy to accept credits earned at institutions fully accredited by their respective regional accrediting associations, provided that such credits have been acquired through university-level courses appropriate to the student's degree curriculum at the University. In no case, however, may a student apply more than 135 transfer credits to a 180-credit baccalaureate degree program. Transfer credits are not normally accepted for application toward the final year.

Community College Credit

The University limits to 90 the number of credits that may be transferred from a community college. Ordinarily, community college credits may not be applied toward the final year.

Credit for Repeated Courses

Credit for a given course is awarded only once. Courses taken at another institution and repeated at the University will carry credit for only the University work. Courses repeated at another institution after being taken at the University will not affect the University of Washington grade-point average.

Credit Restrictions

Credit is not awarded for a mathematics or foreign-language course listed as a prerequisite if taken after the higher-level course. For example, a student who has completed SPAN 201 cannot later receive credit for SPAN 103.

First-year (elementary) or second-year (intermediate) foreign-language credit will not be granted either by examination or by course completion in a student's native language. "Native language" is defined as the language, or one of the languages, spoken in the student's home during the first six years of his or her life *and* in which he or she received instruction in elementary school.

Earning Credit by Special Examination

Regularly admitted and currently enrolled students may take special examinations, sometimes known as challenging a course, in subject matter offered by the University to gain credit without being enrolled in specific courses. Credit may be granted—

1. For independent study.

2. For work completed with private teachers.

3. For work completed in unaccredited institutions if a formal examination is deemed necessary by the Chairperson of the concerned department(s). (In some cases, credit may be validated without an examination. Students who wish to validate credit must make arrangements with the Office of Admissions.) The following restrictions apply:

a. No one may take a credit examination for a course in which he or she has received prior credit.

b. All credits earned by examination are counted as extension credit and are included in the 90-extension-credit maximum that may be applied toward the baccalaureate degree. No credit is allowed by examination if the grade earned is less than 2.0. Grades earned are not included in the grade-point average.

c. No student shall receive credit by examination for a course for which the student would not be eligible to receive credit if the course were taken in residence.

d. No student is permitted to repeat any examination for credit.

e. No student may receive credit by examination for lower-division courses in the student's native language. (Some language departments have more restrictive policies. Consult the individual language department for details.)

f. Credit by examination is not acceptable for application toward an advanced degree in the Graduate School.

A student who wishes to qualify for credit by examination must apply to the Graduation Office for a certificate of eligibility no later than Friday of the second week of the quarter. The student presents it for signed approval to an instructor responsible for the course in which the examination is to be taken, to the Chairperson of the department concerned, and/or to the Dean of the college or school concerned. It is then returned to the Graduation Office. Signed certificates and payment of $25 per course to be challenged must be accomplished by Friday of the second week of the quarter.

Examinations are administered by the Educational Assessment Center during the fifth week of the quarter.

No student is permitted to take more than two examinations in 3-, 4-, or 5-credit courses, or more than three examinations in 1- or 2-credit courses in one day. Should the student plan to take more examinations in a given quarter, an additional day may be permitted and arrangements made with the Educational Assessment Center.

CLEP Credit

Credit for the general examinations of the College Level Examination Program (CLEP) is not accepted or awarded by the University.

Advanced Placement and Advanced Placement Credit

The University grants advanced placement or credit on the basis of performance in the Advanced Placement Program of the College Board. Student records in the Advanced Placement Program are evaluated for credit by the department or college concerned. Additional information on advanced placement appears in the Undergraduate Study section of this catalog.

A student who is placed in the third quarter of the second-year University language sequence may receive 5 credits for the second quarter of the second-year course, provided the third-quarter course is successfully completed. Similarly, a student whose high school study has brought him or her to the level of the completion of the second year of University study may be granted 10 credits for the second- and third-quarter courses of the second-year sequence, provided an upper-division course in the language other than courses in English translation or in conversational practice is successfully completed.

A student who is placed by examination at the level of MATH 125 or higher receives additional credits. If the student's first University mathematics course is MATH 125, credit for MATH 124 is given. A student whose first mathematics course is MATH 126 is given credit for both MATH 124 and 125.

A student must apply for advanced placement credits at the Grade Recording Department of the Registrar's Office after having completed the advanced course.

Full- or Half-Time Status Requirements

Some agencies require that a student have full-time status to receive maximum benefits or to retain a certain privileged status. To be classified as a full-time student by the University, an undergraduate must enroll for at least 12 credits per quarter and a graduate student must enroll for at least 9 credits per quarter. To be classified as a half-time student by the University, an undergraduate must enroll for at least 6 credits per quarter and a graduate student must enroll for at least 5 credits per quarter.

STUDENTS FROM OTHER COUNTRIES

A student attending the University on a student visa (F-1) must maintain a full course of study, or he or she must be reported to the Immigration and Naturalization Service. For this purpose, to maintain a full course of study as defined by the University:

1. An undergraduate, postbaccalaureate, or nonmatriculated student must register for at least 12 credits each quarter.

2. A graduate student must register, except Summer Quarter, for a minimum of 9 applicable credits each quarter.

3. One vacation quarter each year is allowed, provided the student has completed one academic year and intends to register for the subsequent quarter.

4. A student in the final quarter of his or her degree program needs to register for only those credits required for graduation.

5. The Immigration and Naturalization Service also requires the University to report such a student if he or she fails to register within sixty days of the expected initial registration date or if attendance at the University is terminated.

STUDENTS RECEIVING SOCIAL SECURITY BENEFITS

A student who wishes to receive Social Security educational benefits must be enrolled as a full-time student in accordance with the general definition outlined above. Additional information may be obtained at the Office of Veterans Affairs/Special Services, 460 Schmitz.

Transcripts

Official copies of student academic records at the University of Washington must bear the official embossed seal of the University, the signature of the Registrar, and the date of issue.

Transcript Fee

A charge of $3, payable to the Transcript Office in advance, is made for each transcript. Partial transcripts are not issued. Each transcript must include all work taken at the University of Washington.

Transcripts From Other Schools

A transcript covering a student's previous secondary and college education that has been submitted to the University as a requirement for admission becomes part of the official file and will not be returned to the student. Any student who desires transcripts of his work earned elsewhere must order official transcripts from the institution at which the work was undertaken. The University does not issue or certify copies of transcripts from other institutions.

Graduation

University Requirements for Baccalaureate Degree

To graduate, a student must meet University, college or school, and departmental requirements. Only University requirements are listed in this section. Requirements of colleges, schools, and departments appear in the section pertaining to the college, school, or department concerned.

FILING AN APPLICATION FOR BACCALAUREATE DEGREE

A student should file with the Graduation Office, in Schmitz Hall, a written application for his or her degree three quarters before the expected date of graduation. The absolute deadline for filing an application is Friday of the third week of the quarter the student intends to graduate (Tuesday of the third week for College of Arts and Sciences students, who file their applications at B10 Padelford).

It is the student's responsibility to apply for a degree and/or certificate, because degrees are not automatically awarded when requirements have been satisfied. Application forms and diploma cards are available at the Graduation Office and in the major departments.

The signature of the department head or of an authorized adviser must appear on the application in the space provided for "Signature of major adviser." A student leaves the application (and any supporting documents) at the college Dean's office (in Arts and Sciences, at B10 Padelford) for signature after obtaining the adviser's signature.

After the application is approved, the second and third copies are sent to the department or college office, and the original is retained in the Graduation Office. If a problem regarding the application arises, the Graduation Office will notify the student. Any required course listed on the approved application may be changed only by written notification to the Graduation Office by the student's departmental adviser.

If an applicant is ineligible to graduate because of a deficiency, the Graduation Office notifies the student.

SCHOLASTIC STANDARDS REQUIRED

To be eligible for the baccalaureate degree, a student must earn a cumulative grade-point average of 2.00 for all work done in residence at the University.

The *graduation* grade-point average is computed when the student has completed all work for the degree and includes only University of Washington residence credits.

CREDITS REQUIRED

To be eligible for graduation from the University with the baccalaureate degree, a student must satisfy all other specific requirements and must offer a minimum of 180 academic credits.

LIMITATION ON ROTC CREDITS

Credits earned in first- and second-year military training courses may not be counted in the basic 180 credits required for graduation. Some third- and fourth-year courses may count, depending on the student's college or school.

LIMITATION ON PHYSICAL EDUCATION ACTIVITY CREDITS

No school or college allows more than three 100-level physical education activity credits to apply toward graduation.

FINAL-YEAR RESIDENCE REQUIREMENT

To be recommended for a first or subsequent baccalaureate degree, a student must complete the final 45 credits as a matriculated student in residence at the University. The granting of exceptions to this rule is the responsibility of the Dean of the college or school awarding the degree. If an exception is granted, the student must still present a minimum of 45 credits taken in residence as a matriculated student to be awarded a University of Washington degree.

UNIVERSITY GENERAL EDUCATION AND PROFICIENCY REQUIREMENTS

The University has adopted the following minimum general education and proficiency requirements. Individual schools and colleges may establish general education and proficiency requirements in excess of University requirements.

General Education Requirement
Undergraduates entering any college or university Autumn Quarter 1985 or after must include at least 30 general education credits within the 180 required for a baccalaureate degree. A minimum of 18 of the 30 credits must be earned in two or more linked sequences of courses. Each sequence may consist of either two or three courses linked together as described by the student's school or college.

University Proficiency Requirement
Undergraduates entering any college or university on or after Autumn Quarter 1985 must include in their baccalaureate program the following proficiency requirements:

English Proficiency
Each student must complete at least 5 credits in English composition and an additional writing course or two W-prefix courses. W-prefix courses are courses that include a substantial writing component. W courses may also be used to satisfy general education requirements if so designated by the school or college.

Mathematics or Quantitative/Symbolic Reasoning Proficiency
Each student must complete at least 4 credits in courses involving quantitative and/or symbolic reasoning. Such courses may be offered in mathematics, logic, statistics, computer sciences, or other departments with courses so designated. Students may also fulfill this requirement by passing an approved test.

SECOND BACCALAUREATE DEGREE

A second baccalaureate degree may be granted, but a student must earn a minimum of 45 credits beyond the number required for the first baccalaureate degree. These credits usually must be earned in residence, with the granting of exceptions to the residency rule being the responsibility of the college or school awarding the degree. The student must achieve no less than a 2.00 cumulative grade-point average in the last 45 credits earned.

Students working for a second baccalaureate degree are not registered in the Graduate School, but in the academic division of the University with jurisdiction over the degree sought.

CATALOG FOR GRADUATION REQUIREMENTS

In general, a student graduates under the requirements of the current catalog. A student may, however, fulfill graduation requirements of the catalog in effect at the time he or she entered the school or college from which he or she is to graduate, provided that (a) not more than ten years have elapsed since the student's entry and (b) the

school or college and department agree that the student may graduate under the earlier requirements.

If the student graduates more than ten years after enrolling in the school or college, the current catalog must be used for graduation purposes. Exceptions to this rule cannot be made without official University and college approval.

The above provisions do not apply to the requirements prescribed by the College of Education for teaching certificates.

DEGREES WITH TWO MAJORS

Some colleges allow a baccalaureate degree with two majors. The student's application for such a degree must show both majors and be approved by the advisers of both departments. Both majors appear on the permanent record.

TWO BACCALAUREATE DEGREES CONCURRENTLY

Two baccalaureate degrees, associated with different majors, may be granted at the same time, but the total number of academic credits earned must reach a minimum of 45 credits in excess of the number required for the first baccalaureate degree.

WAIVER OF GRADUATION REQUIREMENTS

A request for waiver of college or University graduation requirements is petitioned to the college graduation committee, which refers the petition to the Committee on Admissions and Academic Standards if an all-University requirement is involved. These petition forms are available at the Graduation Office or the advisory office and should be filed with the application for degree or as soon as possible after the need arises. A student should see his or her academic adviser to initiate a petition. Because the Committee on Admissions and Academic Standards meets only once each quarter, petitions involving University requirements should be filed early in the quarter.

An exemption from an all-University graduation requirement that is granted by the Committee on Admissions and Academic Standards becomes void at the end of two calendar years from the date such exemption is granted if all degree requirements have not been completed within that period.

GRADUATION REQUIREMENTS FOR ROTC STUDENTS

As a prerequisite for graduation from the University, students accepted for the third- and fourth-year advanced ROTC program must complete the advanced program unless excused or dismissed from this requirement by regulations prescribed by the Secretary of the Army, the Navy, or the Air Force, whoever has the authority in the individual case.

Requirements for Teaching Certification

The College of Education offers professional programs approved by the State Board of Education leading to teaching and other certificates. Additional information appears in the College of Education section of this catalog, or the student may write to the College of Education advisory office, 211 Miller.

Commencement

Formal commencement exercises are conducted only at the close of Spring Quarter. During April of each year, commencement information is sent to each student entitled to participate the following June.

DIPLOMA DISTRIBUTION

Diplomas are issued at the end of each quarter and are ready about twelve weeks after the end of the quarter in which they are earned. Diplomas will be mailed if requested

Tuition, Fees, and Special Charges

Enrollment Service Fee

A new or returning former student or continuing student in a new classification (e.g., undergraduate, postbaccalaureate [fifth-year], graduate) is required to confirm his or her intention to enroll by paying a nonrefundable $50 enrollment service fee (not required of nonmatriculated students). The $50 is applied toward tuition and fees assessed for the quarter for which the student is determined to be admissible and subsequently enrolls. A student who pays the fee for a given quarter but does not register in that quarter is not entitled to refund except in the situations listed below:

1. A new or returning matriculated student who is unable to obtain courses that are applicable to the requirements for the degree or certificate program to which the student has been admitted, and who does not enroll in or attend other courses, is refunded the $50 enrollment service fee upon written request to the Registrar. Petitions should include a statement from an appropriate academic adviser certifying that no such courses are available. Petitions must be submitted by Friday of the second week of the quarter.

2. A new or returning matriculated student who, after meeting with an appropriate academic adviser or receiving a University *General Catalog*, determines that the program for which admission was granted differs substantially from what the student was led to expect based upon earlier available information, will be refunded the $50 enrollment service fee upon written request to the Registrar. Such a request for refund must be submitted before the student registers for courses and in no case later than the first day of the quarter for which admission has been granted.

3. A new or returning student who applies by the prescribed deadline for financial aid administered by the University's Office of Student Financial Aid, and who cannot be awarded financial aid adequate to his or her needs as determined by that office, and who is therefore unable to attend the University, is refunded the $50 enrollment service fee upon application to the Registrar no later than two weeks after receipt of notice of the financial aid award.

4. A new or returning student who is unable to attend the University because of pregnancy, disability, or death, or because of being called involuntarily into the military service of the United States or into civil duty, will be refunded the amount, if any, by which the enrollment service fee exceeds the amount of tuition and fees assessed at the time of withdrawal. Requests for refund must be submitted in writing to the Student Accounts and Scholarships Office by the last day of the quarter for which the student was determined admissible and for which the enrollment service fee has been paid. Proper documentation is required.

Fee Payment

An obligation to pay tuition and fees in United States dollars is incurred when a student registers. A fee statement is mailed to the student's address on file in the Registrar's Office.

Payment of this obligation is due by Friday of the third week of the quarter. Nonpayment of tuition and fees by the due date results in: (1) charge of $30 for late payment, if payment is received within the one-week late payment period; (2) cancellation of registration, if payment is not made by the end of the fourth week. One-half of tuition and fees is assessed when registration is canceled for nonpayment of fees. The *Summer Quarter Bulletin* should be consulted for fees and fee payment schedule applicable to Summer Quarter only.

Specific instructions on how the payment is to be applied must accompany the payment when the payment is not in conformance with the tuition and fee billing. In the absence of such express directions, the University will make a reasoned interpretation of the student's intent and account for the funds accordingly. The student number must be specified on all payments.

Quarterly Tuition and Fee Rates Effective Autumn Quarter 1983

Undergraduate (including nonmatriculated and fifth-year)	*Resident*	*Nonresident*
Full-time—(more than 9 through 18 credits)	$ 436	$1,208
Additional fee per credit for more than 18 credits*	39	116
Part time—9 credits	393	1,087
8 credits	350	966
7 credits	307	845
6 credits	264	724
5 credits	221	603
4 credits	178	482
3 credits	135	361
2 credits (minimum)	92	240
Graduate and Law		
Full-time—(more than 6 through 18 credits)	630	$1,564
Additional fee per credit for more than 18 credits*	83	216
Part time—6 credits	540	1,341
5 credits	450	1,118
4 credits	360	895
3 credits	270	672
2 credits (minimum)	180	449
Medical and Dental		
Full time—(more than 12 credits)	1,018	2,578
Part time—12 credits	940	2,380
11 credits	862	2,182
10 credits	784	1,984
9 credits	706	1,786
8 credits	628	1,588
7 credits	550	1,390
6 credits	472	1,192
5 credits	394	994
4 credits	316	796
3 credits	238	598
2 credits (minimum)	160	400

* Does not apply to Juris Doctor degree candidates.

Fees are subject to change.

Fee schedules for resident and nonresident students apply to the academic year (Autumn, Winter, and Spring quarters). Summer Quarter fees are listed in the *Summer Quarter Bulletin*. The resident fee is charged nonresident students during Summer Quarter, except for students in the schools of Dentistry or Medicine.

Veterans: A special exemption program is available for "resident" veterans who served in Southeast Asia (see section on residence requirements). Under certain conditions, a veteran of World War II who is not eligible for Veterans Administration benefits is fully or partly exempt from tuition. Information concerning these exemptions may be obtained from the Office of Veterans Affairs/Special Services, 460 Schmitz.

Special Course and Laboratory Fees

The amounts listed above normally cover University charges for course registration. Some courses, however, have extraordinary expenses associated with them, and in such cases the University may charge additional fees in amounts approximately the added instructional or laboratory costs.

Other Fees

Auditors: There is no reduction in fees for auditors.

Admission Application Fees: Undergraduate, $25; Graduate, $35; Law, Medicine, Dentistry, $35. Former students returning in the same classification, $25.

On-Leave Registration Fee: This fee of $25, charged graduate students only, provides for a maximum On-Leave registration period of four successive academic quarters or any part thereof and is not refundable.

Late Registration Fees: A registration service charge of $25 is assessed a student granted permission to register after the last scheduled day of registration and through the tenth day. Students registering after the tenth day pay a $75 registration fee. A student who must reregister as a result of a cancellation for nonpayment of tuition and fees must also pay a $75 fee. Waiver or refund of the registration service charge may be petitioned in the Registrar's Office. Waiver or refund of the $75 registration fee may be petitioned in the Student Accounts and Scholarships Office.

Change of Registration Fee: A charge of $20 is made for each change of registration or change of section, or number of changes that are simultaneous after the official change of registration period.

Transcript Fees: A charge of $3, payable to the Transcript Office in advance, is made for each transcript.

Thesis and Dissertation Fees: Publication binding fee, $35; abstract-only fee, $25; copyright service fee, $25.

Replacement Fees: Duplicate diploma, with paper folder, approximately $20; teaching certificate (typed copy), $1; student identification card, $5.

Credit by Examination Fee: In order to obtain credit for independent study, a student may take an examination prepared by the department concerned. The fee is $25 per course. Appropriate forms must be obtained from the Graduation Office.

All fees are subject to change without notice.

Cancellation of Tuition and Fees

Registered students must pay full tuition and fees. Tuition and fees may be canceled or reduced if a student makes an official withdrawal or drops a course during the period specified by state statute. Refunds are given when a fee cancellation or reduction results in an overpayment.

CONTINUING STUDENTS

1. A student who withdraws on or before the fifth class day does not pay tuition and fees.

2. A student who withdraws after the fifth class day through the thirtieth calendar day of the quarter must pay one-half tuition and fees.

3. A student who withdraws after the thirtieth calendar day must pay full tuition and fees.

NEW AND RETURNING STUDENTS

1. A student who withdraws on or before the fifth class day forfeits the $50 enrollment service fee, but does not pay the regular tuition and fees.

2. A student who withdraws after the fifth class day through the thirtieth calendar day of the quarter must pay one-half tuition and fees or forfeit the $50 enrollment service fee, whichever is greater.

3. A student who withdraws after the thirtieth calendar day of the quarter must pay full tuition and fees. The $50 enrollment service fee is applied toward payment of tuition and fees.

FEE FORFEITURE

A student who does not withdraw but is dropping one or more courses is eligible for a lower fee, depending on the total number of credits remaining after the course drop and on the time period when the drop was made. Tuition and fees for students making a course drop on or before the fifth class day are determined by the total credits remaining. Tuition and fees for students making a course drop after the fifth class day through the thirtieth calendar day of the quarter are computed on the total credits remaining plus one-half the difference between the old fee and the new fee. There is no cancellation or reduction in fees for courses dropped after the thirtieth calendar day of the quarter. The fees of a new or returning student cannot be reduced below the $50 minimum paid as an enrollment service fee.

FEE REFUND

When a fee payment is made by check, a three-week waiting period is required before a refund can be authorized. An application for refund may be refused unless it is made during the quarter in which the fees apply. A student who withdraws for disciplinary reasons forfeits all rights to refund or cancellation of any portion of his or her fees.

Residence Classification Requirements

Residence classification information is available from the Residence Classification Officer, 209 Schmitz.

Veterans and Children of Totally Disabled Veterans and Personnel in the Armed Forces

Information on educational benefits and special exemption programs for veterans and their dependents is available at the Office of Veterans Affairs/Special Services, 460 Schmitz.

Veterans and members of the armed forces who apply for admission to the University are subject to the same minimum requirements as regular students and are expected to enroll in accordance with University requirements.

The University complies with the standards of progress as required by the Veterans Administration and the State Approving Agency. A copy of those standards, as approved, is available for review at the Registrar's Office.

Financial Obligations

The Comptroller is authorized to place a hold (administrative) on the records of any student who fails to pay promptly amounts due the University.

Until this hold is cleared, the University (1) does not release the student's record or any information based upon the record, (2) does not prepare transcripts or certified statements, and (3) denies registration for a subsequent quarter as well as graduation from the University. Debts paid by cash, cashier's check, or money order will be released immediately. Those paid by personal check will be released three weeks after receipt of the check, if the check proves valid.

In cases of serious financial delinquency, the Comptroller, with the consent of the Registrar, may order that the student's registration be canceled and that privileges of attendance be withdrawn.

An administrative hold or cancellation also may occur when a student has not complied with other University rules, procedures, or obligations. The hold may be placed on the student's record by the authorized University office responsible for enforcement of the rule, procedure, or obligation involved. The student is not permitted to register for any subsequent quarter or to obtain a transcript of his or her record or a certified statement except on the written release of the office that placed the hold.

Tuition and Fee Exemptions

The following categories of students may be exempted from all or part of tuition and fees. Students in these categories may contact the offices shown either for information on the exemption or to obtain the appropriate form to apply for the exemption. Most of the exemptions must be renewed each quarter and should be renewed before the beginning of the quarter. The various categories of exemptions are established by legislative mandate and may be revoked by the legislature at any time.

Category	*Contact Office*
World War II veterans who have fully utilized federal benefits	Office of Veterans Affairs/Special Services, 460 Schmitz
Children of persons who were POWs or MIA	Office of Veterans Affairs/Special Services, 460 Schmitz
Veterans who served in Southeast Asia during the period of August 5, 1964-May 7, 1975	Office of Veterans Affairs/Special Services, 460 Schmitz
Students participating in the WICHE Program	Student Accounts and Scholarships Office, 129 Schmitz
Medical and dental students in the WAMI Program	Student Accounts and Scholarships Office, 129 Schmitz
Faculty members and their children and spouses	Academic Personnel Office, 65 Administration
Staff members and their children and spouses	Residence Classification Office, 209 Schmitz
TA/RA's with half-time appointments	Graduate School, 201 Administration

To learn the requirements for permanent resident classification and to apply for classification as residents as soon as they might meet the requirements, students are invited to contact the Office of Residence Classification, 209 Schmitz.

Student Rights and Responsibilities

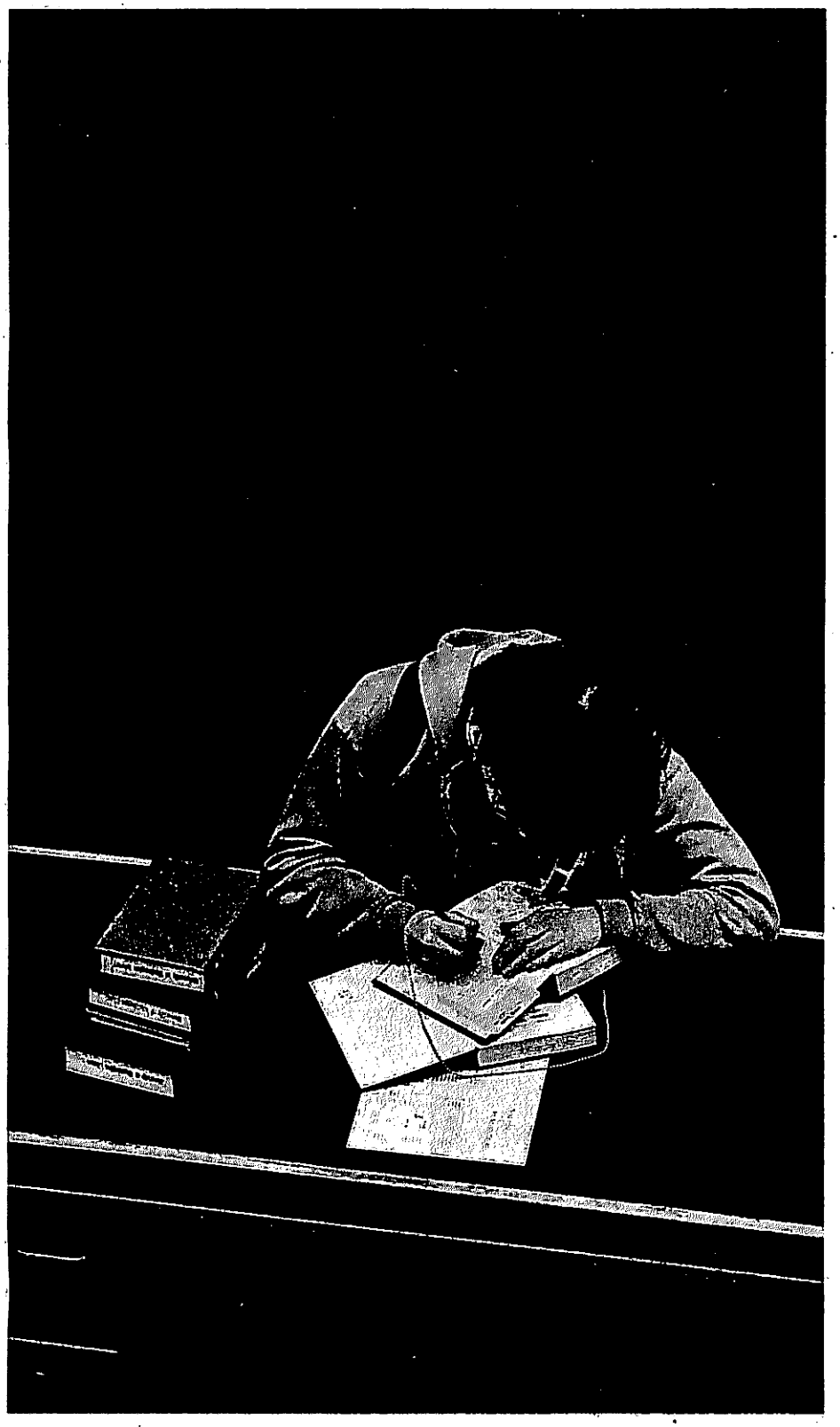
Student Conduct Code

The University Board of Regents has adopted a *Student Conduct Code*, which applies to both academic and nonacademic conduct for students while in attendance at the University. The code specifies standards of conduct, jurisdiction for hearing disciplinary matters, and due process. Interested students may obtain copies through either their advisers or the Office of Student Affairs, 459 Schmitz.

University Policy on Student Education Records

A copy of the University's policy on a student's right to inspect his or her education records and the University's responsibility to maintain the confidentiality of such records is located at each departmental reference station. The policy is filed under the Washington Administrative Code 478-140-010. Copies of the policy are available at the Registrar's Office, Schmitz Hall.

UNDERGRADUATE STUDY



Students who plan to enter the University of Washington as undergraduates must meet the general admission criteria, satisfy certain requirements, and complete the necessary procedures before they can qualify for admission and subsequent enrollment.

The University welcomes inquiries regarding its many undergraduate programs and invites prospective students to visit the campus. Tours, lasting about 1½ hours, are normally conducted weekdays at 2:30 p.m. Interested individuals may write or telephone the Office of Admissions for reservations.

General Admission Policy

Eligibility for admission is determined through criteria established by the University faculty. In general, admission is based on the applicant's scholastic standing, admission test scores, and adequacy of preparation for University study while in high school or another collegiate institution, with preference given, as necessary, to those with the greater probability of success in completing a degree program. In the event that there are more qualified applicants than can be accommodated, priority is given to those students offering the highest admission qualifications. Special consideration is given to the applicant's choice of curriculum and the availability of space at the proposed level of entrance.

ADMISSION OF NONRESIDENT STUDENTS

Because the University is a state institution, its primary obligation is toward the education of residents of the state. Students who are nonresidents are expected to present academic credentials higher than those required of Washington residents. Nonresident students also pay higher tuition and fees than those paid by residents.

Nonresident sons and daughters of University alumni are considered for admission according to resident admission requirements, but are required to pay nonresident tuition and fees.

Admission Requirements for Undergraduates

To be considered for admission as a freshman or transfer student, an applicant must submit the following:

1. A completed application, accompanied by a $25 application fee before the announced closing date.

2. Transcripts showing completion of the equivalent of an acceptable college preparatory program and records of all college study. Prior studies must include fourteen specified high school course units (or college equivalents) as follows:

- Three years of English.
- Two years of one foreign language.
- Three years of college preparatory mathematics (normally one year of geometry and two years of algebra, including an introductory component on trigonometry). Transfer students who have not satisfied this requirement in high school may do so in college either by completing appropriate high school equivalents or by completing a 5-quarter credit course in intermediate algebra with a grade of at least C (2.0).
- Two years of social sciences.
- One year of a laboratory science (preferably biology, chemistry, or physics).
- Three years of electives chosen from the above areas of study.

In equivalent college courses, 5 quarter credits are treated as equal to one high school unit (one year, or two semesters, of study).

3. Verbal and quantitative composite scores from the Washington Pre-College Test, the Scholastic Aptitude Test, or the American College Test, *unless* the student:

(a) has earned at least 75 quarter credits of transferable college-level work (of which at least 60 credits must be graded), *and either*

(b) qualified under the Direct Transfer Agreement now in force with the Washington community colleges (see below), *or*

(c) has a scholastic record yielding a prediction that his or her upper-division grade-point average at the University will be equal to, or higher than, the median upper-division grade-point average of the University's junior-senior classes.

Qualified applicants are ranked by means of formulas combining their previous grade-point averages with their test scores. Since the University often has many more applicants than it has space to accommodate, it cannot guarantee admission to all qualified students. Each quarter, in accordance with the number of spaces available in the student body, all applicants above a certain ranking are offered admission, but those below the ranking must be denied admission. It is impossible to state absolute or fixed minimums for admission, but in recent years residents of the state of Washington entering from high school with a cumulative grade average of *B* or slightly below, combined with a total of about 100 on the Washington Pre-College

Test for the verbal and quantitative composite scores (or about 900 total for the Scholastic Aptitude Test verbal and mathematics scores), usually have been admissible. Nonresidents are expected to present higher grades and scores. The mean high school grade-point average for freshmen entering from high school in Autumn Quarter 1983 was 3.41; the average college grade-point average for transfer students was 3.22. Of the 3,682 freshmen who entered Autumn Quarter 1982, 91 percent were enrolled in Spring Quarter of 1983.

TRANSFER ADMISSION AGREEMENT

The University of Washington has a direct transfer agreement with each of the twenty-seven community colleges in the state of Washington. The provisions of this agreement are as follows:

1. *Admission:* A student will be guaranteed admission (provided space is available) *without submitting test scores* provided the student (a) is a Washington resident; (b) has satisfied all the University core-subject admission requirements, including foreign language; (c) was in attendance at a Washington community college the last term prior to entering the University of Washington; (d) has completed 75 or more transferable credits (of which at least 60 must be graded); and (e) has attained a grade-point average in transferable courses of at least 2.75 (lower in some quarters). This agreement provides for admission only to the College of Arts and Sciences, not to any other college or school nor to any particular department.

2. *Transfer of Credits:* Students admitted under the transfer agreement will be granted transfer credit in exactly the same way as all other transfer students.

3. *A.A. Degrees:* Students with associate degrees must satisfy the same admission requirements as other undergraduate applicants (see section below on "Associate Degree Transfer Agreement").

4. *Graduation:* Students admitted under the transfer admission agreement, like other students, must satisfy all the requirements of the academic major, the college, and the University in order to graduate, except that for transfer students who first matriculate in a college prior to Autumn Quarter 1985 the proficiency requirement of the College of Arts and Sciences may be considered to have been satisfied if a student enters with 85 or more transferable credits.

ASSOCIATE DEGREE TRANSFER AGREEMENT

Students who obtain approved associate degrees from Washington State community colleges may be considered to have satisfied all or significant portions of the general education and proficiency requirements of the College of Arts and Sciences upon enrollment at the University of Washington. Regular admission criteria are not waived or altered by possession of an associate degree. This agreement applies to associate transfer degrees that meet the Associate Degree Guidelines adopted by the Intercollege Relations Commission and approved by the University of Washington in February 1984. The agreement is effective for students matriculating in the community colleges in Autumn Quarter 1984 or later. Students may consult the Office of Admissions for details of the agreement.

Admission of Postbaccalaureate Students

Students holding baccalaureate degrees from colleges and universities that are fully accredited by their regional accrediting associations may pursue additional undergraduate study leading to a second baccalaureate degree or a teaching certificate by applying for admission to the University for postbaccalaureate (formerly fifth-year) status. Postbaccalaureate status also may be used by students who need to satisfy prerequisites for admission to a particular graduate or professional degree program.

An applicant's scholastic record is the primary criterion for admission. Approval of the department concerned and, ordinarily, a grade-point average of at least 2.50 in the junior and senior years of the undergraduate program are required for admission. The minimum grade-point average is sometimes higher when the University is fully enrolled.

Because postbaccalaureate students are not graduate students, they are not permitted to register for courses numbered 500 or above without special permission. Courses completed while in this status may not ordinarily be applied later to an advanced degree in the Graduate School.

Admission of Nonmatriculated Students and Auditors

The nonmatriculated status is a special classification for students who do not wish to pursue a program leading toward a degree or teaching credential at the University and is usually open only in the summer. Among those who enter the University under this category are students who enroll in courses for the purpose of earning credits toward a degree program at another college or university, teachers and school administrators who take special-interest courses to earn additional University credits, postbaccalaureate students who do not desire formal admission to a graduate or second undergraduate program, and others interested in specific course work.

Nonmatriculated students enroll for courses on a space-available basis after all matriculated (regularly enrolled) students have had an opportunity to register. Admission as a nonmatriculated undergraduate does not guarantee subsequent acceptance as a matriculated student in a specific degree program.

If a nonmatriculated student is later admitted as a matriculated undergraduate, the scholastic standing achieved and appropriate credits earned in the nonmatriculated status will apply toward the requirements for the baccalaureate degree. However, the student must subsequently complete at least 45 credits in matriculated status to qualify for a degree. Credits earned by a nonmatriculated student do not apply to a graduate degree. Nonmatriculated admission is frequently closed due to full enrollment.

Individuals who wish to audit University courses should apply for admission with nonmatriculated standing. Attendance in courses as an auditor is by consent of the instructor involved and is conditioned by the extent to which space is available. Permission to audit is ordinarily granted for lecture classes only. An auditor may not participate in class discussion or laboratory work, and his or her registration may be canceled at the discretion of the instructor. No record of audited courses is kept. Regular tuition and fees are charged. To receive credit for an audited course, the student must register for the class for credit in a subsequent quarter.

Readmission of Former Students

A returning former student who has been away for one quarter or more *or* a graduate student returning from official leave status is required to complete and file a Former Student Enrollment Application and to pay a $25 application fee by the closing date. Returning former students who have been away from the University less than two quarters will have the highest priority for readmission. A student previously enrolled in an academic program with restricted enrollment and/or special admission requirements should consult his or her adviser about procedures for readmission. Returning nonmatriculated students are enrolled as space permits.

A returning student must pay a nonrefundable enrollment service fee of $50 by the date indicated in the offer of readmission.

The Regulations and Procedures section of this catalog contains additional information on registration and tuition and fees.

Admission to Educational Opportunity Program

The University seeks to enroll minority students and others who have not received the usual educational advantages.

American Indian, Black, Asian and Pacific American, Chicano, and White students from disadvantaged backgrounds are urged, regardless of their previous academic records, to apply for admission to the University through its Educational Opportunity Program (EOP), which is administered by the Office of Minority Affairs.

Students who believe they are qualified to participate in this program should contact the EOP admission office. Students in the Educational Opportunity Program are given special assistance so that they may achieve their potential at the University.

Admission of Undergraduate Students From Abroad

The University believes its greatest contribution to international education can be made in the area of graduate study.

Because of limited University facilities and departmental restrictions, only a small number of foreign undergraduate applicants are accepted directly from abroad. Foreign applicants are considered for admission only for Summer Quarter or Autumn Quarter and must present academic records well above the average to be competitive for admission. Such students also must present evidence of English language proficiency by providing scores from the Test of English as a Foreign Language (TOEFL). The only exceptions are native-born citizens of Australia, Canada, Great Britain, Ireland, and New Zealand. More information on the TOEFL appears under English as a Second Language (ESL) Center in the Continuing Education section of this catalog.

Specific information on admission of foreign undergraduates accompanies the special application form for foreign applicants.

ADMISSION OF STUDENTS WITH IMMIGRANT OR REFUGEE STATUS FROM NON-ENGLISH-SPEAKING COUNTRIES

Immigrant, refugee, or foreign students from non-English-speaking countries who have been attending high school in the United States before applying for admission to the University must satisfy the same admission requirements as other applicants. In certain cases, however, a native language other than English can be used to satisfy the foreign-language requirement, and some evidence of proficiency in English may be required. Students in these categories may consult the Office of Admissions for specific information. Evidence of English language competency is required, and students may be required to take English as a Second Language courses if their competency in English is below the 580 level on the TOEFL.

Academic Programs With Special Admission Requirements

Fulfilling the University's minimum requirements for admission does not guarantee acceptance into a specific department or program. Some academic programs have earlier application dates than, and admission requirements in addition to, those required for entrance to the University. Information on admission to programs with special requirements appears in departmental sections of this catalog.

The following academic units currently have special admission requirements: Architecture, Art, Building Construction, Business Administration, Communications, Computer Science, Dance, Drama (B.F.A. degree), Economics, Education, Engineering, Environmental Health, Fisheries, Forest Resources, Geological Sciences, International Studies, Landscape Architecture, Medical Technology, Microbiology, Music, Nursing, Occupational Therapy, Pharmacy, Physical Therapy, Prosthetics and Orthotics, Social Welfare, Society and Justice, Speech and Hearing Sciences, Speech Communication, and Statistics.

Application Process

Application forms, obtained from the Office of Admissions, should be returned as soon as possible, together with the $25 application fee, the necessary test scores, and transcripts, because quarterly quotas may be filled prior to closing dates.

High school applicants usually apply in December or January of their senior year; students transferring from another school or college apply at the beginning of their final term. Foreign students should apply in December or January to be sure of meeting their early closing date. Applications and credentials should be sent to the University of Washington, Office of Admissions, 320 Schmitz, PC-30, 1400 Northeast Campus Parkway, Seattle, Washington 98195.

Admission Closing Dates

To ensure consideration, applications must be received by the following closing dates:

Autumn Quarter
- Foreign applicants (matriculated), March 15
- Freshman (from high school), May 1
- Transfer, postbaccalaureate, and nonmatriculated, July 1

Winter Quarter, November 1
Spring Quarter, February 1
Summer Quarter
- Foreign applicants (matriculated), March 15
- All other applicants for matriculated status, May 15

Applicants for nonmatriculated status, Summer Quarter only, June 1

Some departments have application deadlines earlier than the University closing dates specified above. Refer to the appropriate departmental section of this catalog for detailed information.

Application for Financial Aid

Application for financial aid is a process entirely separate from application for admission. Interested students should contact the University's Office of Student Financial Aid or the counselors at their own school for information about financial aid availability and procedures. Details appear under Expenses and Financial Aid in this catalog.

Reservations for University Housing

Admission to the University does not automatically reserve residence hall space. Because housing arrangements must be made separately, students do not need to wait until they are admitted to the University

before applying for a room in the residence halls. Additional information on student housing appears in The University section of this catalog.

Notification of Admission

Applications are reviewed soon after they are received, and applicants are notified of their admission status as soon as possible. Eligible applicants receive an offer of admission and a leaflet informing them of required procedures for enrollment. Admission is not confirmed until these procedures are completed.

The offer of admission is valid only for the quarter indicated. Applicants who wish to be considered for a different quarter must file a new application and application fee with the Office of Admissions.

Appeal of Admission Decisions

An applicant who is dissatisfied with the original admission decision may appeal to the Committee on Admissions and Academic Standards with the assurance that any additional evidence in support of the application will be carefully reviewed. Students accepted by the committee are expected to comply with requirements outlined by the committee at the time of admission.

Retention of Admission Credentials

The credentials of an applicant who does not register for the quarter to which he or she has been admitted are retained only for a twelve-month period unless the applicant has notified the Office of Admissions of a continued interest in attending the University or of enrollment in independent study programs.

Credentials submitted to the Office of Admissions become the property of the University and may not be returned to the student or duplicated for another school.

Transfer Credits

The University reserves the right to accept or reject credits earned at other collegiate institutions. In general, it is the University's policy to accept credits earned at institutions fully accredited by their respective regional accrediting associations.

Students entering from two-year community colleges may apply a maximum of 90 transferable credits toward a baccalaureate degree. The final 45 credits of a University of Washington degree program must be earned at the University.

Transfer courses equivalent to University courses apply toward the baccalaureate degree exactly as do their counterparts taken at the University. Other transfer courses that are not exact equivalents, but which cover areas of instruction offered by the University, are also accepted. Only 3 credits for physical education activity courses may apply to a baccalaureate degree.

Up to 15 credits for occupational-vocational programs may be given at the point of admission, depending on the quality of the program and its relevance to the proposed University program. The application of such credits toward the degree, however, requires the approval of the college or school concerned.

The University reserves the right to accept or reject credits earned in educational programs sponsored by the armed forces. In general, consideration is given to work completed according to recommendations made by the American Council of Education. The maximum number of credits obtainable through completion of such programs is 30.

Course work completed in unaccredited institutions may be validated or certified through examinations described under Earning Credit by Special Examination in the Regulations and Procedures section of this catalog.

The University does not accept or award credits for the College Level Examination Program (CLEP) general examinations.

Advanced Placement (College Board)

Students who do college-level work in high school can receive appropriate credit or placement, or both, at the University on the basis of performance in the Advanced Placement Program (AP) of the College Board.

Listed below are departmental policies on granting placement or credit for AP examinations. Grades range from a high of 5 to a low of 1; in most departments, credit and/or placement is awarded for grades of 3 or higher. In some cases, the student must consult the appropriate departmental adviser after arriving at the University.

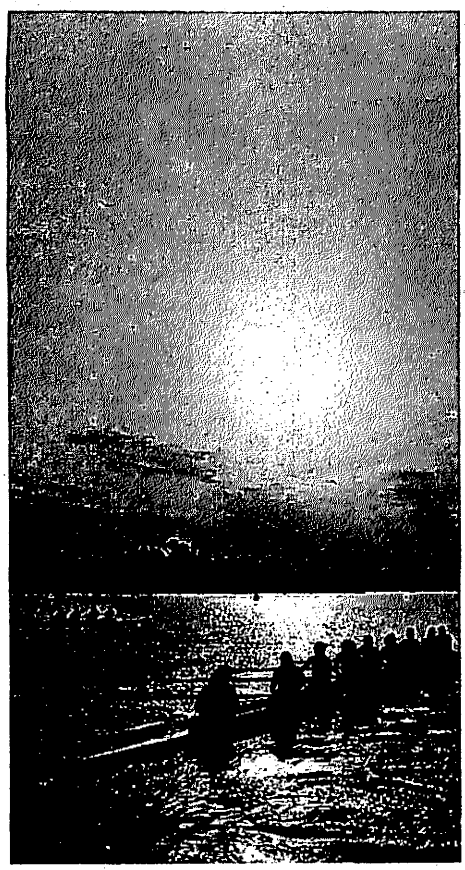
Art		
Art History	AP-5	ART H 201, 202, 203 (9 credits)
	AP-4, AP-3	Exempt from ART H 201, 202, 203; no credit
Studio Art		No credit; see departmental adviser for placement
Biology	AP-5, AP-4	See departmental adviser for credit and placement. A minimum of 5 credits awarded after conference with adviser; up to 10 credits possible. "BIOL X" AP credit may be counted toward natural science distribution
Chemistry		No credit will be given
	AP-5	Exemption from CHEM 140, 150, 151, 160 granted upon successful completion of CHEM 231 or 335; consult departmental adviser
	AP-4	Exemption from CHEM 140, 150, 151, granted upon successful completion of CHEM 160 or 164; consult departmental adviser
	AP-3	Exemption from CHEM 140 granted on successful completion of CHEM 150; consult departmental adviser
Classics		
Latin Lyric	AP-5, AP-4	LAT 305, 306 (6 credits)
Vergil	AP-5, AP-4	LAT 305, 307 (6 credits)
Latin Lyric *and* Vergil	AP-5, AP-4	LAT 305, 306, 307 (9 credits)
English	AP-5	ENGL 111, 181 (10 credits)
	AP-4	ENGL 111, 171 (8 credits)
	AP-3	ENGL 171 (3 credits) Students are eligible to receive AP credit for either the language and composition or composition and literature examination
German		
Language	AP-5	GERM 201, 202, 203, 207 (15 credits)
	AP-4	GERM 201, 202 (10 credits)
	AP-3	GERM 201 (5 credits)
Literature		See departmental adviser for exact courses and placement
	AP-5	(12 credits)
	AP-4	(9 credits)
	AP-3	(6 credits)
History		
American	AP-5, AP-4	HSTAA 201 (5 credits)
European	AP-5, AP-4	HST 113 (5 credits)
Mathematics		
AB Examination	AP-5	MATH 124, 125 (10 credits)
	AP-4, AP-3	MATH 124 (5 credits)
BC Examination	AP-5, AP-4	MATH 124, 125 (10 credits)
	AP-3	MATH 124 (5 credits)
Music		
Appreciation		See departmental adviser for placement and possible credit
Theory		No credit; see departmental adviser for placement
Physics	AP-5, AP-4	No credit; exemption from PHYS 121, 122 for Physics C Examination, or from PHYS 114, 115, 116 for Physics B Examination
Romance Languages		See department adviser for placement
Language	AP-5	FREN (SPAN) X 15 credits
	AP-4	FREN (SPAN) X 10 credits
	AP-3	FREN (SPAN) X 5 credits
Literature	AP-5	FREN (SPAN) LIT X (15 credits)
	AP-4	FREN (SPAN) LIT X (10 credits)
	AP-3	FREN (SPAN) LIT X (5 credits)

University Placement Tests

Information concerning mathematics and chemistry placement tests is included with the offer of admission or in the leaflet on registration instructions, which is mailed to applicants upon receipt of their enrollment confirmation. Additional information on recommended tests may be obtained from the appropriate college or departmental advising office. Testing information is also available at the Educational Assessment Center in Schmitz Hall.

Programs of Study

At the undergraduate level, the freshman or transfer student generally enrolls in the college that offers his or her chosen major. If admission to the selected major is restricted, or if the student has not yet selected a major, the student enters the College of Arts and Sciences as a premajor. The premajor category is also provided in certain other colleges for those students who have not made a definite choice of major in the college. Undergraduates preparing for professional study in such fields as architecture, business administration,



dentistry, education, engineering, medical technology, medicine, occupational therapy, pharmacy, physical therapy, prosthetics and orthotics, and social welfare, and complete preliminary work in the preprofessional programs offered within the College of Arts and Sciences.

Following are the principal fields of study offered by the University's schools and colleges. Not all areas listed below lead to degrees. The appropriate department may be consulted for specific information on program and degree requirements.

College of Architecture and Urban Planning

Architecture
Building Construction
Landscape Architecture

College of Arts and Sciences

Afro-American Studies
American Indian Studies*
Anthropology
Art
Art History
Asian American Studies*
Asian Languages and Literature
Astronomy
Atmospheric Sciences
Biology
Botany
Chemistry
Chicano Studies*
Chinese Regional Studies
Classics (Latin, Greek, Classical Studies)
Communications (advertising, editorial journalism, broadcast journalism, communication theory)
Comparative History of Ideas
Comparative Literature
Comparative Religion
Computer Science
Dance
Drama (general drama program, professional actor training program)
Economics
English
Environmental Studies*
Ethnomusicology*
General Studies
Genetics†
Geography
Geological Sciences
Geophysics†
Germanics
History
International Studies
Japanese Regional Studies
Jewish Studies*
Korean Regional Studies
Linguistics
Mathematics
Microbiology and Immunology
Music
Music Engineering*
Near Eastern Languages and Civilization
Philosophy
Physics
Political Science
Psychology
Romance Languages and Literature
Russian and East European Regional Studies
Scandinavian Languages and Literature
Scientific and Technical Communication*
Slavic Languages and Literature
Society and Justice
Sociology
South Asian Studies
Speech and Hearing Sciences
Speech Communication
Statistics
Women Studies*
Zoology

* Program that may be taken for a degree under General Studies.

School of Business Administration

Accounting
Business, Government, and Society
Finance, Business Economics, Quantitative Methods
Management and Organization
Marketing, International Business

School of Dentistry

Dental Hygiene

College of Education

Elementary Education
Secondary Education
Special Education

College of Engineering

Aeronautics and Astronautics
Bioengineering†
Chemical Engineering
Civil Engineering
Electrical Engineering
Industrial Engineering
Materials Science Engineering
Mechanical Engineering
Nuclear Engineering†
Ocean Engineering
Scientific and Technical Communication

* Program that may be taken for a degree under General Studies.
† Graduate program. Certain courses open to undergraduates.

College of Forest Resources

Forest Engineering
Forest Resources Management
Forest Science
Outdoor Recreation
Pulp and Paper Science
Quantitative Science
Wood and Fiber Science

Interschool or Intercollege Programs

Bioengineering†
Quantitative Science

School of Library and Information Science

School of Medicine

Animal Medicine
Medical Technology
Microbiology and Immunology
Occupational Therapy
Physical Therapy
Prosthetics and Orthotics

School of Nursing

Community Health Care Systems
Parent and Child Nursing
Physiological Nursing
Psychosocial Nursing

College of Ocean and Fishery Sciences

Fisheries Science
Food Science
Marine Affairs
Oceanography

School of Pharmacy

Medicinal Chemistry
Pharmaceutics
Pharmacy Practice

Graduate School of Public Affairs†

School of Public Health and Community Medicine

Environmental Health

School of Social Work

Social Welfare†

Foreign Study Programs

The Foreign Study Office of the University of Washington administers and cooperates in international study programs in Europe, Asia, Latin America, the Middle East, and the Soviet Union. The option exists for qualified undergraduates and graduates to enroll concurrently at the University while studying abroad. Programs are offered on a quarter, semester, or academic year basis. Opportunities range from general studies programs (Avignon, London, Köln, Guadalajara) to advanced language programs requiring two or three years of language preparation (Seville, Rennes, Beijing, Leningrad, Madrid, Nantes), to specialized professional programs (Tokyo, Copenhagen) and to direct enrollment in foreign universities. In addition, the University is developing reciprocal exchanges with major research institutions abroad, including the University of Tubingen, the University of Guadalajara, and Hebrew University in Jerusalem. This kind of exchange allows University students to enroll at designated international universities while paying regular University tuition. The University Committee on Foreign Study, composed of University administrators and faculty from various academic departments, reviews those programs for which University credit is available.

Program information and course descriptions are available from the Foreign Study Office, 572 Schmitz, (206) 543-9272.

Other Programs

A description of other study programs offered by the University, including extension credit programs, independent study through correspondence, noncredit studies, short courses and conferences, and telecourses, appears in the Continuing Education section of this catalog.

* Program may be taken for a degree under General Studies.

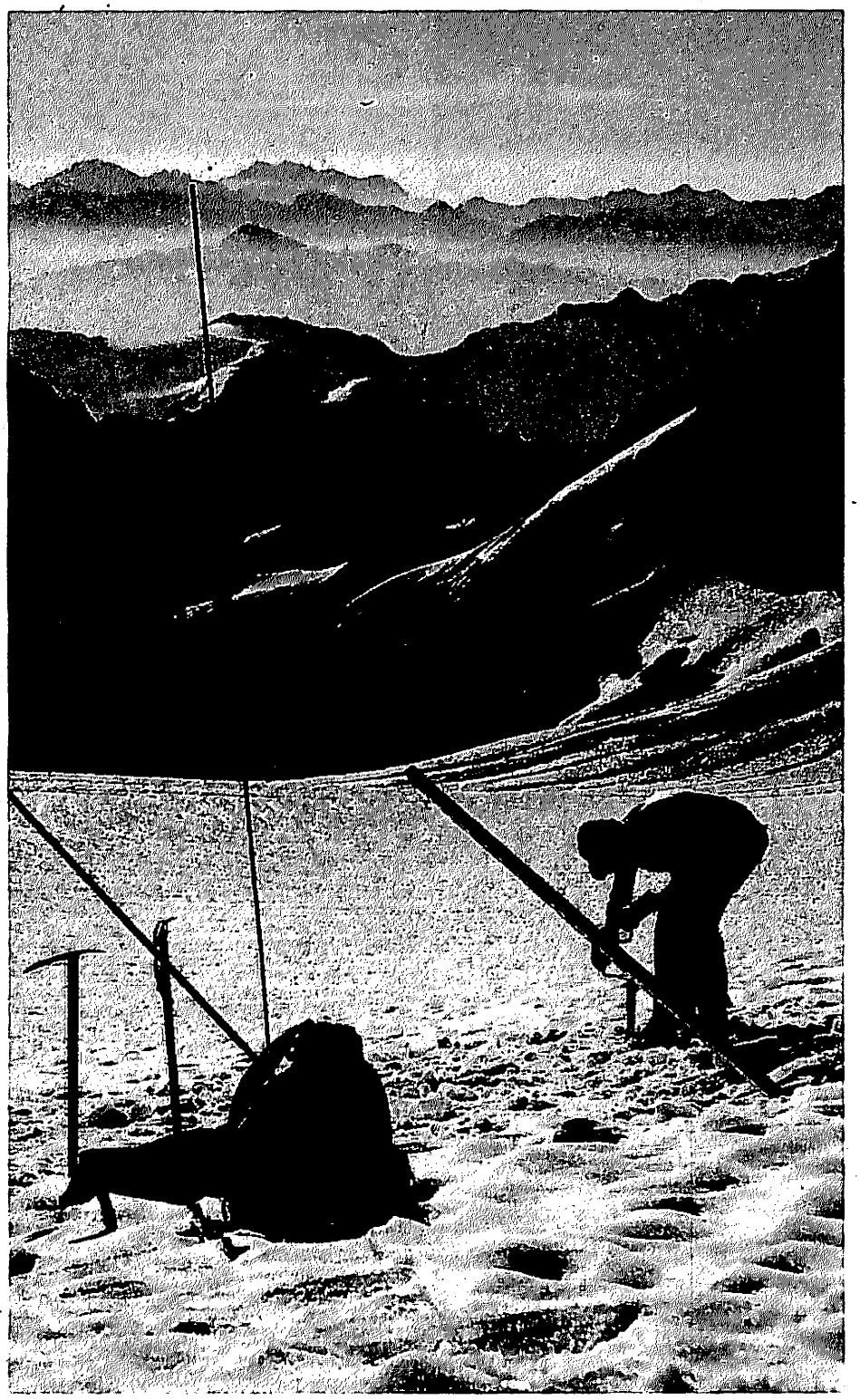
† Graduate program. Certain courses open to undergraduates.

Undergraduate Degrees

The University of Washington grants the following degrees upon satisfactory completion of appropriate programs of study in the departments, schools, and colleges:

Bachelor of Arts	B.A.
Bachelor of Arts in Business in Administration	B.A.B.A.
Bachelor of Fine Arts	B.F.A.
Bachelor of Landscape Architecture	B.L.Arch.
Bachelor of Music	B.Mus.
Bachelor of Science	B.S.
Bachelor of Science in Aeronautics and Astronautics	B.S.A.&A.
Bachelor of Science in Building Construction	B.S.B.C.
Bachelor of Science in Ceramic Engineering	B.S.Cer.E.
Bachelor of Science in Chemical Engineering	B.S.Ch.E.
Bachelor of Science in Civil Engineering	B.S.C.E.
Bachelor of Science in Electrical Engineering	B.S.E.E.
Bachelor of Science in Engineering	B.S.E.
Bachelor of Science in Fisheries	B.S.Fish.
Bachelor of Science in Forest Resources	B.S.F.
Bachelor of Science in Industrial Engineering	B.S.I.E.
Bachelor of Science in Mechanical Engineering	B.S.M.E.
Bachelor of Science in Medical Technology	B.S.Med.Tech.
Bachelor of Science in Metallurgical Engineering	B.S.Met.E.
Bachelor of Science in Nursing	B.S.Nurs.
Bachelor of Science in Occupational Therapy	B.S.Occ.Therapy
Bachelor of Science in Pharmacy	B.S.Pharm.
Bachelor of Science in Physical Therapy	B.S.Phys.Therapy

THE GRADUATE SCHOOL: GRADUATE STUDY AND RESEARCH



Dean and Vice Provost for Research

(new Dean and Vice Provost for Research to be designated)

Associate Dean for Academic Programs and Research

Joe G. Norman, Jr.

Associate Dean for Graduate Student Services and Minority Education

Trevor L. Chandler

Assistant Dean

Norman G. Arkans

Assistant Provost for Research

Donald R. Baldwin

Director, Graduate Admissions

James D. Linse

The University of Washington awarded its first graduate degree, a Master of Arts in the field of classical languages, in 1885. In 1914, the University awarded its first Doctor of Philosophy degree, in the field of chemistry. The University has conferred more than forty thousand master's degrees and eight thousand doctoral degrees, exclusive of medical, dental, and first legal doctorates.

The Graduate School was created in 1899 and achieved a permanent basis in 1910. Its purposes are to exercise leadership for the University of Washington in matters pertaining to graduate education, to facilitate the performance of research by its faculty and students, and to foster the integration of education and research to the benefit of both. Through graduate programs, the University fulfills several functions vital to a healthy society: by fostering research, it advances human knowledge; by educating scholars and teachers, it preserves and transmits our cultural heritage; by training professionals, it makes information and help available to the various sectors of the public; and, by virtue of all of these, it contributes to the resolution of the problems and needs of society.

Graduate study and research is guided by the Dean of the Graduate School and a Graduate Faculty of two thousand members, selected for their scholarly and research qualifications and their concern with graduate education. More than seven thousand graduate students are now in residence, working toward master's or doctoral degrees; several hundred postdoctoral students and appointees also are in residence. Programs in the Graduate School leading to master's and doctoral degrees are offered in eighty-eight departments or other organizational units of the University. The Graduate School directly sponsors seven interdisciplinary degree programs by organizing Graduate School groups of interested faculty members and assisting them in developing such programs. In some instances, a student works with a specially appointed faculty committee to develop an individual Ph.D. program.

Usually focused on a specific field of knowledge, graduate study is conducted through a variety of means, including lectures, seminars, independent advanced study, special reading courses, internships, and participation in research. Graduate programs leading to the Master of Arts, Master of Science, or Doctor of Philosophy degrees emphasize the development of the student's ability for independent scholarly work and the creation of new knowledge through research. Practice-oriented programs, which ordinarily lead to the degree of master or doctor in a particular professional field, emphasize preparation of the student for professional practice at the frontiers of existing knowledge.

Many master's and all doctoral programs culminate in the presentation of a thesis or dissertation conveying the results of the independent study and research carried out by the student. A master's thesis contributes to knowledge, reviews or critiques the state of knowledge in a field, creates a new design or composition, or represents some other appropriate kind of independent contribution. A doctoral dissertation must set forth a significant contribution to knowledge or understanding in the student's field, be presented in scholarly form, and demonstrate that the student is competent to engage independently in the pursuit of solutions to important problems. The student must defend the doctoral dissertation in a Final Examination conducted by a faculty committee and open to all other Graduate Faculty members. A member of the Graduate Faculty from some other discipline participates as an official representative of the entire Graduate Faculty in all aspects of the student's program, including various major evaluations such as the General Examination and Final Examination.

Acting through an elected council that advises the Dean, the Graduate Faculty establishes Graduate School policies. Each degree-offering unit within the University appoints a graduate program coordinator, who serves as an important link between the unit and the Graduate School. Students are advised to seek the help of the gradu-

ate program coordinator when questions concerning Graduate School and departmental degree requirements arise.

In addition to its primary concern with graduate students, Graduate Faculty, and programs leading to advanced degrees, the Graduate School has been given a number of responsibilities that relate to its primary ones. It promotes research throughout the University by administering the Graduate School Research Fund, which is composed of institutional funds and is available to support faculty and student activities. It coordinates all requests to outside agencies for the support of research and advanced training. It awards certain graduate fellowships and assistantships. It also administers a number of centers, institutes, and laboratories for advanced study, as well as such central facilities as the University of Washington Press. A particularly significant responsibility is the selection of scholars to occupy the Walker-Ames and the Jessie and John Danz distinguished visiting professorships.

The University has obligated itself to promote greater access to advanced study by women and members of ethnic minority groups. Within the Graduate School, the Minority Education Division actively solicits applications for admission, facilitates their review, and helps with various procedures related to the enrollment of minority graduate students. In conjunction with the University's Office of Minority Affairs, the division offers financial aid to students who need such help. A special appropriation of funds by the Washington State Legislature permits the award of Graduate Opportunity Assistantships to encourage the recruitment and retention of women and minority students in areas of study where they are particularly underrepresented.

Graduate Degree Programs Offered

Academic Unit	*Graduate Degrees Offered*
Anthropology	M.A., Ph.D.
Applied Mathematics	M.S., Ph.D.
Architecture	M.Arch.
Art	M.F.A.
Art History	M.A., Ph.D.
Asian Languages and Literature	M.A., Ph.D.
Astronomy	M.S., Ph.D.
Atmospheric Sciences	M.S., Ph.D.
Biochemistry	M.S., Ph.D.
Biological Structure	M.S., Ph.D.
Biology Teaching	M.A.T.
Biomathematics	M.S., Ph.D.
Biomedical History	M.A.
Botany	M.S., Ph.D.
Business Administration	M.B.A., Ph.D.
Accounting	M.P.Acc.
Chemistry	M.S., Ph.D.
Classics	M.A., Ph.D.
Communications	M.A., M.C., Ph.D.
Comparative Literature	M.A., Ph.D.
Computer Science	M.S., Ph.D.
Dentistry	M.S.D.
Oral Biology	M.S., Ph.D.
Doctor of Arts	D.A.
Drama	M.F.A., Ph.D.
Economics	M.A., Ph.D.
Education	M.Ed., Ed.D., Ph.D.
Engineering	
Aeronautics and Astronautics	M.S.A.&A., M.Eng., Ph.D.
Ceramic Engineering	M.S.Cer.E., M.S., Ph.D.
Chemical Engineering	M.S.Ch.E., Ph.D.
Civil Engineering	M.S.E., M.S.Civ.E., M.S., Ph.D.
Electrical Engineering	M.S.E., M.S.E.E., Ph.D.
Mechanical Engineering	M.S.E., M.S.M.E., Ph.D.
Metallurgical Engineering	M.S.Met.E., M.S., Ph.D.
Nuclear Engineering	M.S.N.E., Ph.D.
English	M.A., M.A.T., Ph.D.
Fisheries	M.S., Ph.D.
Forest Resources	M.S., M.F.R., Ph.D.
Genetics	M.S., Ph.D.
Geography	M.A., Ph.D.
Geological Sciences	M.S., Ph.D.
Geophysics	M.S., Ph.D.
Germanics	M.A., Ph.D.
Health Services Administration	M.H.A.
History	M.A., Ph.D.
International Studies	M.A.I.S.
East Asian Studies	
International Studies	
Middle Eastern Studies	
Russian and East European Studies	
South Asian Studies	
Laboratory Medicine	M.L.M.
Landscape Architecture	M.L.A.
Law	LL.M., Ph.D.
Library and Information Science	M.Libr.
Linguistics	M.A., Ph.D.
Marine Studies	M.M.A.
Mathematics	M.A., M.S., Ph.D.
Microbiology and Immunology	M.S., Ph.D.
Music	M.A., M.M., D.M.A., Ph.D.
Near Eastern Languages and Civilization	M.A.
Nursing	M.N., M.S., Ph.D.
Nutritional Sciences	M.S.
Oceanography	M.S., Ph.D.
Pathology	M.S., Ph.D.
Pharmacy	
Medicinal Chemistry	M.S., Ph.D.
Pharmaceutics	M.S., Ph.D.
Pharmacology	M.S., Ph.D.
Philosophy	M.A., Ph.D.
Physics	M.S., Ph.D.
Physiology and Biophysics	M.S., Ph.D.
Physiology-Psychology	Ph.D.
Political Science	M.A., Ph.D.
Psychology	M.S., Ph.D.
Public Affairs	M.P.A.
Public Health and Community Medicine	
Biostatistics	M.S.
Environmental Health	M.P.H., M.S.
Epidemiology	M.P.H., M.S., Ph.D.
Health Services	M.P.H., M.S.
Pathobiology	M.S.
Radiological Sciences	M.S.Rad.Sci.
Rehabilitation Medicine	M.S., M.P.T., M.R.M.
Romance Languages and Literature	M.A., Ph.D.
Scandinavian Languages and Literature	M.A., Ph.D.
Slavic Languages and Literature	M.A., Ph.D.
Social Work	M.S.W., Ph.D.
Sociology	M.A., Ph.D.
Special Individual Ph.D. Program	Ph.D.
Speech Communication	M.S., Ph.D.
Speech and Hearing Sciences	M.S., Ph.D.
Statistics	M.S., Ph.D.
Urban Planning	M.U.P., Ph.D.
Zoology	M.S., Ph.D.

For additional information, see individual program descriptions elsewhere in this catalog.

Graduate Admissions

The Graduate School is responsible for determining the requirements for admission to graduate study. Within the limit imposed on overall graduate enrollment in the University, admission to a specific graduate degree program is limited to the number of students for whom faculty, staff, and facilities can provide graduate instruction and research guidance of high quality. Each graduate student must be admitted into a specific graduate program; the Graduate School does not permit general graduate enrollment.

Admission Procedure

Admission to the Graduate School is granted by the Dean of the Graduate School. Application for admission is made to the Office of Graduate Admissions. Each applicant must submit a completed University of Washington application form and arrange for the receipt of official transcripts by the office from all previously attended colleges, universities, and institutes. Each department or other unit authorized to offer a graduate degree program maintains a Graduate Admissions Committee consisting of not fewer than three Graduate Faculty members. The committee receives from the Office of Graduate Admissions all completed applications for admission to the unit. The Admissions Committee is responsible for the fair and complete evaluation of applicants and for recommending to the Dean of the Graduate School the names of applicants who are considered to be qualified for admission.

Priority for admission of applicants into a graduate degree program is based upon the applicant's apparent ability, as determined by the University, to complete the program expeditiously with a high level of achievement and also upon the applicant's promise for success in his or her subsequent career. In addition, Graduate School admission policy requires that:

No practice may discriminate against an individual because of race, color, national origin, handicap, sex, age, religious preference, or background, or status as disabled veteran or Vietnam era veteran, and that:

Sustained efforts shall be made to recruit qualified students who are members of groups that have been subject to discrimination or are underrepresented in certain disciplines.

In developing a pool of qualified applicants for admission to the Graduate School, the following factors may be taken into account by a degree-offering unit:

1. Undergraduate grades, especially for subjects in, or closely related to, the field of the applicant's proposed graduate work (at least a *B*, or 3.00 grade-point average is expected).

2. The applicant's consistency in proceeding through an undergraduate degree program.

3. Scores on the Graduate Record Examination verbal, mathematical, and analytical tests, and on the GRE advanced test or other tests related to the applicant's field and on other aptitude tests that may be required.

4. Personal interviews of the applicant by the department admissions committee.

5. The career objectives of the applicant and the extent to which the graduate degree program may be expected to prepare him or her for those objectives.

6. Written and oral recommendations from persons who are qualified to evaluate the applicant's academic record and promise.

7. The applicant's degree objective (i.e., master's degree, doctoral degree, or a master's degree followed by a doctoral degree).

Weights given to these factors may vary among academic units.

Admission to the Graduate School usually signifies admission into a program of graduate study leading to a master's degree or the equivalent, or into post-master's study if the student admitted already has received a master's degree or has successfully completed equivalent graduate study. Admission does *not* imply acceptance of a graduate student into a program of study leading to a doctoral degree. A student becomes a candidate for the doctoral degree only on the completion of specific requirements interided to de September Februarymonstrate to the satisfaction of the student's unit and the Graduate School the apparent ability of the student to progress satisfactorily through the doctoral degree program.

Counseling and Financial Assistance

To assist in attracting individuals from low-income families into the qualified applicant pool, the Graduate School offers certain kinds of financial assistance and works with other University offices to arrange for counseling and financial aid.

Enrollment Limitation

Total Graduate School enrollment is determined by the University administration in furtherance of University intent to maintain proportions of graduate students and other categories of students appropriate to the role of the University in its particular setting. The Dean of the Graduate School, after consultation with other University officers and faculty, assigns enrollment targets to the graduate-degree-offering units. These targets are based on the combined judgment of these parties as to the demand for the program and the resources available to it.

First preference in enrollment is given to continuing graduate students (i.e., those who already have been admitted into a graduate

program, who are in good standing, and who have maintained continuous enrollment as in-residence, *in absentia*, or On-Leave students). After continuing graduate students are accommodated, the remaining places are available for the enrollment of new students or the reenrollment of former students who have not maintained continuous enrollment.

Visiting Graduate Students

A student who wishes to enroll in the Graduate School at the University of Washington and who intends thereafter to return to the graduate school in which he or she is working toward an advanced degree may be admitted as a visiting graduate student. This admission is contingent on available space and facilities.

Such a student must have been officially admitted to another recognized graduate school and be in good standing and actively pursuing a graduate program at present. The student need not submit a full transcript of credits, but must apply for admission, pay the $35 application fee, and furnish certification of status on a special form entitled Visiting Graduate Student—Certificate of Status, which may be obtained by writing to the University of Washington, Office of Graduate Admissions, AD-10, Seattle, Washington 98195.

Applications must be filed according to instructions on the application form prior to the following dates: July 1 for Autumn Quarter, November 1 for Winter Quarter, February 1 for Spring Quarter, and May 15 for Summer Quarter.

Admission to the University of Washington as a visiting graduate student *does not guarantee* admission to any particular course of study. A visiting graduate student is permitted to register only in those courses for which he or she is judged to be eligible by a faculty adviser or the instructor in the course and if space is available to accommodate registration.

If at any later time the student wishes to apply for admission to the Graduate School of this university to work toward a degree, he or she must make formal application and submit complete credentials. If a visiting graduate student is later given formal admission and begins work toward a degree at the University of Washington, he or she may petition the Dean of the Graduate School for allowance of credit for courses taken as a visiting graduate student to be applicable toward the graduate program.

How to Apply

Requests for the form Application for Admission to the Graduate School should be addressed to the graduate program coordinator of the department in which the student expects to pursue a program of study or to the Office of Graduate Admissions. Other correspondence relative to admission procedures should be addressed to the University of Washington, Office of Graduate Admissions, AD-10, Seattle, Washington 98195.

Each applicant for admission to the Graduate School as a regular graduate student or as a visiting graduate student must pay an application fee of $35. Payment, in United States currency only, must accompany the application. This fee is not refundable and is not credited against any other fees charged by the University.

REGULAR GRADUATE STUDENTS

The application for admission, the required transcripts in duplicate, and the $35 application fee must be filed, in accordance with instructions appearing on the application form, prior to the following dates: July 1 for Autumn Quarter, November 1 for Winter Quarter, February 1 for Spring Quarter, and May 15 for Summer Quarter (these dates are subject to change by the University). Early application is advised, because some departmental targets are filled well in advance of these dates.

The foregoing dates apply to new students as well as to former students of the University who have not attended since receiving their baccalaureate degrees. A former student must apply as a new student for admission to the Graduate School or for admission to an undergraduate college as a postbaccalaureate student. In some cases, departments suggest that applications be submitted earlier than the dates herein set forth.

When the required application, official credentials, and $35 application fee have been received, an evaluation is made and the applicant is notified of his or her admission status.

All records become a part of the official file and can be neither returned nor duplicated for any purpose. A student should obtain an additional copy of his or her official credentials to keep for advisory purposes. Failure to submit complete and accurate credentials may result in permanent dismissal from the University.

General information and instructions for registration are mailed to new students with the notice of admission. In the event of a discrepancy, these instructions supersede those found in earlier publications. *The University assumes no responsibility for students who come to the campus before they have been officially notified of their admission.*

The admissions credentials of applicants who do not register for the quarter to which they have been admitted are normally retained in the Office of Graduate Admissions for a period of one year from the date of application. At the end of this period, credentials on file are discarded unless the applicant has notified the Office of Graduate Admissions of a continued interest in attending the University.

University of Washington students who are within 6 credits of completing their undergraduate work, and who have met the requirements for admission to the Graduate School, may register the quarter immediately preceding admission to Graduate School for up to 6 credits in graduate courses in addition to the last 6 credits they require of undergraduate work. This registration and these arrangements must be approved by the graduate program that the student will enter; however, students concerned are not reclassified as graduates until the baccalaureate degree has been granted and after their official admission to the Graduate School. At that point, it is necessary to petition the Graduate School to transfer the 6 credits. Only under these circumstances may graduate work taken as an undergraduate be applied toward an advanced degree. Further registration for graduate work is contingent upon completion of the requirements for the baccalaureate degree.

INTERNATIONAL STUDENTS

Students from abroad are expected to meet the same general requirements as applicants educated in American schools. The admission application, official credentials, and $35 application fee must be received in the Office of Graduate Admissions at the University of Washington before the closing dates for domestic graduate students. In addition, applicants must demonstrate a satisfactory command of English and must have sufficient funds available in the United States to meet their expenses. The $35 fee, which must accompany the application, must be payable in United States currency in the form of an international postal money order, a draft on a United States bank, or a traveler's check.

ENGLISH LANGUAGE COMPETENCE

Prospective international, immigrant, and permanent resident students whose native language is other than English and who have not received degrees from institutions in countries where English is the native language are required to submit their scores on the Test of English as a Foreign Language (TOEFL), or the Michigan Test.

Students who are admitted with TOEFL scores below 580, or Michigan Test scores below 90, are required to take the University-administered diagnostic English test upon matriculation, and must take the English as a Second Language (ESL) courses identified as required.

Those accepted for Autumn Quarter admission prior to May 15 may register for intensive English through the Language Learning Center for the Summer Quarter. Information may be obtained from the graduate program coordinator.

Graduate Nonmatriculated Students

The Application to Graduate Nonmatriculated Status form should be completed and filed with the graduate academic unit to which the student is applying.

The student should obtain official transcripts from the registrars of all collegiate institutions attended and have them forwarded to the graduate unit. Only transcripts received directly from these institutions can be considered official.

Complete application and credentials should be received prior to: September 1 for Autumn Quarter; November 15 for Winter Quarter; March 1 for Spring Quarter; May 15 for Summer Quarter.

Graduate Student Registration

A regular graduate student: (1) has been granted regular admission to the Graduate School; (2) has developed a current program of studies satisfactory to the graduate program coordinator; and (3) has completed all of the required steps for registration, including the depositing of registration materials at Sections and the payment of tuition and fees.

Visiting graduate students follow regular registration procedures.

Graduate students are required to maintain continuous enrollment from the time of their first registration until completion of the advanced degree (see section on Continuous Enrollment).

All students currently attending the University who wish to attend a succeeding quarter should participate in preregistration. However, if this is not possible, students can make an appointment with the Registrar to go through in-person registration. Fee statements are mailed to students and must be paid by the stated deadline. Students are held responsible for knowing and observing the registration procedures, dates, and deadlines that appear in this catalog, in official notices in the University of Washington *Daily*, and in the quarterly *Time Schedule*.

After new students are notified of their admission, the Registrar contacts them, requesting a $50 enrollment service fee. If this payment is received by the date specified, the Registration Appointment Office will mail the new student a registration appointment and instructions for registering. The $50 enrollment service fee is not required of Summer Quarter students.

Advising

After notification of admission and before registration, the student should confer with the departmental graduate program coordinator about the program for current registration. It is primarily to the graduate program coordinator in the department that the student must look for individual counsel, guidance, and instruction in the scholarly study and research that characterize graduate work.

Financial Aids for Graduate Students

Students applying for fellowships, traineeships, and assistantships or associateships must make certain that complete transcripts and other credentials are on file by February 15 (earlier submission of applications and supporting documents is urged by all departments and required by some). Awards and appointments are usually made about April 1. Application forms may be obtained by writing to the graduate program coordinator of the appropriate department.

Fellowships, Traineeships, and Scholarships

A limited number of fellowships, traineeships, and scholarships are available through the Graduate School or through the graduate departments to outstanding students in all fields of study leading to advanced degrees. Application forms may be obtained from the graduate program coordinators in the departments or from the Graduate Fellowship and Assistantship Division in the Graduate School.

The Graduate School also provides computer searches to assist enrolled graduate students, faculty, and staff in locating fellowships, grants, and other sources of funding. The data base contains over two thousand awards from foundations, government agencies, associations, and other non-University organizations. These awards are made on a national competitive basis, and application must be made directly to these foundations or organizations.

Graduate Student Service Appointments

The University provides for the employment of many graduate students as teaching, research, and staff assistants, predoctoral associates, predoctoral instructors, and predoctoral lecturers. Approximately two thousand such appointments were made during the past year.

The University's policy regarding these appointments is set forth in detail in Executive Order 28. Copies of this statement are available from the graduate program coordinator or the Graduate School. Some of the information is provided below.

Appointments are granted only to graduate students who have carefully defined educational goals and who exhibit the highest intellectual competence and attainment. Succeeding appointments may be made if the student maintains high scholarship and continues to make satisfactory progress toward the degree.

Graduate appointments are granted to graduate students only. An initial appointment may be offered to a student before being admitted formally to the Graduate School, but the appointment is contingent upon admission to graduate status before the beginning of the appointment.

1984-85 GRADUATE STUDENT SERVICE APPOINTMENTS

(Students holding these appointments pay resident tuition and fees. Stipend levels are subject to periodic increases. A 3.6 percent increase is scheduled for January 1, 1985.)

Stipend for Half-time Service
(20 hours per week)

Title	*Monthly Salary*	*Academic Year Salary*
Teaching Assistant	$842	$7,578
Predoctoral Teaching Associate I	$890	$8,010
Predoctoral Teaching Associate II	$944	$8,496
Predoctoral Instructor	$944*	$8,496*
Predoctoral Lecturer	$944*	$8,496*
Research Assistant	$824	$7,416
Predoctoral Research Associate I	$866	$7,794
Predoctoral Research Associate II	$926	$8,334
Predoctoral Researcher	$926*	$8,334*
Graduate Staff Assistant	$842	$7,578
Predoctoral Staff Associate I	$890	$8,010
Predoctoral Staff Associate II	$944	$8,496

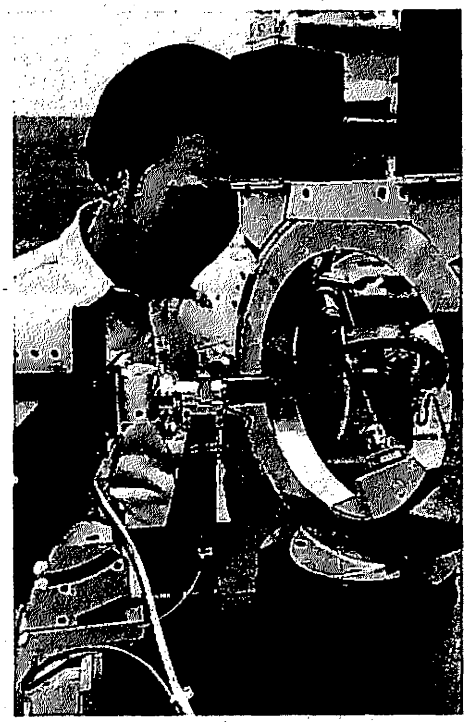
* Minimum.

Graduate students appointed to the beginning level of graduate teaching appointments are not permitted to be in overall charge of a course, but are given an appropriate degree of responsibility and supervision of laboratory or classroom work so that they may be introduced to teaching activities gradually and effectively. Student appointees may also serve as assistants in research activities for which a faculty member is responsible.

Two special categories for teaching appointments and one for research appointments are provided above the predoctoral associate level: predoctoral instructor, for the graduate student who has achieved Candidate status and is ready for increased teaching responsibility; predoctoral lecturer, for a mature and competent graduate student who, though he or she need not be a Candidate, has had exceptional previous teaching or other professional experience; and predoctoral researcher, for the student who has special skills or qualities obtained outside of his or her experience as a graduate student or who carries major responsibilities in relation to research activities. For the 1984-85 academic year these appointments carry a minimum stipend of $926 per month (half time) with no designated maximum so that the stipend may be adjusted to a level appropriate to the appointee's experience and his or her teaching and research responsibilities.

An additional series of appointments titled Graduate Staff Assistant and Predoctoral Staff Associates I and II is provided for University service activities that are not appropriately described as teaching or research but are closely related to the student's field of advanced study. Appointments of specific graduate students to these positions may not be made until after the position itself has been specifically approved.

Students who hold any of the above appointments are required to render twenty hours of service per week to the University. The appointments may be on a nine-month basis and ordinarily cover the period from September 16 through June 15. Some of these appointments may be extended to eleven or twelve months. Graduate student appointments do not provide for paid vacations or sick leave. Students who accept these University service appointments normally confine their employment to such appointments.



Nonresident graduate students holding assistantship or associateship appointments as described in this section, which require at least twenty hours of service to the University, are entitled to pay resident tuition. The employing department must submit the appropriate form to the Payroll Office, 3903 Brooklyn Avenue Northeast, by the first day of the quarter. Those who are unable to obtain the exemption during the first week must apply at the Student Accounts and Scholarship Office, 129 Schmitz, PE-10.

A graduate student service appointee must register for, and carry throughout each quarter except Summer Quarter, a minimum of 9 credits in formal courses or in research, thesis, or dissertation work. These credits must be in courses that are applicable toward an advanced degree.

Under exceptional circumstances and with the prior approval of the Graduate School, the above graduate appointments may be made on an hourly basis. Other hourly appointments for graduate students not employed on any of the above appointments are also available to assist faculty members in teaching and research. Readers are so classified, as are students who give routine assistance in research.

Work Study Graduate Assistantships

Graduate students who are eligible for the need-based college work study program may qualify for work study graduate assistantships in teaching or research. Students must submit financial aid applications to the Office of Student Financial Aid by the March 1 deadline to be considered for these positions. Information is available from the Office of Student Financial Aid.

Employment Opportunities

The campus offers other job opportunities for graduate students. Students may apply directly to the Chairperson of the department in which they hope to work or to the Student Employment Office. Students seeking part-time employment must be enrolled and on campus before they may obtain jobs.

Advisory positions in University residence halls paying room and board are available for single graduate students, both men and women. Additional information may be obtained from the Director of Residence Halls Programs, 301 Schmitz.

The University offers a number of full- and part-time employment opportunities for spouses of married students. These positions offer pay comparable to the prevailing salaries in the community, and some carry such fringe benefits as vacations, sick leave, and opportunities to enroll in University courses. Inquiries may be directed to the Staff Employment Office, 1320 Northeast Campus Parkway, Seattle.

Loans

Long-term educational loans are available to graduate students through the National Direct Student Loan and the Guaranteed Student Loan programs.

The National Direct Student Loan Program usually provides a maximum annual loan to graduate students of $2,500 and bears an interest rate of five percent. There are certain cancellation provisions in the National Direct Student Loan Program for combat-zone veterans and teachers of the disadvantaged. Loan application forms for this program are available in the Office of Student Financial Aid, PE-20, 105 Schmitz, telephone (206) 543-6101. The application deadline is March 1 for the following Autumn Quarter.

Students should meet the application deadline even if they have not yet been admitted to the Graduate School.

The Guaranteed Student Loan Program is based on the student's financial need and provides for a long-term bank loan in which the graduate student can borrow up to a maximum of $5,000 per year, depending on individual lending institutions' policies. This loan currently bears an eight percent interest rate. Nonresident students may obtain application forms at the student's bank. Washington residents must obtain application forms from the Office of Student Financial Aid. Lending institutions establish their own application deadlines and policies for making guaranteed student loans. An early inquiry to the student's bank is advisable. Nonresidents should check with the lending institutions in their home states. Three months are usually required to process this loan.

Short-term emergency loan funds also are available through the Office of Student Financial Aid. Several different types of short-term loans are possible, from $100 interest-free loans to $400 loans at six percent interest. In an emergency, students may also borrow the amount equal to resident graduate tuition or a twenty-five percent advance on a guaranteed student loan. More information is available from the Office of Student Financial Aid.

Financial Aid for Minority Graduate Students

Fellowships and assistantships based on need and on merit are open to men and women whose ethnic origin is either American Indian, Asian American, Black, or Hispanic American. These awards are generally made through the nomination and support of the department in which the student is enrolled. Supplemental fellowships ranging from $250 to $1,000 are also awarded by the Minority Education Division of the Graduate School, based upon an evaluation of the student's need as established by the Office of Student Financial Aid.

Financial assistance from individual departments also may be available, and prospective students should apply directly to the Chairpersons of the departments in which they intend to do their graduate work.

Also available are a limited number of tuition scholarships for minority Washington State residents. Students may also apply for loans through the National Student Loan programs. Additional information can be obtained by writing the University of Washington, Graduate School, Minority Education Division.

All awards are contingent on the student's admission to the University of Washington Graduate School.

Graduate Degree Policies

The following sections contain detailed information concerning policies and procedures relating to admission into, and completion of, graduate degree programs. Students are advised to verify this information with the graduate program coordinator and the supervisory committee.

Graduate Program Coordinator

The graduate student's initial work at the University is guided by the graduate program coordinator in his or her field. The coordinator must be a senior tenured member of the Graduate Faculty and is the official representative of the academic unit that offers the graduate degree program. The graduate program coordinator maintains familiarity with policies and procedures of the Graduate School and provides overall coordination of graduate activities within the unit.

Graduate Courses

Graduate courses are intended for, and ordinarily restricted to, either students enrolled in the Graduate School or graduate nonmatriculated students, and are given numbers from 500 through 800. Some courses at the 300 and 400 levels are open both to graduates and to upper-division undergraduates. Such courses, when acceptable to the supervisory committee and the Graduate School, may be part of

the graduate program. The Graduate School accepts credit in approved 300-level courses for the minor or supporting fields only. Courses at the 300 level are not included in the calculation of grade-point average and will not apply toward the minimum Graduate School requirement of 18 graded credits for the master's or doctoral degree. Approved 400-level courses are accepted as part of the major as well as minor or supporting fields. Courses numbered 498 and entitled Special Topics or Special Projects normally are not applicable to a graduate degree program if addressed primarily to introductory content and undergraduate students. Undergraduate research (499) is not accepted as part of the graduate program. Graduate School Memorandum No. 36 offers additional information on graduate courses.

Grading System for Graduate Students

In reporting grades for graduate students, units that offer graduate degrees use the system described herein. Grades are entered as numbers, the possible values being 4.0, 3.9, . . . and decreasing by one-tenth until 1.7 is reached. Grades below 1.7 are recorded as 0.0 by the Registrar and do not count toward residency, total credit count, or grade and credit requirements. A minimum of 2.7 is required in *each course* that counts toward satisfying the Graduate School requirement for 18 hours of course work numbered 500-700 at the master's level and for half of the course work at the 500-800 level for the doctoral degrees. A minimum grade-point average of 3.00 is required for graduation.

Correspondence between number grades and letter grades is as follows:

Numeric Grade-point Equivalent	*Letter Grade*	*Numeric Grade-point Equivalent*	*Letter Grade*
4.0	A	2.8	B–
3.9		2.7	
3.8	A–	2.6	
3.7		2.5	
3.6		2.4	C+
3.5		2.3	
3.4	B+	2.2	
3.3		2.1	
3.2		2.0	C
3.1		1.9	
3.0	B	1.8	
2.9		1.7	
		1.6-0.0	E

The following letter grades also may be used:

I *Incomplete.* An incomplete may be given only when the student has been in attendance and has done satisfactory work to within two weeks of the end of the quarter and has furnished proof satisfactory to the instructor that the work cannot be completed because of illness or other circumstances beyond the student's control. A written statement giving the reason for the incomplete and indicating the work required to remove it must be filed by the instructor with the head of the unit in which the course is offered.

To obtain credit for the course, a student must convert an incomplete into a passing grade by the last day of the next quarter in residence. This rule may be waived by the Dean of the college in which the course is offered. In no case may an incomplete be converted into a passing grade after a lapse of two years or more.

N *No grade.* Used only for hyphenated courses and courses numbered 600 (Independent Study or Research), 601 (Internship), 700 (Master's Thesis), 750 (Internship), or 800 (Doctoral Dissertation). An *N* grade indicates that satisfactory progress is being made, but evaluation depends on completion of the research, thesis, internship, or dissertation, at which time the instructor or supervisory committee chairperson should change the *N* grade(s) to one reflecting the final evaluation (normally credit or no credit).

S/NS *Satisfactory/not satisfactory.* A graduate student, with the approval of the graduate program coordinator or supervisory committee chairperson, may elect to be graded *S/NS* in any numerically graded course for which he or she is eligible. The choice must be indicated at the time of registration or during the official change period; only in very unusual cases may *S/NS* grades be converted to numeric grades or vice versa. The instructor submits a numeric grade to the Registrar's Office for conversion to *S* (numeric grades of 2.7 and above) or *NS* (grades lower than 2.7).

CR/NC *Credit/no credit.* With the approval of the faculty in the academic unit, any course may be designated for grading on the credit/no credit basis by notice in the appropriate *Time Schedule*. For such courses, the instructor submits a grade of *CR* or *NC* to be recorded by the Registrar's Office for each student in the class at the end of the quarter. All courses numbered 600, 601, 700, 750, and 800 may be graded with a decimal grade, a *CR/NC*, or *N* at the instructor's option.

W *Withdrawal.* Official withdrawal from a course during the first ten class days of a quarter is not entered on the permanent academic record. After the first two weeks and through the seventh week of the quarter, a graduate student may withdraw from a course by filing a form with the Registrar's Office. A grade of *W* is recorded. No official withdrawal is permitted after the seventh week of the quarter except under the conditions described under Withdrawal Policy.

Unofficial withdrawal from a course shall result in a grade of 0.0.

The grade *W* counts neither as completed credits nor in computation of the grade-point average.

Of the minimum number of credits required for a graduate degree, a graduate student must show numerical grades in at least eighteen quarter hours of course work taken at the University of Washington. These numerical grades may be earned in approved 400-level courses, and 500-level courses.

The student may petition the Dean of the Graduate School to modify the procedures described above. The petition should be accompanied by comments and recommendations from the graduate program coordinator or supervisory committee chairperson.

Withdrawal Policy

1. During the first two weeks of the quarter, graduate students may withdraw from a class for any reason by filing an appropriate form with the Registrar. No entry is made on the student's record.

2. After the first two weeks and throughout the seventh week of the quarter, a graduate student may withdraw from a course by filing an appropriate form with the Registrar. A grade of *W* is recorded.

3. No official withdrawal is permitted after the seventh week of the quarter except as follows: A student may petition the Registrar in writing to drop a course. The Registrar grants such a petition with the concurrence of the Graduate School if in his or her judgment (a) the student is unable to complete the course in question due to a severe mental or physical disability, or (b) unusual and extenuating circumstances beyond the student's control have arisen that prevented him or her from dropping by the end of the seventh week. Petitions must be filed promptly after the occurrence of the event that gave rise to the need for dropping. The Registrar shall enter the grade of *HW* (Hardship Withdrawal) for all courses approved for drop by petition.

4. The withdrawal schedule shown above applies to quarters of the regular academic year. The deadlines for Summer Quarter are established by the Dean of Summer Quarter.

5. Unofficial withdrawal from a course results in a grade of 0.0.

Scholarship

A cumulative grade-point average of 3.00 or above is required to receive a degree from the Graduate School. A graduate student's grade-point average is calculated entirely on the basis of number grades in 400- and 500-level courses. The grades of *S, NS, CR, NC,* and *N* are excluded, as are all grades in courses numbered 600, 601, 700, 750, and 800, and in courses at the 100, 200, and 300 levels.

Failure to maintain a 3.00 grade-point average, either cumulative or for a given quarter, constitutes low scholarship and may lead to a change-in-status action by the Graduate School. Failure to maintain satisfactory performance and progress toward a degree may also result in a change-in-status action by the Graduate School.

See Graduate School Memorandum No. 16 for additional information.

Language Competence Requirements and Examinations

Competence in one or more languages in addition to English is desirable for all fields of advanced study and is often required, especially in the scholarly and research-oriented programs leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy. It is assumed that students from English-speaking countries who are admitted to the Graduate School are competent in the English language; students from non-English-speaking countries must demonstrate a satisfactory command of English.

Requirements for foreign-language competence are established by the Graduate Faculty in the unit offering the graduate program. Language competence in certain languages other than English (i.e., languages that may have special significance to the field) may be specified as helpful or desirable or may be required. Students should consult the graduate program coordinator for information and advice about desirable or required competence in foreign languages. Details of completion of this departmental requirement must be transmitted to the Graduate School by the graduate program coordinator.

When appropriate, students are urged to establish foreign-language competence as undergraduates before entering the Graduate School or as early as possible in their graduate careers. The University's language competence requirements in French, German, and Spanish may be satisfied by successful completion of the standardized examinations given by the Educational Testing Service (ETS). These examinations are given at the University and elsewhere throughout the United States on published dates. For other foreign languages, examinations are given at the University of Washington on the day before scheduled ETS examinations.

Residence

The residence requirement for the master's degree is one year (three full-time quarters). For the doctoral degree it is three years, two of them at the University of Washington, and one of the two years must be spent in continuous full-time residence (three out of four consecutive quarters). The residence requirement for the doctoral degree cannot be met solely with summer or part-time study.

Once a student is admitted to a graduate degree program, a full quarter of residence is granted for any quarter in which at least 9 credits in graduate course, research, thesis, internship, or dissertation work are satisfactorily completed.

Part-time students registered for fewer than 9 credits per quarter may add part-time quarters together to achieve the equivalent of one full-time quarter (9 or more credits) to be applied toward fulfilling residence requirements. However, full-time students completing more than 9 credits in any one quarter may not use the credits beyond the minimum registration in the manner described above.

Only courses numbered 400, 500, 600, 700, and 800 can be applied to residence or course credit in the major field for advanced degrees. Courses numbered 300 are not applicable to residence or course credit toward advanced degrees except when applied by permission of the graduate program coordinator or supervisory committee toward the graduate minor or supporting courses. Courses numbered below 300 are not applicable to residence or course credit for advanced degrees.

Final Quarter Registration

A student must be registered as a full- or part-time student at the University during the quarter the master's degree, the Candidate certificate, or doctoral degree is conferred.

A student who has been approved for the tentative degree list for a particular quarter and does not complete the requirements by the published deadlines (two weeks prior to the end of the quarter), but who does complete all the requirements by the last day of that quarter, receives the degree the following quarter without further registration.

Continuous Enrollment and Official On-Leave Requirement

POLICY

Each student from the time of first enrollment in the Graduate School is to be registered or officially On-Leave each quarter until completion of all requirements for the graduate degree for which the student is working, including the filing of the thesis or dissertation, the passing of the master's or doctoral final examination, and the awarding of the degree. A registered graduate student must be enrolled as a full-time, part-time, or On-Leave student to maintain graduate status. Summer Quarter On-Leave enrollment is automatic for all graduate students who were either registered or On-Leave the prior Spring Quarter. Failure to maintain continuous enrollment constitutes evidence that the student has resigned from the Graduate School.

A student's petition for On-Leave status must be approved by the departmental graduate program coordinator or alternate. The student must have registered for, and completed, at least one quarter in the University of Washington Graduate School to be eligible for On-Leave status. An On-Leave student is entitled to use the University

library and to sit for foreign-language competence examinations, but is not entitled to any of the other University privileges of a regularly enrolled and registered full- or part-time student. The student pays a nonrefundable fee to obtain On-Leave student status covering four successive academic quarters or any part thereof. An On-Leave student returning to the University on or before the termination of the period of the leave must file a Former Student Enrollment Application (available at 225 Schmitz) before the deadline stated on the form and register in person in the usual way as a full- or part-time student (see Graduate School Memorandum No. 9 for procedures).

REGISTRATION *IN ABSENTIA*

In unusual cases, a graduate student may need to work *in absentia* at a place distant from the campus and yet actively continue in correspondence or conferences with professors at the University and proceed with the thesis or dissertation research. In this situation the student enrolls and registers as a full-time student *in absentia* or a part-time student *in absentia* and pays the usual fees for a full- or part-time student, after previously having the proposed *in absentia* work approved by the student's graduate program coordinator or supervisory committee chairperson. Periods of *in absentia* registration are counted toward completion of the requirements for residence by graduate students on the campus of the University of Washington.

READMISSION

A student previously registered in the Graduate School who has failed to maintain continuous enrollment but who wishes later to resume studies must file an application in person or by mail for readmission to the Graduate School by the regularly published closing dates. If the student is readmitted, registration will occur during the usual registration period. If the student has attended any other institution during the period when not registered at the University of Washington, official transcripts in duplicate of the student's work must be submitted. An application for readmission carries no preference and is treated in the same manner as an application for initial admission, including the requirement of payment of the application fee of $35.

Master's Degree

SUMMARY OF GRADUATE SCHOOL REQUIREMENTS

Each master's degree candidate must meet the following Graduate School *minimum* requirements:

1. Under a thesis program, a minimum of 36 or more quarter credits (27 course credits and a minimum of 9 credits of thesis) must be presented. Under a nonthesis program, a minimum of 36 or more quarter credits of course work is required.

2. At least 18 of the minimum 36 quarter credits for the master's degree must be for work numbered 500 and above. (In a thesis program, 9 of the 18 must be course credits and 9 may be for 700, Master's Thesis.)

3. Numerical grades must be received in at least 18 quarter credits of course work taken at the University of Washington. The Graduate School accepts numerical grades (a) in approved 400-level courses accepted as part of the major, and (b) in all 500-level courses. A minimum cumulative grade-point average of 3.00 is required for a graduate degree at the University.

4. A minimum of three full-time quarters of residence credit must be earned. Part-time quarters may be accumulated to meet this requirement (see detailed information under Residence).

5. A certificate or, where applicable, departmental verification of proficiency in a foreign language if one is required for a particular degree.

6. In a thesis degree program, a thesis, approved by the supervisory committee, must be prepared. A student must register for a minimum of 9 credits of thesis (700).

7. A final master's examination, either oral or written, as determined by the student's supervisory committee, must be passed.

8. Any additional requirements imposed by the graduate program coordinator in the student's major department or by the student's supervisory committee must be satisfied. A master's degree student usually takes some work outside the major department. The graduate program coordinator in the major department or the student's supervisory committee determines the requirements for the minor or supporting courses.

9. The graduate student must make application for the master's degree at the Graduate School within the first two weeks of the quarter in which he or she expects the degree to be conferred, in accordance with Application for the Master's Degree, as described below.

10. The graduate student must be registered either as a full- or part-time student at the University for the quarter in which the degree is conferred (see detailed information under Final Quarter Registration).

11. All work for the master's degree must be completed within six years. This includes applicable work transferred from other institutions (see detailed information under Transfer Credit).

12. *A student must satisfy the requirements for the degree that are in force at the time the degree is to be awarded.*

13. A second master's degree may be earned at the University of Washington by completing an additional set of requirements as indicated above.

TRANSFER CREDIT

A student working toward the master's degree may petition the Dean of the Graduate School for permission to transfer to the University of Washington the equivalent of a maximum of 12 quarter credits of graduate-level course work taken while a registered graduate student in another recognized graduate school. The petition must be accompanied by a written recommendation from the graduate program coordinator and an *official* transcript indicating completion of the course work.

Approved transfer credits are not to exceed the equivalent of 12 quarter credits and are applied toward total credit count for the master's degree only. (Transfer credits are not applicable toward a doctoral degree.) The minimum residence requirement of three quarters at the University of Washington; the 18 quarter credits of numerically graded course work; and 18 quarter credits of 500-level-and-above course work may not be reduced by transfer credit.

Credit by either independent study through correspondence or advanced credit examinations is not acceptable.

THESIS PROGRAM

The master's thesis should be evidence of the graduate student's ability to carry out independent investigation and to present the results in clear and systematic form. Two copies of the thesis, normally written in the English language, along with the appropriate forms signed by the members of the supervisory committee from the student's graduate program, must be deposited in the Graduate School at least two weeks before the end of the quarter in which the degree is to be conferred. The faculty in the graduate program may require that the student present an additional copy for its own use. Instructions for the preparation of theses in acceptable form may be obtained at the Graduate School.

NONTHESIS PROGRAMS

The faculty in some graduate programs have arranged programs of study for the master's degree that do not require the preparation of a thesis. These nonthesis programs normally include a more comprehensive plan of course work for more extensive examinations than are required in thesis programs, or they may include some approved research activity in lieu of a thesis.

FINAL EXAMINATION FOR MASTER'S DEGREE

As soon as is appropriate, the faculty in the student's graduate program appoints a supervisory committee, ordinarily consisting of two or three members but not more than four. The committee chairperson arranges the time and place of the final examination, the results of which must be reported by the graduate program coordinator to the Graduate School at least two weeks before the date on which the degree is to be conferred. The examination may be oral or written, and all members of the supervisory committee must certify its results. If the examination is not satisfactory, the committee may recommend to the Dean of the Graduate School that the student be allowed to take another examination after a period of further study.

APPLICATION FOR THE MASTER'S DEGREE

The student must make application for the master's degree at the Graduate School *within the first two weeks of the quarter in which he or she expects the degree to be conferred.* The filing of the application is the *responsibility solely of the student.* When the application is received, the student's record is reviewed in the Graduate School. All previous course work in addition to current quarter registration must meet the requirements for the degree if the application is to be approved. The applicant is notified by the Graduate School if the *minimum* requirements for the degree cannot be satisfied at the end of the quarter. Once approved, the application is forwarded to the appropriate graduate program coordinator.

The master's degree application, reporting the final examination results and signed by the student's supervisory committee, certifying that all departmental requirements have been met, must be returned to the Graduate School at least two weeks before the end of the quarter of the initial application if the degree is to be conferred that quarter. If all requirements are completed *after* this deadline but *before* the last day of that quarter, the degree is conferred the following quarter without further registration.

Master's degree applications are valid for *two consecutive quarters,* and if requirements for the degree are not completed during the quarter of the initial application, the student's application may be retained by the graduate program coordinator for the quarter *immediately* following (e.g., Autumn to Winter, Winter to Spring, Spring to Summer, Summer to Autumn) and returned to the Graduate School two weeks before the end of the second quarter. Thereafter, the application is void, and the student must file a *new* application for the degree in the Graduate School during the first two weeks of the quarter in which work for the degree is to be completed.

The student and the graduate program coordinator should be thoroughly acquainted with the requirements for the particular degree.

MASTER OF ARTS FOR TEACHERS

Master's degree programs for experienced teachers, which focus upon the fields of knowledge normally taught in the common school and the community college, have been established at the University. These programs provide alternatives to the research-oriented Master of Arts and Master of Science degree programs, which emphasize particular fields of knowledge. Programs leading to the M.A.T. degree are offered in biology and English.

CANDIDATE'S CERTIFICATE

The Candidate's certificate gives formal recognition of the successful completion of a very significant step toward the doctoral degrees awarded through the Graduate School: Doctor of Philosophy, Doctor of Arts, Doctor of Education, and Doctor of Musical Arts. Students who have passed the Graduate School General Examination and who have completed all requirements for the degree except the dissertation and the Final Examination are awarded the Candidate certificate.

Doctoral Degree

The doctoral degree is by nature and tradition the highest certificate of membership in the academic community. As such, it is meant to indicate the presence of superior qualities of mind and intellectual interests and of high attainments in a chosen field. It is not conferred merely as a certificate to a prescribed course of study and research, no matter how long or how faithfully pursued. All requirements and regulations leading to the doctoral degree are devices whereby the student may demonstrate present capacities and future promise for scholarly work.

SUMMARY OF REQUIREMENTS

In order to qualify for the doctoral degree, the student must meet the following Graduate School *minimum* requirements:

1. Completion of a program of study and research as planned by the graduate program coordinator in the student's major department or college and the Supervisory Committee. Half of the total program, including dissertation credits, must be in courses numbered 500 and above. At least 18 credits of course work at the 500 level and above must be completed prior to scheduling the General Examination.

2. Presentation of a minimum of three academic years of resident study (see detailed information under Residence), two of them being at the University of Washington with at least one year in continuous full-time residence. The continuous year may be satisfied with three out of four consecutive full-time quarters being completed at the University of Washington and is completed prior to the General Examination. Residence requirement for the doctoral degree cannot be met solely by part-time study. A minimum of two academic years of resident study must be completed prior to scheduling the General Examination.

3. Numerical grades must be received in at least 18 quarter credits of course work taken at the University of Washington prior to scheduling the General Examination. The Graduate School accepts numerical grades in approved 400-level courses accepted as part of the major, and in all 500-level courses. A minimum cumulative grade-point average of 3.00 is required for a graduate degree at the University.

4. Demonstration of a reading knowledge of one or more foreign languages related to the major field of study, if required for the student's particular degree program. Details of completion of this departmental requirement must be transmitted to the Graduate School by the graduate program coordinator.

5. Creditable passage of the General Examination.

6. Preparation and acceptance by the Dean of the Graduate School of a dissertation that is a significant contribution to knowledge and clearly indicates training in research. Credit for the dissertation ordinarily should be at least one-third of the total credit. *The Candidate is expected to register for a minimum of 27 credits of dissertation over a period of at least three quarters.* Normally, two of these three quarters must come after the student passes the General Examination and before a warrant is authorized for the Final Examination.

7. Creditable passage of a Final Examination, which is usually devoted to the defense of the dissertation and the field with which it is concerned.

8. Completion of all work for the doctoral degree within ten years. This includes applicable work from the master's degree or a master's degree from another institution, if applied toward one year of resident study other than the continuous full-time year of study.

9. Registration as a regular full- or part-time student at the University for the quarter in which the degree is conferred (see detailed information under Final Quarter Registration).

10. *A student must satisfy the requirements that are in force at the time the degree is to be awarded.*

SPECIAL INDIVIDUAL PH.D. PROGRAMS

Special Individual Ph.D. Programs may be arranged by permission of the Dean of the Graduate School for exceptionally able students whose objectives for study toward the Ph.D. degree do not fall within the scope of a single, Ph.D. degree-offering unit.

A graduate student may request permission to pursue a Special Individual Ph.D. Program when he or she has completed the master's degree or identifiable equivalent, or has been admitted to the Graduate School and completed at least three quarters of full-time work at the University and has carefully planned an appropriate program of studies.

The graduate student should discuss the proposal with a Graduate Faculty member qualified to provide appropriate guidance. If the faculty member agrees that the program is feasible and desirable, he or she then establishes a special advisory committee. This committee will consist of at least three, but usually not more than five, other members of the Graduate Faculty representing the student's fields of interest, and it must include faculty members from at least two academic units of the University.

The student then submits a Special Individual Ph.D. Program Proposal, accompanied by the endorsement of the special advisory committee, to the Dean of the Graduate School. Programs of study are derived from existing courses in academic units. Independent study or dissertation credit may be taken through IPHD 600 (Independent Study or Research) or IPHD 800 (Doctoral Dissertation). Graduate School Memorandum No. 25 contains additional information, proposal forms, and instructions, and is available from the Graduate School.

CONCURRENT GRADUATE AND PROFESSIONAL DEGREE PROGRAMS

Graduate students may enroll in two programs simultaneously, with one program leading to a professional degree (i.e., Law, Medicine, or Dentistry), and the other program leading to an advanced degree in an academic unit that offers a degree program in the Graduate School. Information may be obtained from the graduate program coordinator in the student's area of interest.

DOCTOR OF ARTS DEGREE

The policy of the Council of Graduate Schools in the United States declares that "preparation at the doctoral level for a career in the practice of undergraduate college teaching, ordinarily in one of the fields of the humanities or the social sciences or the natural sciences, may be recognized by the award of the degree of Doctor of Arts." The Graduate School of the University of Washington recognizes that further study leading to the Doctor of Arts degree may be appropriate for those who look forward to a career of professional practice in undergraduate or community college teaching and who desire to carry their preparation beyond the master's degree. Therefore, under certain circumstances the degree may be offered.

Inquiries concerning this degree program should be addressed to the Graduate School.

APPOINTMENT OF DOCTORAL SUPERVISORY COMMITTEE

A *Supervisory Committee* is appointed by the Dean of the Graduate School to guide and assist a graduate student working toward an advanced degree and is expected to evaluate the student's performance throughout the program. The Supervisory Committee must be appointed no later than four months prior to the General Examination. Appointment of the Supervisory Committee indicates that the Graduate Faculty in the student's field finds the student's background and achievement a sufficient basis for admission into a program of doctoral study and research. "Preliminary" examinations, if required, should be completed prior to the request for appointment of the Supervisory Committee. If "preliminary" examinations are not an academic unit's requirement, it is appropriate to request appointment of the Supervisory Committee during the student's first year of study (see Graduate School Memorandum No. 13 "Supervisory Committees for Graduate Students").

ADMISSION TO CANDIDACY FOR THE DOCTORAL DEGREE

At the end of *two years of graduate study*, the chairperson of the Supervisory Committee may present to the Dean of the Graduate School, for approval, a warrant permitting the student to take the General Examination for admission to candidacy for the doctoral degree. This means that, in the opinion of the committee, the student's background of study and preparation is sufficient to justify the undertaking of the examination. The warrant is approved by the Dean of the Graduate School only after the prescribed requirements of residence and study have been met and any specified language requirement has been fulfilled. The warrant must be received at least three weeks prior to the proposed examination date. Written and other examinations prior to the oral are the responsibility of the graduate program and do not need Graduate School approval. During the oral examination, the chairperson and at least two members of the examining committee, as well as the Graduate Faculty Representative, must be present.

If the student's performance is judged by the Supervisory Committee to be satisfactory, a warrant certifying the successful completion of the General Examination is filed in the Graduate School by the chairperson of the student's Supervisory Committee. Any members of the committee who do not agree with the majority opinion are encouraged to submit a minority report to the Dean of the Graduate School.

Thereafter, the student is identified and designated as a *Candidate* for the appropriate doctoral degree and is awarded the Candidate's certificate described earlier in this section. After achieving Candidate status, the student ordinarily devotes his or her time primarily to the completion of research, writing of the dissertation, and preparation for the Final Examination.

It is expected a student usually will be registered at least two quarters at the University of Washington after passing the General Examination and before a warrant is authorized for the Final Examination.

DISSERTATION AND FINAL EXAMINATION

The Candidate must present a dissertation demonstrating original and independent investigation and achievement. The dissertation should reflect not only mastery of research techniques but also ability to select an important problem for investigation and to deal with it competently. Normally the dissertation is written in the English language. However, if there are circumstances that warrant the dissertation be written in a foreign language, approval must be received from the Dean of the Graduate School. Requirements for the preparation of the dissertation in acceptable form may be obtained from the Graduate School.

When the Supervisory Committee agrees that the doctoral Candidate is prepared to take the Final Examination, the Dean of the Graduate School should be informed of the decision and asked to designate a Reading Committee from among the members of the Supervisory Committee.

Once the Reading Committee is established officially with the Graduate School, a Request for Final Examination (signed by the Supervisory Committee chairperson and the members of the Reading Committee) is presented to the Graduate School three weeks prior to the Final Examination date, and if the Candidate has met all other requirements, a warrant authorizing the Final Examination is issued by the Graduate School.

The Reading Committee prepares a report briefly summarizing the distinctive achievements of the research, the methods used, and the results. One copy of the report with the original signatures of the Reading Committee must be submitted to the Graduate School after the Final Examination.

If the Final Examination is satisfactory, the Supervisory Committee signs the warrant and returns it to the Graduate School at least two weeks before the end of the quarter in which the degree is to be conferred. Any members of the committee who do not agree with the majority opinion are encouraged to submit a minority report to the Dean of the Graduate School. If the examination is unsatisfactory, the Supervisory Committee may recommend that the Dean of the Graduate School permit a second examination after a period of additional study.

PUBLICATION OF DOCTORAL DISSERTATIONS

Doctoral dissertations are published in full on microfilm, and the abstract is published in "Dissertation Abstracts." Two weeks before the end of the quarter in which the degree is to be conferred, the Candidate must present two copies of his or her dissertation at the Graduate School. Each copy is to be accompanied by an abstract, not exceeding 350 words in length, that has been approved by the Supervisory Committee at the time of the Final Examination. A receipt for the $47.50 publication charge must be shown when the dissertation is presented. If the student wishes to register a copyright for the dissertation using the services of University Microfilms International, a receipt for the $25 copyright fee must also be shown when the dissertation is presented.

The Candidate signs the publication agreement at the time the dissertation is presented to the Graduate School. Publication in microfilm does not preclude other forms of publication.

GRADUATE NONMATRICULATED STUDENTS

Under certain conditions departments, schools or colleges may choose to offer enrollment in their graduate courses to graduate nonmatriculated students (GNM). The purpose of GNM enrollment is to allow qualified students to earn limited graduate credit in a particular area of need. Applicants who meet graduate admission standards may be enrolled as GNM students and may apply up to a maximum of 18 credits earned while so enrolled toward graduate degree requirements if later accepted into a graduate degree porgram. (For additional information, see *Admission Procedures—Graduate Nonmatriculated Status* and Graduate School Memorandum No. 37.)

Research and Scholarly Activities

Research is an essential part of graduate education in the University, and its furtherance is one of the primary concerns of the Graduate School. Grant and contract support of University activities is coordinated by the Graduate School. Additionally, the Graduate School administers certain public and private funds made available to encourage the research activities of faculty and students by support of their research and by securing the services of outstanding visitors to the campus.

External Support for Research and Training

The University of Washington is one of the nation's leading research institutions, receiving more than $170 million annually in support of a wide array of research and training programs. Since 1968, the University has ranked among the top five institutions in the United States (including two years as first) with respect to receipt of federal awards. About ninety percent of the University's grant and contract funds comes from federal agencies, most of the remainder coming from foundations, industry, and other private sources. These funds are awarded in response to faculty-initiated, University-approved proposals for grants to support specific projects in accord with the University's educational goals and are apart from legislative appropriations for the basic operation of the University. Grant- and contract-supported programs employ about 3,500 employees and provide significant opportunities for graduate students who work with faculty members in the conduct of research as a vital component of graduate education.

In addition, private donations to the University, amounting to more than $17 million a year, add significantly to the opportunities of students and faculty to pursue scholarly interests.

Institutional Support for Research and Training

The *Graduate School Research Fund* (GSRF) provides support for special needs in graduate study and research, including, but not lim-

ited to: (1) initiation of research programs by new faculty members; (2) exploratory research by faculty members and their graduate students to establish a basis for seeking outside funding; and (3) colloquia, symposia, and other means of disseminating the results of research and scholarly contributions by faculty and students.

Support for the GSRF is derived from the following:

1. State monies that are provided in the University's regular biennial budget.

2. Grants to the University that permit some discretion to the institution in supporting its general programs.

3. A portion of the funds provided to the University as institutional allowances associated with graduate and postdoctoral fellowships and traineeships.

4. Private donations such as the Agnes H. Anderson Research Fund, which was established with the proceeds of a gift from two anonymous friends of the University.

5. Income from patents and royalties in which the University has an interest.

Information about the Graduate School Research Fund may be obtained from the University of Washington, Graduate School, 201 Administration, AG-10.

Special Lectureships and Professorships

The *Walker-Ames Fund* was established in the 1930s through a bequest from the estates of Maud Walker Ames and her husband, Edwin Gardner Ames. Its stated purpose is to enable the University of Washington "to guarantee to the state of Washington the scholarly and educational services of the most distinguished minds available in this and other countries."

Chaired by the Dean of the Graduate School, a committee of University faculty members considers nominations from their colleagues and makes recommendations to the President for the appointment to Walker-Ames Professorships of distinguished scholars of national and international reputation.

Since 1936, when the first Walker-Ames Visiting Professor was appointed, nearly three hundred scholars and members of the professions have come to the University as temporary members of the faculty, enriching the intellectual life of the University community and the state.

The *Jessie and John Danz Fund* was established in 1961 by a gift and bequest from John Danz; an additional gift was made to the Danz fund in 1969 by his wife, Jessie Mohr Danz. The Danz fund is intended primarily to enable the University to bring to the campus each year one or more "distinguished scholars of national and international reputation who have concerned themselves with the impact of science and philosophy on man's perception of a rational universe."

The Danz fund supports special lectureships and professorships. Appointments are arranged in a manner similar to the Walker-Ames professorships, as well as other types of appointments or arrangements compatible with the terms of the Danz bequest (e.g., the publication and distribution of certain lectures given by Danz lecturers).

Questions pertaining to the Walker-Ames Fund and the Jessie and John Danz Fund may be directed to the Dean of the Graduate School.

Special Programs and Facilities

In addition to regular academic offerings, the University maintains a wide range of programs and facilities that provide special opportunities for graduate study and research. The following units are administered by the Graduate School:

CENTER FOR LAW AND JUSTICE

Joseph G. Weis, Director
1107 Northeast Forty-fifth Street, No. 505, JD-45

The Center for Law and Justice is a multidisciplinary research center established in 1975. Its goals are to engage in research, to contribute to the education and training of students, to offer consultation, and to provide liaison to the community in the areas of law and justice. To achieve these goals the center: (1) apprises faculty members of research opportunities and assists in the development of proposals; (2) involves students from different disciplines in research training and education and sponsors biweekly colloquia; (3) provides consultation to the criminal justice system and responds to the broader informational needs of the community; and (4) sponsors conferences and functions as the University's planning unit for the allocation of funds from the Law Enforcement Assistance Administration's state planning agency.

FRIDAY HARBOR LABORATORIES

A. O. Dennis Willows, Director
Friday Harbor, Washington 98250

University Office: 208 Kincaid, NJ-22

The Friday Harbor Laboratories is the principal marine science field station of the University of Washington. Its faculty comprises members from various academic units of the University, including botany, fisheries, oceanography, and zoology, as well as visiting faculty members from other institutions.

The laboratories, located approximately eighty miles north of Seattle near the town of Friday Harbor on San Juan Island, offers a biological preserve of 484 acres of wooded land with about two miles of shoreline. The island is one of the largest of the 172 that make up the San Juan Archipelago, located in the northwest section of the state of Washington between Vancouver Island and the United States mainland. In addition to the Friday Harbor site, the laboratories' administration has the responsibility for overseeing biological preserves leased or owned by the University on San Juan Island (False Bay and Argyle Lagoon), Shaw Island (uplands adjacent to Point George and Parks Bay; Cedar Rock Biological Preserve), and Lopez Island (Point Colville and Iceberg Point). Goose and Deadman islands, biological preserves owned by the Nature Conservancy, are under the stewardship of the laboratories.

The laboratories are close to seawaters that range from oceanic to those highly diluted by streams, some with depths to a thousand feet, others with bottoms varying from mud to rock, and water movements ranging from those of quiet bays and lagoons to those of swift tideways. The waters about the San Juan Archipelago abound in varied marine flora and fauna.

During spring, summer, and autumn, the laboratories offer opportunities for independent and supervised research, as well as a varied program of instruction for graduate and undergraduate students. Throughout the year, use of the laboratories' facilities for research in various areas of marine science is encouraged.

INSTITUTE FOR ETHNIC STUDIES IN THE UNITED STATES

John P. Keating, Chairman, Steering Committee
217 Guthrie, NI-25

The Institute was established in 1981 to encourage multiethnic and cross-ethnic interdisciplinary research in generic problems of ethnicity, with particular reference to minority groups living in the Pacific Northwest. Its thrust is toward generating significant scholarly publications and other scholarly activity.

JOINT INSTITUTE FOR STUDY OF THE ATMOSPHERE AND OCEAN

John M. Wallace, Director
608 Atmospheric Sciences-Geophysics, AK-40

Established by an agreement between the University of Washington and the National Oceanic and Atmospheric Administration, the Institute is intended to facilitate and strengthen cooperation between the two organizations in research and other collaborative efforts in the oceanographic and atmospheric sciences. To the campus it will bring scientists from NOAA laboratories and from other nations to join with University faculty and students in research projects initially directed toward mechanisms of climate change and studies of estuarine processes.

OFFICE OF SCHOLARLY JOURNALS

James D. Linse, Administrator
4045 Brooklyn Avenue Northeast, JA-15

The Office of Scholarly Journals provides assistance to members of the faculty who have editorial responsibilities for the publication of scholarly journals originating in, or associated with, the University of Washington.

NORTHWEST CENTER FOR RESEARCH ON WOMEN

Pamela Keating, Director
111 Cunningham, AJ-50

A multidisciplinary center with regional responsibilities, the center is designed to encourage and facilitate research on women and on gender-related issues. The center is governed by a policy board, which is appointed jointly by the deans of the College of Arts and Sciences and the Graduate School, and is advised by a community group.

QUATERNARY RESEARCH CENTER

Stephen C. Porter, Director
158 Quaternary Research-Geophysics, AK-60

Quaternary research focuses on the processes presently shaping the environment and those that have operated on it for the past several million years. To foster such study, the Quaternary Research Center was established at the University in 1967. Cooperating faculty members come from anthropology, atmospheric sciences, botany, chemistry, civil engineering, forest resources, geography, geological sciences, geophysics, oceanography, and zoology. They have in common a commitment to linking the past, present, and future through interdisciplinary study and research. The result is a broad spectrum of interdisciplinary study possibilities.

In addition to various geophysical laboratories, the Quaternary Research-Geophysics Building includes laboratories for palynology, potassium-argon dating, radiocarbon dating research, oxygen isotope research, and periglacial studies.

UNIVERSITY OF WASHINGTON PRESS

Donald R. Ellegood, Director
4045 Brooklyn Avenue Northeast, JA-20

The University of Washington Press, the book-publishing division of the University, has more than nine hundred titles in print, with special emphasis on art, anthropology, Asian studies, biology, ethnology, history and government, language and literature, oceanography, and regional subjects. The press publishes about fifty new books each year by members of the University faculty, as well as by scholars outside the University. In addition, the press has a paperback reprint series, entitled Washington Paperbacks, and an import program that makes known important books in English published abroad. It produces and distributes phonograph records and films, most of which grow out of original research on campus.

In addition to the Graduate School units described above, the following programs and facilities concerned with graduate education and research are administered by other University units:

CENTERS, INSTITUTES, AND INTERCOLLEGE PROGRAMS

Aerospace and Energetics Research Program. An interdepartmental and interdisciplinary program within the College of Engineering.

Alcoholism and Drug Abuse Institute. Coordination of research and training in the fields of alcoholism and drug abuse; provides community consultation.

Applied Physics Laboratory. A research and development organization with capabilities in ocean and environmental sciences and engineering, arctic technology, energy resource research, biosystems engineering, and forest engineering.

Center for Bioengineering. Program of the College of Engineering and the School of Medicine that applies the concepts and techniques of engineering to problems of biology and medicine.

Center for International Health. A network of approximately two hundred affiliates at the University and other regional institutions, representing several areas of specialization relevant to international health and development. Its purpose is to foster awareness and cross-cultural communication on international health issues.

Center for Quantitative Science in Forestry, Fisheries, and Wildlife. A broad program in applied mathematics and in mathematical services concerned with quantitative descriptions of the management of both aquatic and terrestrial ecosystems.

Center for Research in Oral Biology. Assists in the national effort to reduce the toll of oral disease and to promote the general level of oral health.

Center for Social Welfare Research. Offers policy and practice research in such areas as health and mental health, child welfare, income maintenance, individual and family adjustment, corrections, and gerontology.

Center for Urban Horticulture. Offers research, education, and public service problems in the utilization of plants to create, maintain, and enhance the quality of urban environments. In addition to its research and teaching programs at the Union Bay facility, the center manages the *Washington Park Arboretum,* a 200-acre living laboratory within Seattle devoted to the study of woody plants, and the 130-acre *Bloedel Reserve* (Bainbridge Island), used for the study of plant/human interactions.

Child Development and Mental Retardation Center. Provides facilities for teaching and research programs related to mental retardation and child development.

Fisheries Research Institute. Conducts research in fisheries biology and aquatic ecology in the Pacific Northwest and Alaska.

Institute on Aging. A multidisciplinary educational and research unit designed to focus attention on the social, health, psychological, political, and economic issues of human aging.

Institute for Environmental Studies. An interdisciplinary educational unit established to develop environmentally related programs in teaching, research, and public services.

Institute of Forest Resources. The research, continuing education, and information branch of the College of Forest Resources.

Institute for Public Policy and Management. Coordinates and promotes the efforts of other University units to deal with problems of public policy and administration in the state of Washington and the Pacific Northwest.

Regional Primate Research Center. One of seven throughout the nation; provides opportunities in biomedical research on nonhuman primates.

Washington Mining and Mineral Resources Research Institute. Established at the University in 1980, the institute's purpose is to promote and conduct research in fields related to mining and mineral resources, and by doing so to promote the education and training of engineers and scientists in these fields. Departments and individuals from this university and two other state universities are eligible to participate in institute programs. The institute is administered by an interinstitutional and interdisciplinary policy board and technical steering committee.

Washington Sea Grant Program. Fosters the wise use of the sea and its resources through a regional program of research, education, and advisory services.

Washington Technology Center. Designed as a statewide resource to conduct joint industry-university research in new and emerging technology, resulting in the transfer of commercially applicable technology to industrial companies in Washington State. It is structured to facilitate participation by a wide range of the state's industrial companies and research universities. Current research areas include: microsensors and integrated optics/circuits, biotechnology, plant genetic engineering, computer systems and software, manufacturing engineering and robotics, and advanced materials.

SPECIAL FACILITIES (ON CAMPUS)

Academic Computer Center. Provides instructional and research computing services for the University.

Burke Memorial Washington State Museum. An educational and cultural center whose function is to collect, preserve, research, exhibit, and interpret the natural and cultural objects of the human environment, particularly the Pacific Ocean, its islands, and mainland shores.

Drug Plant Garden. Viable seeds and plants of medicinal and pharmaceutical interest are maintained for experimental purposes.

Henry Art Gallery. The art museum of the University of Washington.

John L. Locke, Jr., Computer. Provides computing services to the health sciences complex and to hospitals and clinics in the community for medical research, teaching, training, and patient-care programs.

KCTSeattle/Channel 9. Community-supported television licensed to the University. Public Broadcasting System affiliate that offers public affairs, cultural, performance, entertainment, documentary, instructional, and children's programming to audiences in western Washington and British Columbia.

KUOW Radio. Broadcasts programs of an educational, cultural, scientific, informational, and public affairs nature; communicates information on University activities to students, alumni, and the public.

Nuclear Physics Laboratory. Houses a Van de Graaf accelerator and a cyclotron for research in physics, chemistry, cancer therapy, nuclear medicine, radiation biology, and related fields.

Observatory. Houses a six-inch refracting telescope, open for public viewing as well as for study and research.

Oceanographic Research Vessels. Operated for field study and research in Puget Sound and the Pacific Ocean.

Speech and Hearing Clinic. Serves as a center for research in speech science, speech and language pathology, and audiology, and provides services to the public.

University Hospital/Harborview Medical Center. The Health Sciences Center operates two major teaching hospitals: its own 320-bed University Hospital and, under contract with King County, the 300-bed Harborview Medical Center.

University Libraries. The largest research library system in the Pacific Northwest, it has a collection of more than two million volumes, four hundred thousand research reports, forty-seven thousand current serial subscriptions in a variety of languages, and numerous other research aids and services. The Pacific Northwest Bibliographic Center maintains a catalog of more than four and one-half million author entries from libraries throughout the Pacific Northwest.

SPECIAL FACILITIES (OFF CAMPUS)

Big Beef Creek Laboratory. Located at Seabeck, Washington; provides opportunities for research and instruction in the School of Fisheries.

Forest Resources. The College of Forest Resources maintains a variety of field facilities throughout the state that provide a general natural science laboratory for research and teaching of natural resource behavioral patterns and management.

Joint Center for Graduate Study. Administered by the University of Washington and Washington State University, with Oregon State University participating in the academic program. Located in Richland, Washington, it offers graduate-level and upper-division courses in many fields; laboratories owned by the Department of Energy are available for research.

Lake Wilderness Continuing Education Center (King County). A conference and continuing education facility.

Manastash Ridge Observatory (Kittitas County). A thirty-inch reflecting telescope and auxiliary equipment available for research in astronomy.

Primate Field Station (Medical Lake). A primate breeding facility maintained by the Regional Primate Research Center.

Washington Archaeological Research Center (Pullman). Established by the University of Washington, Washington State University, and the state's four other four-year academic institutions to provide information and expertise on the state's archaeological sites to state and federal agencies, local archaeological societies, schools, and private citizens.

Washington Water Research Center (Pullman). One of fifty-one such centers in the nation; established by the University of Washington and Washington State University to coordinate water resources research, education, and public service activities in the state.

West Seattle Laboratories (Seattle). For research and instruction in electrical engineering and research in physics and medicine.

Research at the University of Washington

The University of Washington has built a reputation for excellence in research. It is one of a handful of research universities with noteworthy programs across the whole spectrum of intellectual disciplines in the sciences, arts, and humanities. For many years, the University has been among the leading institutions in the country in federal money received for research. Achievements of its faculty have been recognized in the form of numerous professional awards and fellowships.

The University of Washington is the major research university in the Pacific Northwest, a region encompassing one-third the landmass of the United States. Its location has led to the development of research programs dealing with regional concerns and has stimulated the growth of disciplines whose interests lie well beyond the nation's borders.

The climate of research excellence offers graduate students the opportunity of learning from, and participating in, research with the leading scholars in virtually every field. Perhaps as important is the opportunity for collaborative ventures with outstanding researchers from related fields. The University's reputation also brings to campus many of the world's outstanding scholars to deliver seminars and lectures and to work with faculty members and graduate students. The University recognizes that graduate students are one of its primary assets, and its degree-granting units make every effort to attract the most promising graduate students from across the country. The quality of graduate students at the University has been acknowledged in reviews by granting agencies and continues to be a determining factor in attracting and retaining a renowned faculty.

The following sections contain brief descriptions of some interesting research under way at the University of Washington:

Earth, Ocean, and Atmospheric Sciences

The University of Washington has been able to use the natural disaster of Mount St. Helens' eruption in May, 1980, as a base for several major research projects. The ability of the University to respond to this opportunity is already providing the world with critical knowledge. In addition to a wealth of basic geophysical information from seismic data, the mountain has provided opportunities to study revegetation in blast-scoured areas from which all visible signs of life have been eliminated.

One area that continues to receive intense study is the Mount St. Helens watershed, which contains more than twenty percent of the state's salmon hatcheries. Fisheries scientists are learning how the homing system of salmon has been affected by ash and debris in the rivers and how the fish will adapt to destruction of their normal spawning grounds. Another important study in the mountain's vicinity concerns insects. Their ability to survive the blast has given them an uninhibited opportunity to thrive. The large quantity of dead and dying trees in the area will encourage insect survival, which may pose a threat to surrounding healthy timber. A researcher in the College of Forest Resources is following developments carefully to anticipate possible infestations.

Botanists, soils scientists, and naturalists are studying the ecosystems on the upper slopes of the mountain to document the recovery process in forest zones and meadows. They are determining interactions among soils, local climate conditions, plants, and animals on the mountain's cone and in areas that received varying amounts of mud, ash, and blast damage.

The network of observation stations around the volcano is helping scientists to understand the forces that continue to shape the region. Scientists have identified probable earthquake faults where none had been thought to exist. This has led to a reinterpretation of recent geological history in the region as well as its likely course over the next few thousand years.

Oceanographers, whose studies range worldwide, have made their own contributions to the unfolding story of the region's geological history. A University oceanography team traveling on a U.S. Geological Survey research vessel recently discovered active hydrothermal vents off the Washington-Oregon coast. Their existence was predicted by a University oceanographer nearly a decade ago. Photographs taken by a camera "flown" several feet from the ocean floor revealed plant and animal life flourishing near the vents. The unusual concentrations of living creatures and their ability to exist without sunshine suggest that they may be among the most ancient forms of life on earth.

UW scientists have long been interested in polar research, including both the arctic and the antarctic. The University is one of the major centers in the country for studies of ocean currents, ice formation, ice movement, and air-sea-ice interaction in these regions. UW personnel have developed unusual expertise for operation in polar regions. Principally through the Applied Physics Laboratory, UW investigators regularly conduct studies from bases sited on arctic pack ice and have deployed a series of weather buoys on the ice and in arctic waters that form part of a worldwide weather-forecasting system.

A group of researchers in atmospheric sciences has pioneered the study of clouds and weather systems by flying into the heart of storms approaching, or at, the Washington coast. They have developed techniques for examining the structure of these storms in detail. Their expanding base of knowledge will one day permit

weather forecasting that is more precise than is possible with conventional tools.

A unique scientific resource for the University is Friday Harbor Laboratories. Located on one of the larger islands of the San Juan Archipelago, the laboratories draw researchers from all over the world, who use the pristine Puget Sound water pumped into the laboratories for sensitive studies of reproduction, physiology, and development. One of the most abundant and diverse sources of marine life is found in the surrounding waters; animals and plants that are characteristically found at the bottom of oceans are relatively close to the laboratories.

Physical Sciences

Basic research in the physical sciences is aided by exceptional research tools. The Department of Chemistry has acquired state-of-the-art equipment for studies involving nuclear magnetic resonance (NMR), a sensitive probe for determining complex molecular structures. Besides being used to determine the rates of chemical reactions, NMR is used by health researchers studying complex biological processes because it is one of the few tools that can analyze a reaction while it is taking place.

Recently, researchers in the Department of Chemistry received funds to develop a Center for Process Analytical Chemistry. This center will be a joint University/industry effort to develop devices and techniques for continuous monitoring of chemical processes.

The University has one of three nuclear physics laboratories located at American universities supported by the Department of Energy. Recently, this laboratory received $8 million to construct a superconducting booster for its accelerator. This enhancement will create a nuclear physics research facility on a par with the best in the world. The Department of Physics experimental particle physics group and the Visual Techniques Laboratory are engaged in a number of studies at the frontiers of knowledge involving high-energy particles created both in laboratories and by nature. The visual techniques group has planned a series of experiments that will occur on future missions of the space shuttle.

The University also has been a leader in the development and use of EXAFS, a sophisticated x-ray tool for determining the structure of materials that are not formed from crystals. The use of EXAFS is giving scientists an understanding greater than ever before of how catalysts work, and it is giving life scientists a new tool for exploring the structure of proteins on an atomic scale. EXAFS is also being used by a number of physicists studying condensed matter. Experiments in this field employ the use of monolayer films just one atom in thickness, so that the complexity of interactions is reduced to two dimensions.

Astronomers at the University conduct research on planets in the solar system, such as studies of the meteorology of Mars. Besides helping scientists understand the formation of the universe, the studies are useful for examining aspects of weather forecasting on earth. Astronomers also seek clues to understanding quasistellar objects, or quasars. Current theories advanced by research at the University and elsewhere tie their existence to black holes and suggest they were formed shortly after the universe began. UW astronomers and graduate students have been rewarded for their research excellence by being granted more time per capita on major national telescopes than any other university group in the country.

Applied Sciences

The University's contribution to the space shuttle program has achieved national recognition. Since 1963, a team of engineers has been working with the National Aeronautics and Space Administration to study options for materials that might be used to protect the shuttle and its occupants from the heat generated during reentry. What began with a small initial study has resulted in more than $6 million in funding for the College of Engineering and the creation of a multidisciplinary team whose mission-oriented work has enriched the careers of many graduate students. Moreover, the successful program has resulted in unusually close ties between the University, government, and private industry. The program is now an integral part of the academic program in the College of Engineering and has led to the development of a series of interdisciplinary courses that attempt to solve technical problems of materials science for industry.

The Washington Technology Center, established in 1983, was designed as a statewide resource to conduct joint industry-university research in new and emerging technology. The center facilitates collaboration by a wide range of the state's industrial companies and research universities. Current research areas include: microsensors and integrated optics/circuits, biotechnology, plant genetic engineering, computer systems and software, manufacturing engineering and robotics, and advanced materials.

Mechanical engineers work on a variety of problems, including the design of special devices to meet the needs of handicapped persons, underground coal-combustion methods, and studies of efficient burning methods for use in home wood stoves. The Aerospace and Energetics Research Laboratory conducts work on efficient heat-rejection systems for space vehicles, innovative methods for heat transfer in power plants, and the use of lasers for photographing and studying eye diseases.

Chemical engineers are studying polymers that may replace metals in many structures, including airplanes. They also are exploring more efficient ways for extracting the last drop of oil from existing wells. Several faculty members and graduate students also are studying processes that occur at the interface between two substances—work that has applications in making better paints and dyes, as well as in improving the technology of oil-spill cleanup.

Civil engineers are studying problems of air pollution and the technology to prevent it; problems of water pollution, acid rain, and lake restoration; methods of predicting the effects of earthquakes on man-made structures; transportation systems that take advantage of the latest advances in technology and computer modeling; and new materials for road surfaces that can replace petroleum-based products with no sacrifice in quality.

In computer science, the University has received a major five-year grant from the National Science Foundation to develop ways of combining the advantages of minicomputers with the power of centralized computing systems. The grant will enable several members of the department to work on advanced software packages that will be especially useful in computer-aided design and office automation. The UW Computer Science Department was the first in the nation to receive a five-year grant for innovative work in this area.

In the Center for Bioengineering, problems facing physicians in diagnosis and treatment are solved with the help of engineers from a variety of disciplines. The center is the home of pioneering work in diagnostic ultrasound, which enables physicians to study a patient's circulatory system in detail without surgery. The center's team also has developed a laser scapel, a device that can markedly reduce blood loss during surgery, which can be an especially serious problem with burn patients. A renowned group of researchers has made important strides in understanding how to design man-made materials that are compatible with the human body. Such research is important in artificial-organ research as well as in other health-related work.

Life Sciences

A strong program in zoology includes research on the neurological basis of behavior and the origin of circadian rhythms; the physiology of insect development and the role of hormones in metamorphosis; and the ecology of intertidal communities. Recent work also has centered on a bird, the storm petrel, that may help scientists identify toxic substances and possible oil spills in the North Pacific. The studies, moreover, do not harm birds or require elaborate instrumentation—but they are as accurate as any other environmental monitoring system available in the region.

Since its establishment more than thirty years ago, the UW Health Sciences Center has become well known for its teaching, research, and patient care. University physicians and staff pioneered the first successful long-term kidney dialysis techniques, which have led to lifesaving treatments for tens of thousands of persons. Continuing research in this field has as one of its aims the production of more portable and simpler devices for persons suffering kidney failure. Medic I, a system of rapid response for victims of accidents and heart attacks, is based at Harborview Medical Center, one of the University's two teaching hospitals. It has provided a national model for immediate prehospital care.

UW research in cancer continues to improve the prognosis for several forms of the disease. University physicians have been leaders in the development of bone marrow transplantation, which offers the hope of curing several forms of leukemia. University programs explore the genetic basis of cellular abnormalities that occur in response to aging or to environmental insults. An active and recognized group of researchers explores the response of the immune system to cancerous cells.

The schools of the Health Sciences Center receive approximately half of all research money that comes to the University, which reflects their strength and diversity. Research programs in the study of heart disease, diabetes, and sexually transmitted diseases have achieved international recognition. The University's Child Development and Mental Retardation Center is recognized for its pioneering work in the causes, prevention, and treatment of diseases and disorders leading to mental retardation.

The School of Pharmacy has a growing program in pharmacokinetics, the study of how drugs are metabolized and the rate at which they affect target organs and are eliminated by the body. Research in this field is aimed at the scientific analysis and prediction of drug effects through the development of sophisticated mathematical models.

The rapidly expanding field of research made possible by genetic engineering techniques is found in the health sciences and in units within the College of Arts and Sciences. The Department of Genetics, a leader in understanding the genetics of yeast, has conducted basic research that could lead to cheaper methods for producing interferon, as well as antigens that are found in hepatitis vaccines. Other projects using recombinant DNA include studies of the immune system and the expression of foreign genes in higher plants.

Social Sciences

Interactions among individuals and groups determine the texture of society. The study of these interactions is the province of social scientists, whose work ranges from basic research on perception to the effect of interest groups on public policy.

Nationwide attention has been given to UW investigators studying couples and the common factors that underlie successful relationships. In related research, several investigators are examining the processes of interaction in small groups, from families to work teams.

Important research in leadership and motivation, in human memory, and in alcoholism and addictive behavior is being carried on in a number of academic disciplines. Alcoholism studies range from physiological experiments to model counseling programs for pregnant women to participant-observer studies of addictive behavior. The focus for this effort is the Alcoholism and Drug Abuse Institute.

Social scientists have performed provocative studies on the changing role of urban neighborhood organizations. Another group has concentrated on deviant behavior, receiving a major grant for the study of juvenile delinquency and possible prevention strategies. This grant is part of a larger effort by faculty members and graduate students to explore the ways that society's institutions react to deviant behavior.

Anthropologists are studying the changes in fertility, medical history, and cultural adaptation of the Japanese-American community in the Pacific Northwest, and the challenges facing immigrants from Vietnam and Laos. Other faculty members are pursuing problems in distant locales, such as the beginning of agriculture in the Nile Valley.

Geographers are studying regional issues, such as the economic linkages between the Pacific Northwest and other parts of the country; the design and financing of efficient and equitable transit systems; the recent surge in population of nonmetropolitan areas and its policy implications; and the geography of access to health care.

Economists continue working on models to predict the results of federal monetary and fiscal policy. A group of researchers is breaking ground in a relatively unexplored area, the economics of natural resources, comparing the costs and benefits of different patterns of usage. These investigations are designed to help policymakers evaluate alternatives.

Social scientists at the University have a special interest in international relations. The University has been a pioneer in research concerning the Near and Far East, and this important role was emphasized with the establishment of the School of International Studies in 1978, the culmination of more than sixty years of scholarly activity in area studies and international relations. Scholars in political science, anthropology, sociology, and the humanities study the role of culture in international affairs. Economists and geographers study development, resource management, and international economics. Historians complement the work of social scientists in exploring the basis of current thought, and scholars in languages and literature provide essential knowledge of original texts and the relationship of language to culture.

One major component of the school is its Center for Contemporary Chinese and Soviet Studies, established with support from busi-

nesses and private citizens in the Pacific Northwest. The center gathers information and disseminates it through publications and major conferences that attract participants from around the world.

Humanities and the Arts

Research in the humanities often fulfills a primary mission of humanistic study—the preservation of the literary and artistic achievements of mankind. One aspect of this research is textual scholarship, involving the identification and authentication of original texts and artifacts. New knowledge is also generated through reassessment of earlier texts and works of art. A University art historian has proven that "Salvator Mundi" was indeed painted by Leonardo da Vinci, and in all likelihood it was his final painting. Analysis of his work, using x-rays and infrared photographs, identified the materials used in the painting, the method of application, and the type of wood on which the painting was made.

Texts that form part of Egypt's Nag Hammadi Library, found more than a quarter of a century ago but only recently translated from Coptic, may lead to a reinterpretation of early Christianity. Located near the upper Nile, the library contains documents from little-known monastic groups, previously unknown Christian gospels, and both familiar and unfamiliar sayings of Jesus. A UW scholar studying these texts expects them to have as great an impact as the discovery of the Dead Sea Scrolls. The texts also will shed more light on the heretical Gnostic movement, which offers a radically different interpretation of Genesis.

A faculty member in the Department of English, working in the British Library, recently discovered several issues of a previously unknown periodical written by Henry Fielding, the famous eighteenth-century novelist. He is currently in the process of preparing annotated facsimiles of the issues, which should shed new light on aspects of Fielding's life, as well as adding some important material to the history of journalism.

A scholar from the Department of History learned in 1978 that some conversations held in the Oval Office of the White House during the administration of President Franklin D. Roosevelt had been secretly (and perhaps inadvertently) recorded. These recordings provide a candid, unedited view of Roosevelt and his advisers.

Research often is meant to describe exclusively the generation of new knowledge, but in the humanities a growing number of faculty members explore the theoretical basis underlying our knowledge and the means of transmitting it. The focus for these studies is a colloquium in theory that involves faculty members and graduate students. Discussions on problems in the theory of narrative, for instance, may span literature, history, science, and psychoanalysis—in fact, wherever the written word is used. The colloquia have acted as catalysts for several scholarly articles and may lead to an expanded program encompassing other disciplines, perhaps also eventually including advanced undergraduate students.

Theoretical studies also form an important component of research in the arts. The UW faculty in the School of Music conducts extensive research in the scientific analysis of sound, known as systematic musicology. Studies in this field include the influence of vibrato on judgments of vocal blend; context and time in musical perception; and rhythmic responses of preschool children. A number of faculty members are exploring new ways of creating music, including the use of computers.

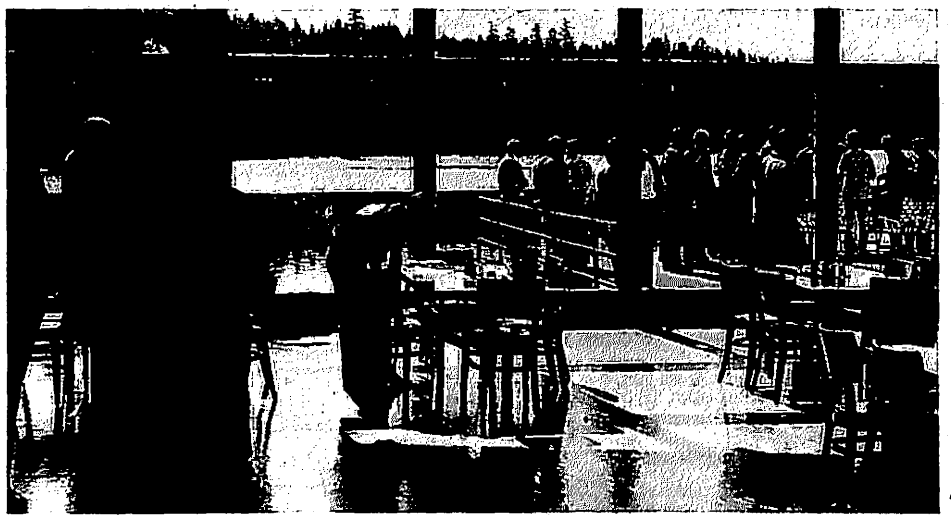
The concept of scholarly achievement in the arts often is synonymous with performance or exhibition. The UW School of Music has on its faculty a number of nationally recognized composers, including two longtime recipients of research funds from the American Society of Composers, Authors, and Publishers (ASCAP). The awards are designed to encourage and assist writers of serious music. The School of Music also is home to one of the finest opera programs in the country.

The School of Art faculty includes a number of nationally and internationally known artists. The school also has pioneered the introduction of new forms of art to the Pacific Northwest. It contains the most extensive program in video art in the region and has been an innovator in the creation of performance films. Printmaking plays a prominent role in the school, which was among the first in the country to offer training in collagraphy, a technique using burnt-lacquer plates.

The UW School of Drama houses the famous Professional Actors' Training Program, which, besides teaching basic acting skills, provides an intensive introduction to the practice of the theatre arts. The program attracts dedicated students who work for demanding, scrupulous visiting directors from the commercial stage. Graduate research in the history and practice of theatre forms an integral part of the school's diverse program.

The University's program in creative writing is one of the oldest in the country. It achieved prominence in the 1950s and 1960s, when its faculty included Theodore Roethke, winner of the Pulitzer Prize in 1953. The tradition of excellence continues, with current University poets and authors receiving critical acclaim throughout the nation. This concentration of talent has made the University a center for literary activity in the Pacific Northwest.

CONTINUING EDUCATION



Vice Provost and Director

Richard L. Lorenzen

Associate Director

Samuel P. Magill

322 Lewis

The Division of Continuing Education provides the general public with access to the intellectual life of the campus. Through educational experiences, technical assistance and consulting, and counseling and advising, Continuing Education presents lifelong learning opportunities beyond the traditional college years. Some professional programs are managed by their respective schools.

This section briefly describes the various programs currently part of Continuing Education. *Spectrum*, the quarterly journal of Continuing Education, contains details of many program offerings. It is mailed without charge to residents of the state, who may receive it by telephoning (206) 543-2590 or by writing to the University of Washington, Continuing Education, 208 Lewis, DW-27, Seattle, Washington 98195. Additional information on programs not listed in *Spectrum* may be obtained by calling the numbers listed with the individual programs.

Extension Credit Classes

Self-sustaining extension credit classes are offered each quarter, both on and off campus, to anyone of legal age who has a high school diploma or the equivalent. Formal application to the University is not required for enrollment, but credit awarded in such manner is restricted in its applicability to a baccalaureate degree (90-credit maximum). Grades earned are not computed into the University grade-point average, which is based solely on courses taken in residence at the University. All extension credit classes have been approved by the appropriate academic department, school, or college, and are recorded on an official University transcript. Approximately a hundred courses are offered each quarter, ranging from basic mathematics and language instruction to courses specific to professionals meeting licensure or certification requirements. Course fees vary.

Graduate Nonmatriculated Program

Individuals seeking enrollment in graduate-level courses, but not admission to a graduate degree program, may apply directly to those academic departments that offer enrollment in their graduate courses to graduate nonmatriculated students. Application forms are available from participating departments, the Graduate School, or Continuing Education. The Graduate Study and Research section of this catalog offers more details. Additional information may be obtained by telephone, (206) 543-2590, or by contacting individual departments.

Independent Study

Independent Study, a credit correspondence program, offers approximately 160 undergraduate courses in print format prepared and instructed by campus faculty. Courses typically consist of assigned texts, study guides, assignments and examinations, and such supplementary materials as audio cassettes, records, slides, and laboratory kits. Special arrangements can be made for Independent Study students to take some University courses not currently listed in the correspondence curriculum. Certain noncredit courses required for University entrance are available for those who wish to qualify for admission. Other courses provide subject matter for professional continuing education.

Courses are open to persons over the age of eighteen who, because of distance, work schedule, physical disability, or educational preference, require an alternative to on-campus classroom meetings. Resident University students often find correspondence study a convenient way of earning extra credits during summers or leaves of absence, or a way of taking courses that would otherwise conflict with day-school schedules.

Formal admission to the University is not required for enrollment in credit correspondence courses. Students may register at any time and have one year in which to complete their work. Up to 90 credits earned through correspondence may be applied to a University baccalaureate degree. Upon successfully completing a course, each student receives a certificate, and the grade and number of credits earned are recorded on an official University transcript. Grades earned, however, are not computed in the University grade-point average, which is based solely on courses taken in residence.

A bulletin listing Independent Study courses may be obtained by telephone, (206) 543-2350 (voice or TTY), or by writing to Independent Study, University of Washington, 222 Lewis, DW-30, Seattle, Washington 98195.

English as a Second Language Center

The English as a Second Language (ESL) Center, 323 Parrington, provides nonnative speakers of English who are interested in improving language skills with the following services and resources:

Academic ESL courses for UW students. English is the language of instruction at the University, and many international students need additional English training to facilitate participation in regular University programs.

International students (whose native language is not English) admitted with TOEFL scores of at least 500 but below 580, or Michigan Proficiency Test scores of at least 80 but below 90, are required to take the University's ESL placement test before matriculating. Students whose test results show their English to be adequate for full-time University study are excused from ESL course work. Others must take consecutively those ESL courses designated as required.

During the academic year, the courses offered are designed for international students officially enrolled in a degree program at the Uni-

versity as either undergraduate or graduate students. These students take ESL courses along with their regular programs of study. English as a Second Language courses count the equivalent of 5 credits each for the purposes of satisfying visa requirements, but do not count toward graduation. As they are special tuition courses, fees must be paid before students may register for them.

During Summer Quarter, nonstudents whose TOEFL scores are at least 450 may be accepted into ESL courses with permission of the ESL Center.

Continuing Education ESL courses for all nonnative speakers. The ESL Center offers a separate series of noncredit courses that are open year-round to any adult nonnative speaker who would like to study English. These courses do not require formal admission to the University.

Additional information about ESL services, including complete listings and descriptions of current ESL course offerings at the University, is available at the ESL Center, 323 Parrington, telephone (206) 543-6242.

Career Planning

The Office of Career Planning assists out-of-school adults, through individual counseling and group guidance, in focusing their resources for professional and career change. Courses and seminars explore educational and vocational choices. Additional information may be obtained by telephone, (206) 543-4262, or by writing to Career Planning, University of Washington, 336 Lewis, DW-25, Seattle, Washington 98195.

Conference Management and Planning

The Office of Conferences and Institutes provides conference management services for University academic departments and administrative units, as well as for professional associations and community groups with University sponsorship. Consultative service and assistance with program development and planning are available. Other services include the making of arrangements for meeting and housing facilities, catering, mailing, registration, and promotion. Additional information may be obtained by telephone, (206) 543-5280, or by writing to Conferences and Institutes, University of Washington, 230 Lewis, DW-50, Seattle, Washington 98195.

Continuing Education Abroad

Continuing Education conducts several noncredit tours abroad each year. These tours of two to three weeks' duration offer enjoyable, in-depth travel to interesting areas of the world and are open to all adults. Lecture series precede each tour to prepare participants for the most rewarding experience possible while abroad. Brochures and additional information are obtainable by telephone, (206) 545-2804, or by writing to Continuing Education Abroad, University of Washington, DW-26, Seattle, Washington 98195.

Lake Wilderness Continuing Education Conference Center

This center serves as a remote retreat for the purpose of augmenting on-campus educational facilities. The center is used by faculty, staff, students, governmental agencies and other educational institutions for seminars, short courses, conferences, and workshops. It accommodates forty persons for overnight conferences and more than a hundred for daytime meetings. Additional information may be obtained by telephone, (206) 543-5380 or 432-4282, or by writing to Lake Wilderness Continuing Education Conference Center, University of Washington, 336 Lewis, DW-21, Seattle, Washington 98195.

Media Systems

Continuing Education provides support and consultation services in the development of instructional programs delivered by telecommunication media. The Office of Media Systems operates Cablearn, a network of programming for the Educational Access cable channels in the Puget Sound area. Cablearn viewers have the opportunity to earn credit toward degree programs, to gain vocational training, or to satisfy avocational interests. Programming includes courses in such subject areas as computer education, teacher in-service, introduction to earth sciences, international studies, and electrical engineering. Additional information and monthly program guides may be obtained by telephone, (206) 543-2378, or by writing to Media Systems, University of Washington, M118 Kane, DG-15, Seattle, Washington 98195.

Noncredit Classes

Continuing Education offers a broad range of courses, lecture series, workshops, and seminars for out-of-school adults, students, and children. Many of these programs are open to resident students, faculty, and staff at a reduced fee. Special noncredit programs include Elderhostel, ACCESS to credit classes for older adults, and residential weekend seminars. The aims of noncredit classes are to offer opportunities for personal, career, and intellectual development when credit is not essential, and to enrich campus and community life. Specific programs are announced quarterly in *Spectrum*. Registration information is available at 203 Lewis and by telephone, (206) 543-8037.

KEY TO SYMBOLS AND ABBREVIATIONS

The symbols and abbreviations below are used in the listings of faculty members and course descriptions. Colleges, schools, and departments are presented in alphabetical order. If you are unable to locate the department or program of your choice, consult the index.

Faculty

Each entry includes highest degree obtained, date awarded, and name of institution. Entries may also include Emeritus, Acting, or Research faculty (title indicated in parenthesis), area of specialization, and the symbols below:

* Member of the Graduate School faculty.

† Joint appointment (other department name(s) indicated in parentheses).

‡ Adjunct faculty member with primary appointment in another department.

Course Descriptions

Each course listing includes prefix, course number, title, and credits. Each listing also may include quarter(s) offered, names of instructor(s), description of the course, and prerequisite(s).

Specific information on courses offered in a particular quarter, including descriptions of courses approved since the publication of this catalog, appears in the quarterly *Time Schedule*.

Course Numbers

100-299 Lower-division courses primarily for freshmen and sophomores.

300-499 Upper-division courses primarily for juniors, seniors, and postbaccalaureate (fifth-year) students. Graduate students may enroll in 300- and 400-level courses. When acceptable to the major department and the Graduate School, approved 400-level courses may be applied as graduate credit in the major field and approved 300-level courses may be applied in the supporting field(s).

500- Restricted to graduate students. (Courses numbered in the 500 and 600 series with *P* suffix denote professional courses for students in the schools of Dentistry and Medicine, and such courses may not be applied as graduate credit in the Graduate School.) Undergraduate, postbaccalaureate, and nonmatriculated students who wish to register for 500-level courses must obtain permission from the instructor of the class, departmental Chairperson, or other designated person.

Graduate courses numbered 600, 601, 700, 750, or 800 are restricted to students in the Graduate School. They appear by number and title only where applicable under the departmental course listings in this catalog. Descriptions for these courses are listed below.

(PREFIX) 600 Independent Study or Research (*) Individual readings or study, including independent study in preparation for doctoral examinations, research, etc. Prerequisite: permission of Supervisory Committee chairperson or graduate program adviser. Name of faculty members responsible for supervising the student should be indicated on program of studies.

(PREFIX) 601 Internship (3-9, max. 9) Internship required of students in a graduate degree program other than Doctor of Arts. Permission of Supervisory Committee chairperson or graduate program adviser is a prerequisite. Name of faculty member responsible for supervising the student should be indicated on program of studies.

(PREFIX) 700 Master's Thesis (*) Research for the master's thesis, including research preparatory or related thereto. Limited to premaster graduate students (i.e., those who have not yet completed the master's degree in their major field at the University of Washington). Prerequisite: permission of Supervisory Committee chairperson or graduate program adviser. Name of faculty member responsible for supervising the student should be indicated on program of studies.

(PREFIX) 750 Internship (*) Internship required of all graduate students in the Doctor of Arts degree program.

(PREFIX) 800 Doctoral Dissertation (*) Research for the doctoral dissertation and research preparatory or related thereto. Limited to graduate students who have completed the master's degree or the equivalent, or Candidate-level graduate students. Premaster students initiating doctoral dissertation research should register for 600. Prerequisite: permission of Supervisory Committee chairperson or graduate program adviser. Name of faculty member responsible for supervising the student should be indicated on program of studies.

Credit Designation

ART 100 (5) 5 credits are received for the quarter.

ART 101-102 (5-5) Hyphenated course. Credit is earned, but may not be applied toward graduation until the entire sequence is completed. (An *N* grade may be given the first quarter and the final grade the second quarter.)

ART 100- (5-) Course may take longer than one quarter to complete. Repeated registration may be necessary. An *N* grade is received until the final grade is submitted. *

ART 100 (2, max. 8) 2 credits per quarter; course may be repeated up to four times to earn a maximum of 8 credits.

ART 100 (1-5) Up to 5 credits may be taken in a given quarter. Specific number is determined in consultation with instructor or adviser.

ART 100 (1-5, max. 15) Up to 5 credits may be taken in a given quarter. Course may be repeated to a maximum of 15 credits.

ART 100 (*, max. 10) Credit to be arranged per quarter; course may be repeated to a maximum of 10 credits.

ART 100 (3 or 5) 3 or 5 credits are earned in a given quarter. Specific amount is determined by school or college offering the course. The *Time Schedule* may indicate 3 credits, 5 credits, or 3 or 5 credits. Credits may vary by section.

ART 100 (3 or 5, max. 15) 3 or 5 credits are earned in a given quarter. Course may be repeated to earn a maximum of 15 credits.

ART 700 (*) Credit is to be arranged with school or college offering the course. No maximum stated. Only 600-, 700-, and 800-level courses do not require a maximum.

May be repeated for credit. This statement can appear in the course description, giving permission for repetition of the course for credit.

Background Required

Prerequisites Courses to be completed or conditions to be met before a student is eligible to enroll in a specific course.

Quarters Offered

A,W,Sp,S Indicates the quarter(s) the course is offered. A = Autumn, W = Winter, Sp = Spring, S = Summer.

Examples:

ART 100 AWSp ART 100 offered Autumn, Winter, and Spring quarters.

ART 100, 101 A,W ART 100 offered Autumn Quarter. ART 101 offered Winter Quarter.

ART 100, 101 AW,WSp ART 100 offered Autumn and Winter quarters. ART 101 offered Winter and Spring quarters.

ACADEMIC PROGRAMS, FACULTY, AND COURSES

College of Architecture and Urban Planning

Dean
Gordon B. Varey

Associate Dean
Norman J. Johnston

The College of Architecture and Urban Planning brings together into one unit four departments that, each in its own way, are concerned with the development of the physical environment: Architecture, Building Construction, Landscape Architecture, and Urban Planning. Architecture offers an undergraduate four-year degree that is nonprofessional in nature, focusing on this discipline within the concept of a liberal arts education. The programs of the departments of Building Construction and Landscape Architecture, on the other hand, lead to professional degrees that are the educational credentials for careers in their respective fields. Graduate degrees also are available in the college. The professional degree in architecture and in urban planning is the master's degree. The Department of Landscape Architecture also grants a master's degree. Students in those majors at that level may choose to work toward the earning of the certificate in urban design. In addition, Urban Planning offers a doctoral program. All, however, offer curriculums that not only encompass an appropriate level of design and technical understanding but also include broader, social, economic, and psychological impacts that in their own ways influence, or provide greater insight into, understanding, preserving, and enriching both our built and natural environments.

The grouping of these departments within the college is an acknowledgement of their mutual interests and responsibilities and the opportunities represented for interdisciplinary exchanges. All students share in the specialized physical facilities and educational resources available in the college. Furthermore, as part of a major university and of the larger community composing the heart of the core urban area of the Pacific Northwest, the college is able to use these advantages to reinforce its program and to use its location as a laboratory for study. It also works closely with its various professional communities to build curriculums and a faculty attuned to the understanding and creation of an appropriate contemporary environment.

Urban Design Program

Dennis M. Ryan, Director
410 Gould

The college administers a special graduate program leading to a Certificate of Achievement in Urban Design. Since 1970, this interdisciplinary program has provided a collaborative framework allowing students to specialize in the design of the urban environment as part of their professional education.

The ten-member faculty offers backgrounds in urban design as well as in architecture, landscape architecture, and urban planning. In addition, the communities of the Puget Sound region provide a unique learning laboratory for students to experience the issues and professional activities of urban design. A core curriculum and mandatory course work in five substantive areas provide the student with a firm grounding in theory, methods, and practical skills.

Students are eligible to participate in this certificate program, normally seven quarters in length, if accepted for graduate work by the departments of Architecture, Landscape Architecture, or Urban Planning and if they possess the necessary physical design abilities prior to enrollment in advanced studios.

Center for Planning and Design

David L. Bonsteel, Director
206 Architecture

The Center for Planning and Design has been established in the college to facilitate the interdisciplinary study of the environment and to integrate scholarly knowledge and field experience in meeting the needs of local and regional clients. It has three primary objectives:

To make available the expertise and services of college disciplines in a variety of specializations through consulting, research contracts, seminars, and workshops.

To develop opportunities for students to obtain practical professional experience by participation in field studies.

To assist faculty members of the college in their research, teaching, and community service functions.

Through its membership in various national and international architectural research consortiums, the center is able to obtain information on research and technology transfer from a broad community of interests while participating on a regional basis in research and related activities.

Foreign Study Programs

The departments of the college offer many opportunities for foreign study in which students earn academic credit while studying abroad. Those most specifically sponsored within the college are Architecture in Rome, Italian Hill Towns, and Landscape Architecture in Great Britain. In addition, various study and exchange opportunities exist through the college's agreements with similar international institutions in such locations as Great Britain, Germany, the Scandinavian countries, People's Republic of China, and Japan.

Admission Requirements

Besides satisfying the usual requirements at the high school level for admission to the University, students who plan to enter the college should have taken a semester of trigonometry. Courses in the humanities, the social sciences, and freehand drawing are strongly recommended as electives.

An entering freshman who plans to major in architecture, landscape architecture, or urban planning must enroll in the College of Arts and Sciences for two years. Upon successful completion of the requirements of those two years, either at the University or at a two- or four-year college, a student may then apply to one of those departments. A student majoring in building construction may transfer to that department from another unit of the University or from a two- or four-year college, ordinarily with a minimum of 90 credits.

Inquiries should be addressed to the appropriate department for detailed information on admission requirements.

Admission to the college is highly competitive, and enrollment preference is given those applicants who, in the judgment of the department concerned, are the best qualified to undertake its programs. As a participant in the University Affirmative Action Program, which is designed to increase the number of minority group members and women in education and in the professions, the college encourages their applications.

Additional information on any aspect of the college's departmental programs can be obtained from the department in which the student has an interest.

Architecture

208 Gould

The Department of Architecture offers programs based on the architect's need to be well grounded in the liberal arts, to possess a full command of the principles and practices of the profession, and thus to have the capability for assuming an imaginative leadership role in society.

Undergraduate Program

James J. Donnette, Undergraduate Program Director

Bachelor of Arts Degree

The department admits students at the junior level and offers a nonprofessional program leading to the Bachelor of Arts degree. In this program, students complete approximately half their total credits in the humanities, natural and social sciences, and mathematics during the freshman and sophomore years, then complete the other half of their credits in a concentration in architectural subjects during the junior and senior years. The program serves as an end for students whose goal is a baccalaureate liberal arts degree and as a preparatory study for students planning to continue on to professional degree programs in architecture or related disciplines.

Students preparing for admission to the department may complete first- and second-year requirements in any college or school in the University or complete equivalent courses at other institutions, except for ARCH 200, which must be taken at the University. In considering programs offered by the department and in making application to third- and fourth-year programs, students should obtain information from the department undergraduate program director, 208 Gould, regarding procedures, academic qualifications, important prerequisites, and degree requirements. Criteria for admission include student's academic record in all college-level work, the record earned in the department's introductory course, ARCH 200, a biographic portfolio, and a letter of applicant's intent. Applications are due May 15 for Autumn Quarter admissions, October 15 for Winter Quarter, January 15 for Spring Quarter, April 15 for Summer Quarter.

Curricula are based on 90 credits to be completed in the third and fourth years, including credits in core architectural courses, in general electives, and in one of three concentration options: I (Applied Pre-Professional), II (Behavior, Experience, and Environments), or III (Theories of Architecture).

A more detailed description of the program and its requirements is available in the department undergraduate prospectus.

Graduate Program

David L. Bonsteel, Graduate Program Director/Coordinator

Master of Architecture Degree

Successful completion of the requirements for a professional degree in architecture from an accredited program is the normal educational requirement for qualification as an applicant for licensing (registration) as an architect. At the University of Washington, the Master of Architecture degree is both the professional degree and a terminal degree.

Students are admitted to the graduate program in architecture only in Autumn Quarter, and all application materials should be received by the department no later than the preceding February 15. Notices of admission are given about April 1. The prospective applicant should note that Graduate Record Examination aptitude test scores, at least three letters of recommendation, transcripts of previous degree programs and of additional academic study, a letter of intent, and, normally, a portfolio of accomplished work are required as part of the application and should plan accordingly. Incomplete applications and those received after announced deadlines are not considered by the Graduate Admissions Committee.

The graduate program accommodates three groups of undergraduate degree holders: (1) Persons holding a Bachelor of Architecture degree can usually complete the graduate program in one year, or four quarters. This program requires a 9-credit thesis and 36 quarter credits of graduate-level professional electives. (2) Persons holding a Bachelor of Arts degree in the field of architecture, or equivalent, normally require two years, or seven quarters, of study. The two-year program requires completion of a minimum of 90 graduate credits, of which 36 are design laboratory/design studies options, 9 are credits of thesis, and 45 credits may be selected from a wide range of professional elective courses. (3) Persons holding an undergraduate degree in a field other than those mentioned above normally require at least three years, or ten quarters, to complete the requirements for the degree. The three-year program may vary somewhat in duration and specific course work required, depending on entrance proficiency. Normally, however, it requires approximately 40 credits of architectural course work (preparatory to beginning graduate courses), 36 credits of design laboratory/design studies options, 9 credits of thesis, and 45 credits of professional electives.

A Certificate of Achievement in Urban Design is offered within the Master of Architecture degree program. A newly authorized certification program in preservation design is also available to Master of Architecture students. See statement in college introduction. A more detailed description of the program and its requirements is also available in the graduate program prospectus.

Financial Aid

Each Spring Quarter, the department awards a limited number of scholarships and assistantships that apply to the following academic year. These are normally available only to students enrolled in the graduate program in architecture at the time of the awards. Other financial aid/assistantship possibilities may be found through the Graduate School Fellowship Division and the Financial Aid Office in Schmitz Hall.

Support Facilities

The department has the following facilities (located in Gould Hall), which support research and teaching: computer laboratory, environmental simulations laboratory, lighting application workshop, photo laboratory, graphics laboratory, structures laboratory, and materials laboratory and shop. The college branch library/audiovisual center also is located in Gould Hall.

Faculty

Chairperson

Robert E. Small

Professors

Bonsteel, David L.,* M.Arch., 1964, Washington; design process, computer applications, research.

Bosworth, Thomas L.,* M.Arch., 1960, Yale; design process, history, professional practice.

Dietz, Robert H. (Emeritus), Ph.D., 1967, Nebraska.

Hermann, Arthur P. (Emeritus), B.Arch., 1921, Carnegie Institute of Technology; architecture.

Hildebrand, Grant,* (Art),† M.Arch., 1964, Michigan; history, preservation design.

Jacobson, Phillip L.,* M.Arch., 1969, Helsinki Institute of Technology; design, professional practice.

Johnston, Norman J.,* (Urban Planning),† Ph.D., 1964, Pennsylvania; urban design, history.

Kelley, Charles M.,* M.Arch., 1952, Harvard; design, graphics.

Kolb, Keith R.,* M.Arch., 1950, Harvard; design, professional practice.

Lovett, Wendell H. (Emeritus), M.Arch., 1948, Harvard; design.

Pundt, Hermann G.,* (Art),† Ph.D., 1969, Harvard; history, historical preservation.

Seligmann, Claus A.,* Dipl.Arch., 1951, London Polytechnic Institute; design, design process, theory.

Small, Robert E.,* (Landscape Architecture),† M.Arch., 1955, Oregon; design for elderly disabled, housing, site planning.

Steinbrueck, Victor (Emeritus), B.Arch., 1933, Washington.

Streissguth, Daniel M. (Emeritus), M.Arch., 1949, Massachusetts Institute of Technology; design process.

Thiel, Philip,* M.S.Nav.Arch., 1948, Michigan; design process, graphics, person-environment relations, notation.

Varey, Gordon B.,* (Building Construction),† M.Arch., 1966, California (Berkeley); building technology and construction, professional studies, research.

Zarina, Astra,* M.Arch., 1955, Massachusetts Institute of Technology; design, foreign studies

Associate Professors

Albrecht, Robert G.,* M.S.C.E., 1960, Massachusetts Institute of Technology; structures.

Alden, Richard S.,* Ph.D., 1971, Pennsylvania; design process, research, photography.

Curtis, J. V. William,* M.A., 1969, Washington; design process, professional studies.

Donnette, James J., M.Arch., 1969, Washington; graphics, design.

Heerwagen, Dean R.,* B.Arch., 1971, Massachusetts Institute of Technology; building science, research.

Hill, Warren A., M.A., 1961, New York; interior design, design, history.

LaTourelle, Elaine D.,* M.Arch., 1964, Yale; design, professional practice.

Lebert, Edgar A., M.S., 1967, Washington; structures.

Millet, Marietta S.,* M.Arch., 1972, Massachusetts Institute of Technology; building science, illumination, research.

Minah, Galen F.,* M.Arch., 1968, Pennsylvania; design process, design, professional practice.

Nyberg, Folke E., M.Arch.,* 1960, Yale; theory, urban design, professional practice.

Prussin, Labelle, Ph.D.,* 1973, Yale; design process, low-appropriate technology, research.

Rohrer, John A. (Emeritus), B.Arch., 1937, Washington; graphics.

Rosner, Arnold S.,* M.S.C.E., 1949, California Institute of Technology; design process, building technology.

Sasanoff, Robert,* M.C.P., 1968, California (Berkeley); design process, person-environment relations.

Staub, Christian, Certificate, 1944, Switzerland; photography.

Sproule, John (Emeritus), B.Arch., 1934, Washington; architecture.

Wise, James A.,* Ph.D., 1970, Washington; person-environment relations, research.

Lecturers

Allan, Barbara J., B.F.A., 1972, Washington; handicapped accessibility.

Hein, Michael, M.S., 1973, Princeton; structures.

Johnson, Brian R., M.Arch., 1981, Washington; computer graphics.

Onouye, Barry S., M.S., 1969, Washington; structures.

Vanags, Andris, B.F.A., 1968, Washington; building science.

Williams, Roger B., M.Arch., 1969, Washington; design.

Zuberbuhler, Douglas R., M.Arch., 1968, Washington; graphics, design.

Course Descriptions

Courses for Undergraduates

ARCH 150, 151 Appreciation of Architecture I, II (2 or 3, 2 or 3) ASp,WS *Bosworth, Pundt* Historical survey of the architecture of Western civilization. For nonmajors.

ARCH 200 Introduction to Architecture (9) *Donnette* Lectures, laboratories, and demonstrations that introduce the basic curricular elements of architecture, including design, graphics, structures, building science, person-environment relations, history, theory, and professional practice. Open to nonmajors with sophomore standing. Entry card required.

ARCH 250 American Architecture and Urban Environments (2) Sp *Pundt* Study and critical investigation of architecture and the problems of urban design in North America from colonial times to the present. For nonmajors.

ARCH 300, 301, 302 Introduction to Design: Laboratory (6,6,6) AWSp,AWSp,AWSp Design processes, techniques; and determinants—visual, technological, and behavioral. Entry card required.

ARCH 303-304-305 Introduction to Design Synthesis (6-6-6) AWSp,AWSp,AWSp Provides initial awareness, knowledge, and basic skills needed to develop a mastery of the derivation of building form and the integrative aspects of architectural design. Enrollment limited to students entering the graduate program in architecture with baccalaureate degrees in fields other than architecture. Entry card required.

ARCH 310, 311, 312 Introduction to Design Graphics (2,2,2) AWSpS,AWSpS,AWSpS *Donnette, Zuberbuhler* Lectures and laboratory in theories and processes of graphic communication for designers: lettering, drafting, multiview and paraline drawing, photographic simulation, descriptive geometry, perspective, shade and shadow, computer graphics, and freehand drawing. Entry card required.

ARCH 313 Introduction to Architectural Photography (2) AWSpS *Staub* Introduction to the basic elements and processes of architectural photography to include: camera controls, exposure technique, and photo processing. Student must provide own camera with lens, shutter, and aperture controls. Entry card required.

ARCH 314 Introduction to Architectural Sketching (2) AWS Skill development in conceptualization of forms and their relationships through observation and recording in freehand graphic manner. The course deals with proportion, scales, light effect, value texture, and various perspective techniques. Entry card required.

ARCH 315 Architectural Sketching (2) AWS See 314 for course description. Entry card required.

ARCH 320 Introduction to Structural Theory I (3) A *Albrecht, Lebert, Onouye, Torrence* Lectures on vectors, equilibrium of forces, graphic and analytical study of force systems, and load tracing in buildings. Entry card required.

ARCH 321 Introduction to Structural Theory II (3) W *Albrecht, Lebert, Onouye, Torrence* Nature of structural materials, their reactions to forces and force systems, their strengths and elastic properties and methods of designing and joining structural members. Prerequisites: 320 and permission.

ARCH 322 Introduction to Structural Theory III (3) Sp *Albrecht, Lebert, Onouye, Torrence* Simple building structural elements and systems. Beams and posts. Trussed structures. Introduction to lateral force and vertical force-resisting systems. Prerequisites: 321 and permission.

ARCH 350 Architecture of the Ancient World (3) A *Bosworth* Architecture of the ancient through early Christian, including nonliterate, prehistory contributions.

ARCH 351 Romanesque and Gothic Architecture (3) W *Hildebrand* Architecture of the Byzantine, medieval, European, Islamic, and oriental eras (theocratic societies).

ARCH 352 Renaissance and Baroque Architecture (3) W *Pundt* Architecture of the Renaissance, baroque, and roccoco eras in Europe and America from *circa* 1400 to the French Revolution.

ARCH 353 History of Modern Architecture (3) Sp *Pundt* Architecture since the French Revolution in Europe and America.

ARCH 400, 401, 402 Introduction to Architectural Design Laboratory (6,6,6) AWSpS,AWSpS,AWSpS Registration for credit in these courses permits the student to choose from among a number of sections that introduce architectural design theories and processes. Sections are given in various studio-seminar-lecture formats and include subjects in several groups: introduction to architectural design sections, case studies, and design studies; and introduction to urban design. Entry card required.

ARCH 403 Architectural Problems (6) AWSpS Entry card required.

ARCH 410, 411, 412 Design Graphics Laboratory (2,2,2) AWSp,AWSp,AWSp *Donnette, Zuberbuhler* Continuation of design graphics laboratory with emphasis on advanced architectural graphics. Entry card required.

ARCH 413 Architectural Photography Projects (2) AWSp *Staub* Projects involving the study of illumination and perspective as related to the representation and perception of space, form, color, texture, pattern, and scale of architectural subjects. Student must provide own camera with lens, shutter, and aperture controls. Prerequisite: 313. Entry card required.

ARCH 414 Freehand Drawing (3) *Thiel* Introduction, emphasizing accurate observation of visual qualities of a variety of forms and an experimental approach to their coherent freehand representation using uncorrected contour line. Entry card required.

ARCH 415 Architectural Sketching (3) A *Kelley* Exercises in freehand representational drawing using charcoal, graphite, and conte crayon with emphasis on line, proportion, values, composition. Studies progress from geometric to nongeometric forms. Entry card required.

ARCH 416 Architectural Sketching (3) W *Kelley* Introduction to the use of watercolor as a monochromatic medium in sketching and rendering with emphasis on proportion, value, and composition. Representational drawing ranges from geometric to nongeometric forms. Entry card required.

ARCH 417 Architectural Sketching (3) Sp *Kelley* Studio and field exercises in drawing and sketching of natural and architectural subjects. Various media are utilized, including an introduction to the use of color in watercolor sketching. Entry card required.

ARCH 420 Structural Design I (4) A *Albrecht, Lebert, Onouye, Torrence* Design of complete building frames in timber, laminated wood, and steel; considering earthquake resistance, building responses, continuity, and the structural design process. Entry card required.

ARCH 421 Structural Design II (4) W *Albrecht, Lebert, Onouye, Torrence* Development of basic reinforced and prestressed concrete design process and design of continuous structures in reinforced concrete, employing beams, girders, and slabs. Entry card required.

ARCH 422 Structural Design III (4) Sp *Albrecht, Lebert, Onouye, Torrence* Design of reinforced concrete structures, including flat slabs and plates, columns, footings, shearwalls, and retaining walls. Entry card required.

ARCH 426 Structural Unit Masonry (3) S *Lebert* Structural behavior and design of reinforced brick, tile, and unit masonry structures. Offered jointly with CESM 487. Entry card required.

ARCH 430 Materials and Processes (3) ASp *Vanags* Lectures, field trips, and laboratory sessions directed toward the nature, potentials, and limitations of a variety of materials (wood, metal, plastics, inorganic cementing materials, minerals, rocks, and clay) and the processes involved with their production, fabrication, and system compatibility. Entry card required.

ARCH 431, 432 The Science of the Built Environment (3,3) A,W *Heerwagen* Study of microclimatic controls in the built environment with special emphasis on lighting, acoustics, and thermal phenomena. Lectures, laboratory work, and student presentations. Entry card required.

ARCH 435 Principles and Practices of Environmental Lighting (3) Sp *Millet* Perception-based approach to the principles of natural and artificial lighting; practical considerations of lighting involving environmental evaluations, calculations, and the use of lamps and fixtures; sketch and model studies for applications in both interior and exterior measurements; impact of lighting design on energy conservation; relation of lighting design process to architectural design concepts. Entry card required.

ARCH 440 Introduction to PER Analysis (3) A *Wise* Introduction to the measurement and quantitative analysis of variables encountered in person-environment relations research. Emphasis on basic statistics and decision theory used as design decision-making aids with behavioral data. Prepares students to utilize and critique published design research. Entry card required.

ARCH 441 Methods and Techniques of PER Research (3) W *Wise* Introductory course to ways and means of discovery in person-environment relations. Requires a working knowledge of data summary measures, but is nonquantitative except in application of measures to class projects data. Involves reading and application of research techniques including: unobtrusive measures, direct assessment through interview and survey, simulation and experimental observation, and phenomenological research. Entry card required.

ARCH 442 Intermediate PER Research and Analysis (3) Sp *Wise* Extends material introduced in 440 to include multivariate studies and a more thorough treatment of statistical decision procedures. Understanding simulation and quantitative modeling procedures as a means of pretesting and evaluating design proposals is stressed along with the treatment of this information by appropriate decision-theoretic methods. Applied research problems as a means of developing the techniques. Entry card required.

ARCH 443 Experiential Design Notation (3) *Thiel* Lectures, seminars, and studio/field studies in philosophy, theory, and practice of intervention in the physical environment for socially preferred human experiences. Entry card required.

ARCH 444 User Analysis of Urban Spaces (3) Sp *Bonsteel, Grey* Development and application of techniques for appraisal of the built environment so as to imply planning and design criteria for urban open spaces. Offered jointly with URB P 444. For students in behavioral field studies in architecture, landscape architecture, and urban planning; others by entry card.

ARCH 445 Environmental Design Research Through Photography (3) *Alden* Photographic approach to the collection, analysis, and presentation of visual information relevant to the design and evaluation of man-made environments. Case studies, lectures, and class discussions on technical, psychological, and visual problems, followed by five weeks of individual or team photographic projects resulting in completed visual or audiovisual presentations. Entry card required.

ARCH 447 Physical Structure and Human Interaction (3) *Sasanoff* For social work and architectural students examining the effect of physical structure on human interaction. Entry card required.

ARCH 448 Designing Accessible Environments (3) W *Allan* Planning and designing the environment to be accessible to the broadest spectrum of the population, with emphasis upon needs of persons with functional and age-related disabilities. Open to nonmajors. Prerequisite: junior standing. Entry card required.

ARCH 449 Designing Environments for the Elderly (3) Sp *Kiyak* Introduces students of design disciplines to gerontology and considerations necessary in designing for an aging population. Entry card required.

ARCH 450 Survey of Environmental Arts (5) S *Hildebrand* Environmental arts of architecture, landscape architecture, and urban planning. Historical evolution with special emphasis on factors shaping these arts in the Western world and the twentieth century. For nonmajors.

ARCH 451 Special Studies in Modern Architecture (3) *Pundt* Study and critical analysis of a selected number of distinguished professionals (architects, planners, educators, critics) and their contributions to the evolution of modern and contemporary architectural practice and thought. Entry card required.

ARCH 453 Special Studies in Architecture in the Ancient World (3) *Bosworth* Study and critical analysis of a selected topic from classical or preclassical periods. Prerequisite: 350.

ARCH 454 Greek Architecture (3) Sp *Langdon* Detailed study of Greek architecture from its beginnings, with special emphasis on the Periclean building program in fifth-century Athens. Offered jointly with ART H 446 and CL AR 446. Entry card required. (Offered alternate years.)

ARCH 455 Special Studies in Gothic Art and Architecture (3) *Hildebrand* Detailed study of Gothic architecture and its accompanying sculpture and stained glass, with special emphasis on the twelfth and thirteenth centuries in France and England. Offered jointly with ART H 455. Entry card required.

ARCH 456 History of Chicago School Architecture (3) WS *Pundt* Study and critical investigation of the contribution of major architects in Chicago, the Midwest, and the West Coast from *circa* 1870 to 1920. Entry card required.

ARCH 457 Neoclassicism and Romanticism in Europe and America (3) *Pundt* Study and critical investigation of European and American architecture and urban design from 1750 to 1850. Entry card required.

ARCH 458 South Asian Architecture (3) W *Curtis* Introduction to South Asian architecture, its generating forces, parameters, and consequent environments. Entry card required.

ARCH 459 American Utilitarian Architecture (3) Sp *Hildebrand* Examination of significant American environmental design efforts arising from utilitarian needs (e.g., factories, bridges, mass housing schemes, and associated technical building innovations). Entry card required.

ARCH 460 Design Theory and Analysis (3) AWSpS *Curtis, Minah, Nyberg, Seligmann* Problematical nature of philosophies of architecture; interaction of philosophical concepts and architectural form and expression. Fundamentals of architectural criticism. Entry card required.

ARCH 461 Recent Developments in Architectural Theory (3) W *Seligmann* Review of recent developments in architectural theory. Concentrates particularly on those that spring from recent work in the epistemology of science and in philosophy. Entry card required.

ARCH 480 Contract Drawings (3) ASp *Curtis* Lectures and drafting-room practice. Entry card required.

ARCH 495 Architectural Studies Abroad (9) A *Zarina* Studies conducted under faculty supervision in various locations outside the United States. Student may be registered concurrently in an appropriate studio section. Entry card required.

ARCH 496 Architectural Studies Abroad (9) W *Zarina* History and legacy of the architecture of ancient, Renaissance, and baroque Rome. Survey of Roman topography, customs, and culture. Studies conducted under faculty supervision as a design-related extension of 495. Prerequisite: 495. Entry card required.

ARCH 497 Italian Hilltowns (9) S *Zarina* Introduction to origins and development of built forms prevalent in the hilltowns of central Italy, a comparative analysis of domestic architecture in the agricultural context of the confluence zone of Tuscany, Umbria, and Latium and a historical survey of fortresses, castles, palaces, villas, and gardens of upper Latium. Entry card required.

ARCH 498 Special Projects (1-12, max. 12) AWSpS Instructor-initiated and department-approved systematic study and offering of specialized subject matter. Topics vary and are announced in preceding quarter. Entry card required.

ARCH 499 Undergraduate Research (1-6, max. 6) AWSpS Entry card required.

Courses for Graduates Only

ARCH 500, 501 Architectural Design Laboratory (6,6) AWSpS,AWSpS Theories and processes in architectural design with emphasis on development of professional skills in design synthesis. Entry card required.

ARCH 502, 503, 504, 505 Architectural Studies Options (6,6,6,6) AWSpS,AWSpS,AWSpS,AWSpS A group of advanced architectural studies and sequences in general architectural design synthesis, in special projects examining particular architectural determinants in detail, and in architectural research. Entry card required.

ARCH 506 Advanced Architectural Studies (6) AWSpS Advanced experimental studies dealing with significant architectural relationships involving scholarly investigation, development, and presentation of results. Entry card required.

ARCH 513 Design Communication I (3) Classwork in design illustration techniques together with workshop experience in developing individual experiments in graphic presentation. Entry card required.

ARCH 514 Design Communication II (3) Study in advanced graphic presentation methods with limited classwork, and toward development of individual style and competency in media other than that offered in 513. Entry card required.

ARCH 520 Advanced Wood Structures Design (3) *Albrecht* Study of design methods related to wood structures. Topics include nature of wood as a building material, plywood, glued laminated wood structures, timber piles and pile foundations, pole buildings and conventional wood building framing. Entry card required.

ARCH 521 Structural Design Through Model Studies (3) *Albrecht* Theory of models, dimensional analysis, direct model analysis; studies employing specific materials, techniques of testing and measurement. Offered jointly with CESM 477. Entry card required.

ARCH 522 Skin-Resistant Structures (3) *Albrecht* Resistance mechanisms, structural systems employing plates, folded plates, shells, and membranes with applications to the structural design process. Entry card required.

ARCH 523 Industrialized Building Systems (3) A *Rosner* Consideration of the evolution of prefabrication, building products, components, construction methods, and building systems through the nineteenth and twentieth centuries. Entry card required.

ARCH 530, 531, 532 Graduate Studies in the Science of the Built Environment (3,3,3) Graduate studies in microclimatic controls in the built environment, including individual opportunities for investigation in depth of lighting, acoustic and thermal conditions, as well as other related research interests. Entry card required.

ARCH 535 Graduate Seminar, Study Topics in Environmental Lighting (2) *Millet* Focus on individual student projects involving research and design for lighting. Entry card required.

ARCH 536 Acoustics Seminar (2) *Heerwagen* Principles of acoustical designing as applied to buildings. Entry card required. (Offered alternate years.)

ARCH 543 Seminars in Tents, Transient Architecture, and Tensile Structures (3) Sp *Prussin* Use of soft environments in history and in ethnographic societies, with a focus on symbol, technology, and person-environment relationships in their creation and use.

ARCH 550 Graduate Seminar: Environmental Design Issues (3) *Bosworth* Seminars concerning a wide variety of current issues in the area of environmental design. Seminar focuses on different special topics and is directed by seminar leaders who are authorities in their fields.

ARCH 551 Scandinavian Architecture of the Nineteenth and Twentieth Centuries (3) Sp *Nyberg* Introduction to the contribution of Scandinavian architecture to early functionalism with emphasis on its relationship to neoclassicism and vernacular architecture.

ARCH 552 Seminar in Islamic Architecture (3) A *Prussin* Examination of historical and contemporary Islamic architectures in the Near East, Southeast Asia, Africa, and the Mediterranean as an expression of cultural forces.

ARCH 560 Graduate Seminar on Architectural Theories (3) W *Seligmann* Recent developments in architectural theory, urban design theory, criticism, and the methodology of criticism. Entry card required.

ARCH 561 Urban Design Theory (3) Sp *Nyberg* Theories of nineteenth- and twentieth-century urban design; closely parallels directions in architecture and urban planning. Theoretical premises of these movements related to current practices of urban design in various sociopolitical contexts, European and American. Evolutionary nature of theory. Prerequisite: previous classes in environmental history or permission of instructor.

ARCH 571 Building Economics (3) A Social, political, and economic factors affecting the location, construction, financing, and marketing of buildings. Entry card required.

ARCH 572 Specifications and Contracts (3) W Detailed organization and composition of contracts, specifications, and related contract documents. Entry card required.

ARCH 573 Professional Practice (3) Sp Operation of an architectural office and professional practice. Entry card required.

ARCH 575 Graduate Seminar: Research/Study Methods (3) Methods and techniques used in research/study, with particular emphasis on investigative procedures for graduate students in architecture; includes a review of methodologies from related disciplines as applied to recent and ongoing research/study decision making. Assistance and guidance is given in the selection of a research/study topic, proposal writing, and thesis preparation. Offered on credit/no credit basis only. Entry card required.

ARCH 578 Computer Applications in Architecture (3) A *Bonsteel* Feasibility for application of computing techniques and systems to professional practice. Entry card required.

ARCH 593 Graduate Seminar on the Theory of Housing Design (3) Comparison and evaluation of housing designs: developing the ability to distinguish and apply appropriate referents—historical, stylistic, social, and technical—to the systematic analysis of housing. Entry card required.

ARCH 594 Health Facilities Planning (3) W *Bonsteel* Examination of the organization and execution of the total planning process for health-care facilities, with individual parallel studies in selected topics. Entry card required.

ARCH 596 Fieldwork in Professional Practice (9) ASp *Small* On-location study under the supervision of a practicing professional involved in an aspect of environmental design. Offered on credit/no credit basis only. Entry card required.

ARCH 598 Special Topics for Graduate Students (1-6) AWSpS Systematic study and offering of specialized subject matter. Topics vary and are announced in the preceding quarter. May be repeated for credit. Entry card required.

ARCH 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only. Entry card required.

ARCH 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only. Entry card required

Building Construction

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The educational goals of the Department of Building Construction are (1) to provide education and training that will attract and prepare individuals for senior levels of management or technical positions in the building industry or related businesses or (2) to establish their own business operations. To achieve these goals, the department's faculty, through the educational program, develops in the student: the self-discipline to think and reason logically, the technical ability to visualize and solve practical construction problems, the managerial knowledge to make sound decisions and implement them on a prudent economic basis, the facility to communicate these decisions clearly and concisely, and the human understanding to cooperate with, and provide dynamic leadership for, the construction and related industries and the community.

To satisfy these diverse educational requirements, the Department of Building Construction, in addition to providing for the broader perspectives gained from the humanities and social and natural sciences, offers core courses in three major areas: engineering, technology, and management. The engineering courses are concerned with the theory and utilization of inorganic properties of matter and physical forces for supplying human needs in the form of structures, machines, and manufactured products. Technology deals primarily with the application of scientific knowledge and methods to the fields of manufacture and building. Developing the understanding of the efficient coordination, utilization, and control of the elements of production in the building process (i.e., people, materials, methods, equipment, and money) is the concern of the management courses.

This unique interdisciplinary combination of engineering, technology, and management is now acknowledged as an essential quality of managers in the complex construction industry.

Undergraduate Program

Bachelor of Science in Building Construction Degree

The number of applicants and the limits of the department's resources require that the process of admission be selective. Selection is based on academic performance and potential, extent and quality of relevant experience, apparent aptitude, and personal motivation.

Full-time students receive priority over part-time students. The department strongly encourages ethnic minorities and women to enter the field of building construction.

Applicants must contact the department, 208 Gould, for its individual application form and departmental prospectus, which contains details of requirements for admission and continuation. Closing date for receipt of applications by the department is April 1; however, the University admissions application and its necessary accompanying material must be filed at the admissions office at least four weeks before the department's closing date. Selection for acceptance into the program, which begins Autumn Quarter, is made each year in the spring, and all applicants are notified of the admissions committee results shortly thereafter. Because each application is valid only once, a denied student must reapply for consideration in subsequent years.

The first two years of the program can be completed at the University in the College of Arts and Sciences, or at other four-year institutions or community colleges, and consist of the following University courses or their equivalents at other institutions: ACCTG 210, 220, 230; BG&S 200; CHEM 100 or 101; ECON 200; CIVE 213; English (writing), 5 credits; MATH 105, 157; PHIL 100; PHYS 114, 115, 116, 117, 118, 119; PSYCH 101; QMETH 200, 201; SOC 110; electives, 12 credits.

The following upper-division courses integrate the areas of engineering, technology, and management into a perspective of the building industry: ARCH 310, 312, 320, 321, 322, 420, 421, 422; B CMU 301; B CON 301, 310, 330, 331, 332, 401, 420, 470, 480, 498; CETS 405; ECON 340; OPMGT 301; URB P 300; selected upper-division electives, 27 credits.

Graduation Requirements

The Bachelor of Science in Building Construction degree program requires satisfactory completion of the four-year curriculum requirements with a minimum of 192 credits, a 2.50 minimum grade-point average in required building construction, architecture, and urban planning core courses, and a 2.30 cumulative grade-point average in the student's final six quarters. The last 45 credits must be earned as a matriculated student in residence at the University.

Construction Practice

Although no internship is required for completion of the building construction degree program, every student is encouraged to seek summer employment in the building industry. This work experience lends reality to later, practice-oriented building construction courses and sharpens the student's perceptions of developing perspectives. Part-time positions during the academic year are often available to those students who also can meet class-related responsibilities.

The Department of Building Construction offers to a limited number of qualified students a formal work/study program with participating contractors. A student receives upper-division elective credits for successfully completing B CON 496 (Construction Practice).

Faculty

Chairperson

Steven M. Goldblatt

Professors

Snyder, James H., Ph.D., 1975, Purdue; construction management.

Varey, Gordon B.,* (Architecture),† M.Arch., 1966, California (Berkeley); history of construction.

Associate Professors

Eberharter, Richard L., M.B.A., 1952, Stanford; construction management.

Goldblatt, Steven M., J.D., 1977, Golden Gate; construction law.

Torrence, Gerard R., M.S.C.E., 1950, Massachusetts Institute of Technology; structural design.

Lecturers

Aaronson, Barry L., M.Arch., 1981, Washington; history of building, construction technology.

Anderson, Frances J., M.A., 1979, Washington; construction communications.

Harrison, José, M.Sc., 1965, Oxfordshire (United Kingdom); construction safety.

Hopkins, James W., M.Arch., 1970, Virginia Polytechnic Institute; construction technology.

Lappenbusch, Charles F., Jr., M.B.A., 1961, Washington; building finance.

Lewis, William L., M.S.C.E., 1975, Stanford; construction management.

Olson, R. Court, M.S.C.E., 1972, Stanford; field productivity.

Ossinger, Thomas C., B.S., 1976, Washington; construction estimating.

Rowley, Louis B., studied at California (Los Angeles); construction communications.

Siqueland, Herman S., LL.B.,1960, Michigan, construction law.

Starr, Kenneth F., M.A., 1975, Minnesota; building finance.

Twelker, Neil H., Ph.D., 1958, Harvard; soils engineering.

Course Descriptions

Courses for Undergraduates

B CON 301 Building Industry (3) A *Eberharter* Organization and functioning of the building industry: legal, ethical, business, and management aspects. Prerequisite: permission of department. Entry card required.

B CON 303 Construction Safety (2) Sp *Harrison* Explanation of the requirements of the Occupational Safety and Health Act and other related federal and state legislation, as applied to the building construction industry. Standards for accident prevention and responsibility for compliance are emphasized. Offered on credit/no credit basis only. Entry card required.

B CON 310 History of Building (3) Sp *Aaronson* Historical survey of building techniques and materials as conditioned by environmental, technical, and social influences. Entry card required.

B CON 330, 331, 332 Building Technology I, II, III (3,3,3) A,W,Sp *Hopkins* Introduction to the functional and constructional characteristics of building components: electrical distribution, lighting, heating, air conditioning, plumbing, fire protection, walls, floors, roofs, etc. Prerequisites: 330 for 331; 331 for 332. Entry card required.

B CON 401 Building Estimating (5) AW *Ossinger* The principles of building costs, estimating, and construction cost control. Prerequisites: 332, ARCH 310, 312. Entry card required.

B CON 420 Building Financing (3) W *Starr* The financing of building construction: financial institutions, regulations, government participation, and financing principles. Entry card required.

B CON 470 Construction Management (3) Sp *Lewis* Systematic study of management functions in the building industry: planning and scheduling, organization, time and equipment utilization, monitoring and expediting, project administration, cost control. Prerequisite: senior standing. Entry card required.

B CON 480 Law and the Contractor (3) Sp *Siqueland* Basic legal aspects of construction of private and governmental projects. Survey of general principles relating to rights and liabilities of the contractor and other parties under construction contracts, including union-labor agreements. Major statutory and regulatory requirements affecting the contractor, including lien laws, environment, and minority hiring practices. Prerequisite: senior standing. Entry card required.

B CON 496 Construction Practice (3) S Integration of classroom theory with practical experience through direct, on-the-job application for one summer. For majors in building construction with 135 credits completed. Applicants are selected under competitive application during Spring Quarter. Offered on credit/no credit basis only. Entry card required.

B CON 498 Special Topics (1-10, max. 20) AWSp Systematic study of specialized subject matter. Topics vary each quarter. Prerequisite: permission of department. Entry card required.

B CON 499 Undergraduate Research (*, max. 12) AWSpS Individual or small-group studies in which students may select topics with approval of faculty sponsor and department. Prerequisite: permission of department. Entry card required.

Landscape Architecture

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The expanding roles and opportunities for landscape architects are related to the increasing concern for the wise use of America's natural resources and for the quality of design in the built environment. These trends place great demands on landscape architecture programs to develop technical knowledge, analytical skills, and research balancing human needs with the requirements of a healthy natural environment.

Undergraduate Program

Bachelor of Landscape Architecture Degree

The Bachelor of Landscape Architecture degree program is an accredited, professional program that develops analytical and design skills and focuses on an understanding of the landscape resource. The overall objective of the program is to provide learning experiences whereby the program graduate: (1) is capable of identifying landscape issues and problems in terms of human functional needs, natural resource systems, and the interaction between both; (2) develops basic skills to design, implement, and evaluate workable solutions to meet these landscape needs; (3) is knowledgeable of the history, theory, major directions, and service responsibilities of the profession; (4) is able to contribute to the advancement of knowledge within the profession; (5) is knowledgeable of, and sensitive to, the esthetics of our culture; and (6) is aware of his or her individual creative capabilities.

Of the five-year program, applicants complete the first two years in the College of Arts and Sciences, or its equivalent in another junior college, college, or university. All applicants must have a minimum cumulative grade-point average of 2.50. Students are eligible to apply for regular major status upon completion of 75 university- or college-level credits, including departmental prerequisites. The department strongly recommends the student complete 90 credits before entering the major program. Students are normally admitted for Autumn Quarter, with departmental applications due March 1 prior to the autumn in which entry in the program is desired.

Students are admitted as departmental majors in the third, fourth, or fifth year of the program and continue toward completion of the 235 credits required for the degree in studies in the following areas: 88 credits in landscape architectural courses, such as site planning, small-scale site design, urban recreational design, visual assessment, natural processes, project design, site construction, materials and structures, large-scale site construction, plant identification, planting design, professional practice, and practicum; 29 credits in controlled electives, including city and regional planning, geography, soils, geology, and sociology; 12 credits in environmental history and environmental legislation; and 16 credits in free electives.

Individuals with prior degrees may apply to either the undergraduate or graduate program. Advising is available as to which program best suits individual needs. Contact the department for additional information as to prerequisites, application requirements, procedures, and scheduling.

Graduate Program

Master of Landscape Architecture Degree

The Master of Landscape Architecture program balances design and research, encompassing landscapes extending from the center of metropolitan areas into the surrounding countryside. The Pacific Northwest offers unparalleled opportunities for design case studies and research in a rich diversity of landscape settings. Students desiring additional specialization in urban situations may pursue a M.L.A. degree with certification in urban design, or a joint master's degree with Urban Planning (see urban design statement in college introduction).

The M.L.A. program curriculum is designed to meet the needs of graduates from B.L.A. programs, other environmental design programs, and nondesign programs. All students are required to complete a core curriculum emphasizing design and research. Students with no design background and/or science background are required to complete additional course work in the deficiency area. On a limited basis, students with special experience or expertise may propose a specialized course of study toward the M.L.A. degree.

Contact the department for additional information regarding programs of study, application requirements, procedures, and advising.

Faculty

Chairperson

Sally Schauman

Professors

Beyers, William B.,*‡ (Geography), Ph.D., 1967, Washington; economic geography, regional analysis.

Buchanan, Robert T.,* M.L.A., 1956, Harvard; design, graphic communications, landscape esthetics, environmental art.

Cole, Dale W.,*‡ (Forest Resources), Ph.D., 1963, Washington; soils and land-use planning, nutrient cycling in forest ecosystems, effects of forest management operations.

Del Moral, Roger,*‡ (Botany, Environmental Studies), Ph.D., 1968, California (Santa Barbara); plant ecology, competition, succession, vegetation management.

Haag, Richard, M.L.A., 1952, Harvard; theory and perception of design, reality of the practice.

Johnston, Norman J.,* Ph.D., 1964, Pennsylvania; history of city development, urban design, landscape architecture.

Small, Robert E.,* (Architecture),† M.Arch., 1955, Oregon; architecture and landscape architecture, theory and design of housing environments, environments for disabled and elderly.

Untermann, Richard K.,* M.L.A., 1967, Harvard; urban design and site planning, housing, recreation, nonmotorized circulation.

Associate Professors

Schauman, Sally,* M.S., 1971, Michigan; visual resource analysis and evaluation, resource planning and conservation.

Streatfield, David C.,* M.L.A., 1965, Pennsylvania; regional landscape planning, environmental history, landscape studies, historic landscape preservation, landscape theory.

Assistant Professors

Rice, Arthur R., M.L.A., 1978, Harvard; natural processes, regional planning, computer applications in design, design theory.

Robertson, Iain M., M.L.A., 1975, Pennsylvania; planting design, landscape design.

Lecturers

Hanson, Margaret R., B.L.A., Washington, 1980; landscape construction.

Nakano, Kenichi, M.L.A., 1973, Harvard; project design, multimedia presentation techniques, site planning.

Course Descriptions

Courses for Undergraduates

L ARC 300 Introductory Landscape Architecture Design Studio (6) AS Develops basic design and graphic skills. Studio, lectures, field trips, and one-day workshops. Students conduct site analyses and produce drawing to convey design concepts. Relationship of visual perception to drawing, role of values in design, verbal communication, and behavioral analysis of design process.

L ARC 301 Site Planning (6) A Introduction to site planning and landscape design, covering the factors of site analysis and planning, resource utilization, site suitability related to specific programs and activities; and planning, design, construction, and behavioral studies for selected case study projects.

L ARC 302 Site Design in Urban Context (5) W *Buchanan, Robertson* Design of public use areas in the urban area. Project types for this course are waterfront development, commercial areas, campus and cultural centers, plazas and historical sites; recommendation for policy to be established as part of the design solution.

L ARC 303 Urban Recreational Design (6) Sp *Untermann* Special studies in metropolitan, urban, and neighborhood recreation areas; the design, policies, and behavioral studies of existing parks, playgrounds, public places, and commercial areas. Design projects dealing with the play environment for all ages.

L ARC 311 Landscape Communications (2) A Introduction to communication techniques for various phases of the design process. Many techniques are introduced and their suitability and appropriateness for different purposes explored.

L ARC 322 Introduction to Planting Design (3) A *Robertson* Examination of traditional ways plants are used in landscape design. Emphasis on composition and design characteristics of plant materials. Technical considerations for selection, climate, cultural suitability, availability, costs, and maintenance. Open to nonmajors.

L ARC 331 Landscape Construction (4) W Basic course in site engineering, correlating the design and technical aspects of site development and suitability. Grading, drainage, circulation requirements and alignment, organization concepts relative to landscape resources, site evaluation, utilization and protection, and building and site program analysis and coordination.

L ARC 332 Landscape Construction (4) Sp Materials and structures in landscape construction. Design criteria and construction techniques for detail elements of landscape architecture. Working drawings, specifications, cost estimates, and procedures.

L ARC 341 Site Planning (3) A *Untermann* Introduction to site planning and landscape design, covering the factors of site analysis and planning, resource utilization, site suitability related to specific programs and activities; and planning, design, construction, and behavioral studies for selected case study projects. Open to nonmajors.

L ARC 352 History of Landscape Architecture (3) W *Johnston* Analysis of the landscape as an art form and its relation to the culture of each period. Open to nonmajors.

L ARC 353 History of Modern Landscape Architecture (3) A *Streatfield* Development of profession and art of landscape architecture in the United States, Europe, and South America in context of prevailing social, economic, political, and cultural factors. Relationships with other professions, especially architecture and urban planning and other arts, such as painting and sculpture. Open to nonmajors.

L ARC 361 Theory and Perception of Landscape Architecture (3) AW *Haag* Reciprocal relationships of man/nature are explored, with particular attention given to the cultural variations and interpretations of esthetics, landscape materials, and human behavior and their effects on site planning and project design. Landscape architecture philosophy related to the physical design problems and potentials of the Pacific Northwest. Open to nonmajors.

L ARC 362 Landscape Design in Urban Contexts (3) W *Buchanan* Introduction to site design in context of urban setting. Discussion related to role of landscape architect as contributor to quality of urban environment. Case study material covers diversity of design concepts and vocabulary utilized in landscape design. Recommended: 341, 361.

L ARC 363 Urban Recreation Design (3) Sp *Untermann* Special recreational studies in metropolitan, urban, and neighborhood areas; the design, policies, and behavioral studies of existing parks, playgrounds, public places, and commercial areas. Design projects dealing with the play environment for all ages. Open to nonmajors.

L ARC 401 Landscape Design Studio (6) A *Schauman* Studies of the landscape at various scales and in diversified contexts. Offers better understanding of visual components of landscapes, designer's capacity to evaluate and change these components, and resultant interaction with, and effect on, landscape user.

L ARC 402 Landscape Design Studio (6) W *Untermann* Large-scale site planning and design. Generally related to housing, new communities, and institutional development. Identification of landscape character, resources, and problems of site, cost factors, design alternatives and implications for architectural direction, policy for land acquisition. Program development to maximize site utilization, and preservation of natural attributes.

L ARC 403 Landscape Design Studio (5) Sp *Rice, Streatfield* Project design studies in areas of "critical concern," related to environmental restraints, natural systems, landscape character, and capacity of site to recover from human intervention. Generally deals with environmental issues in relation to federal, state, and local legislation, policies, and funding. Computer applications in design.

L ARC 404 Landscape Design Studio (6) A *Untermann* Elements of urban landscape. Visual assessment and resource identification and implications for large-scale urban landscape planning. Landscape features, image factors, and design potentials for recreation, open-space character, and neighborhood identity. Design policy recommendations and detailed design study for typical problem area, from metropolitan to neighborhood scale.

L ARC 405 Landscape Design Studio (6) A Examination of the ecological restraints and the design criteria for selected land use and development categories. Case studies dealing with landscape types, features, amenities, and cultural resources; their identification, classification, visual assessment, and interpretation for design planning, program development, and policy decisions. Metropolitan to regional scale.

L ARC 406 Landscape Design Studio (6) AWSpS Senior projects in landscape architecture, projects vary according to the student's particular emphasis and needs.

L ARC 411 Landscape Graphics (2) A *Buchanan* Delineation techniques for landscape perspectives, sections, rendering of plant materials. Discussion of historical and contemporary examples of landscape drawing.

L ARC 412 Landscape Graphics (2) Sp Office presentation techniques for various phases of landscape architectural projects. Multimedia techniques and presentation methods suitable for public hearings, citizen groups, design commissions, and private clients. Individual projects and case-study examples.

L ARC 423 Planting Design Studio (3) Sp *Robertson* Utilization of plants as design elements to manipulate space and modify the landscape for various activities and resolutions of site problems. Emphasis on factors that determine the appropriate use and arrangement of plant materials in an urban context. Composition, plant selection, planting techniques, and maintenance requirements are major components of this class. Prerequisite: 322 or BOT 331 or equivalent.

L ARC 424 Advanced Planting Design Seminar (2) Sp Analyzes the complex relationship between plants, man, and environment and affords opportunity to explore methods of utilizing these relationships to plant and to design more responsive landscapes. Prerequisites: upper-division standing and permission of instructor.

L ARC 425 Advanced Planting Design Studio (5) Sp Advanced seminar/studio in planting design. Provides opportunity to explore ecological, technical, and esthetic principles for selecting plants to meet specific site conditions (e.g., problem soils, winds, waters). Project types include historical sites, multifamily housing projects, plazas, landfills, and reclamation sites. Prerequisites: upper-division standing and permission of instructor.

L ARC 433 Large-Scale Site Construction (4) A Includes studies of natural determinants and restraints on large-scale construction, development affected by service and utility systems, physiographic suitability of site, cost-benefit analysis, and critical path methodology for site construction projects. Prerequisites: 331 and GEOL 313.

L ARC 450 History of Environmental Design in the Pacific Northwest (3) SpS *Streatfield* Development of landscape architecture, architecture, and urban planning in the Pacific Northwest from the nineteenth century to the present, with major emphasis on twentieth century. Open to nonmajors.

L ARC 451 History of Environmental Design on the West Coast (3) SpS *Streatfield* Development of the environmental parts of landscape architecture, architecture, and urban planning from the eighteenth century to the present, with major emphasis on twentieth century. Open to nonmajors.

L ARC 462 Site Planning for Housing (3) Large-scale site planning concerned primarily with housing as it relates to physical environmental conditions. Lectures cover methods for understanding and manipulating the land and the house, plus insights into other issues relevant to the site-planning process. Open to nonmajors.

L ARC 463 Natural Processes as Planning and Design Determinants (3) Sp *Streatfield* Introductory lecture course relating methods, procedures, and rationale for use of natural process information—soils, vegetation, hydrology, physiography, wildlife, and geology. The planning/design process covers areas of critical concern, environmental restraints, natural systems, landscape character, and capacity of site to recover from human intervention. Open to nonmajors.

L ARC 470 Landscape Architecture Tutorial (2, max. 6) Tutorial course concerned with various aspects of project organization, programming, scheduling of work loads, graphic and verbal communication problems, data collection methods and interpretation, methodologies for landscape planting and design. Prerequisites: fourth- or fifth-year standing and one quarter advance permission of instructor.

L ARC 473 Professional Practice (3) Sp *Schauman* Professional practice in private office, academic institutions, and public agencies. Evolution of landscape architecture as a profession; possible scenarios for future; variety of practice types and their relationships; ethical and legal/contractual responsibilities of a professional.

L ARC 474 Project Design (6) Sp *Nakano* Detailed design studies of small-to-medium-scale projects. General focus on public landscape areas and social/psychological uses of site: design master plan and details, planting and construction documents, and professional office presentation of material. Prerequisite: fifth-year standing in the department.

L ARC 476 Professional Operations (3-6, max. 6) AWSp *Untermann* Practicum course for landscape architecture majors for internship and exposure to the profession with working experiences at various levels of professional endeavor. Student apprenticeship in selected private offices and public agencies. Prerequisite: permission of instructor.

L ARC 477 Landscape Architecture Consultancy Studio (3-6) AWSpS Simulation of the professional relationship of the landscape architect as a consultant to University students in other design planning and management disciplines. Focus is on site analysis, master planning, schematic designs and detailed design, working drawings, and planting plans associated with student projects. Prerequisites: fourth- or fifth-year standing in the department.

L ARC 495 Landscape Architectural Studies Abroad (1-10, max. 30) S Studies conducted under faculty supervision in various locations outside the United States. Prerequisite: permission of instructor.

L ARC 498 Special Projects (1-10, max. 30) AWSpS Special projects as arranged. Open to nonmajors.

L ARC 499 Undergraduate Research (1-6) AWSpS Individual or small-group studies pertaining to special problems, theories, or issues of landscape architecture and environmental issues. Prerequisites: application approved by a faculty sponsor.

Courses for Graduates Only

L ARC 501 Landscape Design and Planning I (6) A *Nakano* Enhances perceptual awareness and design sensitivity to natural and man-made landscapes. Basic skills necessary for more advanced course work required in the Master of Landscape Architecture degree program (i.e., relationship between landscape perception, graphics, site analysis, and design). Examination of landscape environment through problem-solving techniques that acknowledge holistic approach to the environment. Prerequisite: permission of instructor.

L ARC 504 Regional Landscape Planning (6) A *Rice* Studio in applied regional landscape planning in metropolitan regions to examine conflicting land-use pressures of urban/rural fringe. Ecosystematic approach emphasizes maintenance of landscape quality. Computer applications in design. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 505 Regional Landscape Design (6) W *Streatfield* Theory/techniques of regional design to analyze, evaluate, plan, design, and manage the resources of the regional landscape continuum. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 506 Landscape Visual Resources (6) Sp *Schauman* Survey of existing theory/techniques and the generation of new methods to analyze, evaluate, plan, design, and manage the visual resources of the landscape. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 507 Landscape Art (6) Sp *Buchanan* Public art placed in, or developed for, specific landscape settings. Various aspects and benefits of public art, including materials, technologies, philosophies of landscape imagery and meaning. General planning criteria for location for maximum public benefit and identification of objectives for a specific site and artwork. Open to nonmajors. Prerequisite: student standing in architecture, art, or landscape architecture or permission of instructor.

L ARC 511 Visual Learning (3) A *Schauman* Seminar/laboratory to develop visual learning processes and skills for applying these processes to landscape architecture. Related visualization concepts. Prerequisite: permission of instructor.

L ARC 522 Landscape Technology (3) A *Schauman* Lecture/seminar on design philosophy and construction technology related to landscape habitat development. Technologies and their appropriateness for rehabilitation, restoration, and creation of landscapes at site specific scale, maintenance programs, energy conservation, implementation problems, and public policy. To be taken concurrently with 523. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 523 Landscape Technology (3) A *Schauman* Studio on application of technologies and their appropriateness for rehabilitation, restoration, and creation of landscapes at site-specific scale. Examination of maintenance programs, energy conservation, implementation problems, and public policy. To be taken concurrently with 522. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 550 History and Theory of Modern Landscape Architecture (3) A *Streatfield* Lecture/seminar on history and theory of landscape architecture from the eighteenth century to the present. Relation to theory in related environmental design disciplines such as architecture and urban planning and other disciplines such as geography. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 561 Regional Landscape Planning and Design (2) A *Streatfield* Seminar on objectives, philosophy, history, and theory of regional landscape planning and design. Overview of the context of regional landscape planning, examination of critical issues in the Pacific Northwest region, and opportunities and role of the landscape architect in addressing these issues. Open to nonmajors. Prerequisite: permission of instructor.

L ARC 562 Landscape Art (2) Sp *Buchanan* Process of developing and placing artworks in specific landscape settings. Types of artwork and landscape settings; ways for artist and site designer to interpret, alter, and incorporate factors of landscape; viewer's perception and experience; examples of public and private support.

L ARC 598 Special Topics (1-6, max. 9) AWSpS Systematic study of specialized regional landscape subject matter, including history, technology, implementation, and other topics depending on current interest/needs. Topics vary and are announced in the preceding quarter. Prerequisite: permission of instructor.

L ARC 600 Independent Study or Research (*) AWSpS

L ARC 700 Master's Thesis (*) AWSpS

Urban Planning

410 Gould

The purpose of planning is to provide an informed basis for coordinated action. Urban planning deals with problems of urban settlement. More specifically, urban planning is a continuing and deliberate activity to arrange human settlements to meet the desires of the population within the constraints of the environment and culture.

Graduate Program

Master of Urban Planning Degree

The Master of Urban Planning degree is the usual educational qualification for professional practice of city and regional planning, including specialized research and design positions and generalist planning and administrative positions in a wide variety of public agencies and consulting firms. It is a two-year, or six-quarter, program.

Preparation for master's-level study may be in urban planning or in other appropriate fields, such as economics, geography, or other social sciences; civil engineering and environmental science and studies; or landscape architecture and architecture. Selective urban study and technique courses are taken to provide a basis for professional courses.

The primary objective of the curriculum is to educate professional planners with a broad range of competence; a secondary objective is to provide opportunities for specialization.

Course requirements specify a core of knowledge embodied in required courses. Drawing on the electives in the Master of Urban Planning degree curriculum and obtaining the advice of faculty members with similar interests, the student may put together an area of specialization. Current organized program opportunities include urban design, urban transportation, urban development, comparative urban development, and land-use planning. Other opportunities that may be developed by the student involve the cooperation of other University units, in consultation with the graduate program coordinator and other faculty members.

A Certificate of Achievement in Urban Design is offered within the Master of Urban Planning degree program (see statement in college introduction).

Doctor of Philosophy Degree

Acquisition of the Doctor of Philosophy degree in the urban planning field indicates scholarly abilities, long-term intellectual interests, and substantial achievements related to the discipline of planning. The requirements leading to this degree are devices through which students may demonstrate that they have these qualities and are capable of independent work worthy of the attention of their peers in the academic and professional planning communities. This doctoral program is not viewed as an additional level of training for professional practice.

Admission to the doctoral program is similar to that for the Master of Urban Planning degree program, with the added understanding that the student is essentially interested in an academic or research career in a specialty within the planning field and has demonstrated a high degree of intelligence and academic competence.

For graduation, the program has a minimum of fixed requirements in the Department of Urban Planning in addition to those of the Graduate School. A preliminary examination is required before a Supervisory Committee is appointed to direct the student's specialized preparation for the General Examination, the first of two major requirements. The second requirement is completion of a satisfactory dissertation and Final Examination.

Faculty

Chairperson

Donald H. Miller

Professors

Amoss, Harold L. (Emeritus), Ph.D., 1951, California (Berkeley); planned social change, community development.

Bell, Earl J.,* Ph.D., 1965, California (Berkeley); application of operations research methods to urban and regional planning problems, mathematical programming models.

Grey, Arthur L.,* Ph.D., 1954, California (Berkeley); scope of urban planning, land and development policy, uses of remote sensing in urban planning, economics of land use, professional practice experience, use and need analysis.

Hancock, John L.,* Ph.D., 1964, Pennsylvania; planning history, urban history, planning theory, social analysis and social evaluation methods, comparative urbanism.

Horwood, Edgar M. (Emeritus), Ph.D., 1959, Pennsylvania; urban information systems, transportation analysis and planning.

Johnston, Norman J.,* (Architecture),† Ph.D., 1964, Pennsylvania; history of city development, urban design, landscape architecture.

Miller, Donald H.,* Ph.D., 1973, California (Berkeley); urban spatial structure, consumer behavior and demand for public services, planning theory and evaluation; urbanization processes.

Rabinowitz, Alan,* Ph.D., 1969, Massachusetts Institute of Technology; economics of housing and urban development, municipal finance, program planning and evaluation, regional planning.

Schneider, Jerry B.,*‡ (Civil Engineering, Environmental Studies), Ph.D., 1966, Pennsylvania; metropolitan and regional planning, transportation and land-use interrelationships, computer graphics, forecasting methods, futures research.

Seyfried, Warren R. (Emeritus), D.B.A., 1956, Indiana; urban economics, urban development.

Wolfe, Myer R. (Emeritus), M.R.P., 1947, Cornell; urban planning, planning-design process, planning in other countries.

Associate Professors

Arenas, Claudio,* M.U.P., 1961, Washington, M.B.A., 1966, California (Los Angeles); urban and regional economic development, land-use planning and development housing.

Ludwig, Richard L.,* Ph.D., 1971, Pittsburgh; housing development planning, social factors in development planning.

Norton, Thomas J.,* M.U.P., 1960, Washington; urban community facilities, planning administration.

Ryan, Dennis M.,* Ph.D., 1976, Pennsylvania; continuity in the design of urban environments.

Assistant Professor

Westerlund, Frank V. (Research), Ph.D., 1977, Washington; urban planning.

Course Descriptions

Courses for Undergraduates

URB P 300 Introduction to Urban Planning (3) AWSpS Principles and theories of urban structure and institutions. Concepts and logic of planning as a community process and a professional activity. Evolution of planning ideas in response to changing social, economic, and environmental conditions within the American political framework. Complementary nature of public and private responsibilities. Major procedures used by planners. Prerequisite: junior standing or permission of instructor.

URB P 340 American Urban Problems (3) AS Major trends and problems in urban America that grew out of our past or are developing today. A new topic and new materials are presented each quarter. Topics are selected for their contemporary importance, environmental (biocultural) impact, and planning implications. History is used as our chief record of the past, not as a blueprint of the present and future.

URB P 350 Urban Development and Real Estate (4) AWSpS Introduction to real estate markets, investment, appraisal, accessibility concepts, urban history, urban research, and related topics. Offered jointly with UDRE 310.

URB P 351 Urban Development and Real Estate Finance (4) AW Emphasizes the role of the private sector in urban development; valuation and investment theory; techniques of investment analysis and capital allocation.

URB P 399 Future Patterns of Settlement (3) W Study of possible future patterns of human use of the environment from apocalyptic to glorious. Review of landscape evolution. Problems of long-range regional and national planning. Offered jointly with GEOG 399. Prerequisite: 340 or GEOG 207 or 277, or permission of instructor.

URB P 401 Urban Planning Policies and Programs (3) Sp Goals, processes of policy formulation, methods of planning effectuation, and related problems. Community, regional, state, and national programs. Prerequisite: 411 or permission of instructor.

URB P 407 Urban Planning Studio (5) Sp Synthesis of urban planning problems and methods in a laboratory section. For majors only. Prerequisite: 465 or equivalent substantive focus sequence.

URB P 410 Planning Theory (3) W Synthesis of theories and theorizing drawn from several disciplines and applied to urban planning. Particular emphasis on explanatory concepts associated with a future-oriented rational decision process in complex bureaucratic organization. For majors only. Prerequisite: 300.

URB P 411 Planning Process and Methods (3) Sp The urban plan and plan making. Emphasis on comprehensive, coordinative urban planning. Methods and analytical techniques used in planning public actions and policies. Various planning surveys and methods discussed. For majors only. Prerequisite: 410.

URB P 412 Forecasting Methods in Urban Planning (3) Sp Examination of several forecasting methods, including trend extrapolation, Delphi, relevance trees, morphological boxes, cross-impact matrices, scenario generation, and literature-monitoring techniques. Past failures and successes. Applications to urban planning problems.

URB P 420 Introduction to Quantitative Analysis in Urban Planning (3) A Data analysis for urban planning, statistical description, probability, sampling, estimation, hypothesis testing. Examples, including computer exercises, to be taken from planning literature using real data from assessors' files, building permit files, etc., and from other environmental design fields. Prerequisite: MATH 105.

URB P 421 Quantitative Analytical Models and Methods (3) W Survey of probabilistic and mathematical models and other techniques of operations research relevant to planning. Emphasis on linear and dynamic programming, critical path methods, queuing models, networks, and the Bayesian approach to decision making under uncertainty. Stress placed upon the underlying model and implications for planning. Prerequisite: 420 or permission of instructor.

URB P 426 Transportation System Impact Analysis (3) Review and evaluation of methods of forecasting the social, economic, political, environmental, and energy impacts of proposed transportation projects. Prerequisite: 412 or URB P 430 or permission of instructor.

URB P 429 Computer-Aided Planning of Urban Systems (3) W Survey of on-line planning applications; use of various on-line systems to solve urban systems design problems; investigation of hardware/software trade-offs; human factors in man-computer systems design theory as it relates to problem-solving activity. Offered jointly with CETS 472.

URB P 444 User Analysis of Urban Spaces (3) Sp Development and application of techniques for appraisal of the built environment so as to imply planning and design criteria for urban open spaces. Offered jointly with ARCH 444. For students in behavioral field studies in architecture, landscape architecture, and urban planning; others by permission of instructor.

URB P 446 Practical Experience (4, max. 8) AWSp Off-campus experience under academic supervision in situations useful to the education of planners, such as planning offices, public bureaucracies, projects related to the environment, cross-cultural matters, and decision making. Assistance in identifying appropriate projects. Prerequisite: permission of instructor.

URB P 447 Social Factors in Urban Planning (2) A Analyzing the impact of planning and planning policies on the social environment, including an examination of those social factors important to the planning process, such as neighborhood and community structure, age and sex composition, race, and class. Methods for evaluating and incorporating social information into the planning process. Prerequisite: 300, which may be taken concurrently.

URB P 448 Directed Social Change (3) A General course for both undergraduate and graduate students on the theories and practice of directed social change and citizen involvement in the planning process.

URB P 449 Planning Problems of the Black Community (3) W Course objective is to enable student to acquire an understanding of the complex factors operating in urban communities that give rise to and sustain the inner-city ghetto and how planning has been related to these problems in both their creation and solution.

URB P 450 Urban Community Facilities (3) WS Relationships of goal structure and physical requirements of public facilities. Criteria pertinent to schools, parks, utilities, etc., and their effect on the comprehensive plan. Prerequisite: 300.

URB P 451 Housing (3) AS Survey of housing and redevelopment problems, theories, standards, and practice. Development of public policies, finance, technological considerations, social factors and priorities. Prerequisite: 300.

URB P 452 Urban Development and Real Estate Location Determinants (4) W Practical workshop on empirical methods to conduct and evaluate locational studies.

URB P 460 History of City Development (3) A Analysis of city forms and designs emphasizing their relation to the culture of each period.

URB P 461 History of Urban Planning in the United States (3) W Seminar in origins, development, and significance of the American planning movement and the profession that emerged from it, as defined by some of its seminal innovators, theories, practices, and achievements; and as evaluated by cultural realities thereby served. Emphasis on the twentieth-century American urban record, foreign influences, and planning as an instrument for societal change.

URB P 465 Land Use (3) W Substantive presentation of land use as a focus for planning issues. Development of problems: consideration of analysis, programming, and implementation methods in preparation for 407. Seminar and group project sections. Prerequisite: 481.

URB P 467 Urban Planning Uses of Remote Sensing (3) Sp Using aerial photographs, related data, and maps in urban planning. Urban change analysis, land-use classification systems, other planning applications. Scale and resolution considerations. Development of proficiency through laboratory exercises. Prerequisite: 300 or equivalent; recommended: 465.

URB P 468 Land Use From Satellite Data (3) W Digital data from Landsat, etc., are used to determine land-use and land-cover classification in urban and rural areas. "Hands-on" exercises on computer. Photo interpretation, statistics, land-use classification, and verification are incorporated. Prerequisite: 465, 467, or permission of instructor.

URB P 470 Introduction to Urban Design (3) Sp Definitions and examples of basic urban design; importance of urban physical form in the attainment of social objectives; heritage of urban design; designing parts of the city; theories of city building; the role of urban design in the fields of architecture, landscape architecture, civil engineering, and urban planning. Enrollment restricted to seniors with permission of instructor.

URB P 471 History of Urban Design (3) Sp Aspects of form, pattern, and space that mark efforts of individuals and groups to express their values and goals in the design of their cities. Special attention given to both historical and modern examples.

URB P 472 Graphic Communication in Urban Planning (3) A Introduces nondesign student to use of graphics and other representational techniques as a means of conceptualizing and expressing ideas, and for recording, analyzing, and controlling environment. Covers use of drawing, three-dimensional models, mapping, diagrams, report layout, photography, exhibit preparation, etc., as tools for effective communication of ideas.

URB P 475 Town as Artifact (3) Sp Studies of contemporary and historic towns, utilizing work in cultural anthropology and settlement geography to examine urban form and structure. Focus on the physical environment of the town as the container of social interaction. Human activity related to the "shelter" society builds, at the scale of the whole community. Prerequisite: 479.

URB P 479 The Urban Form (3) A Examination of the physical patterns of urban areas related to the forces producing them. Observation, identification, and methods of recording aspects of the urban scene. Prerequisite: 300.

URB P 480 Introduction to Urban, Suburban, and Metropolitan Political Systems (5) Causes and consequences of variations in urban form and political structure. Social, economic, and cultural characteristics of different urban forms; and processes by which they have developed; emphasis on suburbanization and metropolitanism. Offered jointly with POL S 480. Recommended: POL S 101 or 202.

URB P 481 Legal Basis for Planning (3) A Political, legal, and administrative institutions closely related to the planning process. Issues of devolution of authority and public representation and participation. Legal basis for planning and associated regulation. Prerequisite: 300.

URB P 482 Legal Aspects of Urban Development and Real Estate (3) Legal aspects of modern land utilization, including the urban plan, zoning, and private and public ownership, with preliminary discussion of the nature of property and a brief survey of real property law.

URB P 498 Special Topics (1-6, max. 15) AWSpS Systematic study of specialized subject matter. Topics for each quarter vary, depending upon current interest and needs, and are announced in the preceding quarter. Prerequisite: permission of instructor.

URB P 499 Special Projects in Urban Planning (*, max. 6) AWSpS Independent/tutorial study for undergraduates. Individual reading, research, fieldwork, or other special project, outlined in advance, approved by, and under the direction of, the faculty adviser most appropriate for the project proposed. A report on the purposes, procedures, and results of the study is required. Prerequisites: senior standing and permission of the supervising instructor.

Courses for Graduates Only

URB P 500 Survey of Urban Planning (3) A Concepts and logic of planning as a professional activity. Evolution of guiding ideas in relation to changing social, economic, and environmental conditions within the American political framework. Major procedures used by planners. Critical appraisal. Open to graduate students in urban planning and to graduate students in architecture seeking the Urban Design Certificate.

URB P 501 Resources for Urban Planning (2) A Introduction to areas of specialized study in environmental planning and policy programming. Organization for planning in the Seattle region; range of activities and emphases, established and changing roles. Required of new graduate students; not open to others.

URB P 502 Metropolitan Planning (3) W Review and critique of metropolitan planning concepts, processes, methods, and impacts in several North American cities. Special attention to major shapers of urban development patterns: transportation, utilities, open space, and major activity centers. Prerequisite: 399 or permission of instructor.

URB P 506- General Urban Planning (2-) W Introduction to applied professional planning. Consideration of analysis, programming, and implementation methods in preparation for general urban planning laboratory. Prerequisites: 500, 501.

URB P -507 General Urban Planning Laboratory (-5) Sp Laboratory exercise in applied professional planning, utilizing a local study area to examine the realities of problem solving in situations of functional and normative conflict. Integration of analysis, programming, implementation, and presentation phases of the planning process. Prerequisite: 506.

URB P 508 Specialized Planning Laboratory (5, max. 10) A Several different sections or options are to be offered each year, such as regional-environmental planning, urban systems analysis, housing, metropolitan planning, urban design, and community services and organization. Prerequisites: 500, 501; some sections may have prerequisite urban planning lecture or seminar courses.

URB P 510 Theories and Methodologies of Planning I (4) W Survey of the philosophy, methods, and analytical techniques used in planning public actions and policies, with emphasis on the logic and assumptions on which these are based. Various planning surveys and methods discussed. Open to graduate students in urban planning and to graduate students in architecture seeking the Urban Design Certificate. Prerequisite: 500.

URB P 511 Theories and Methodologies of Planning II (4) Sp Factors relating to the timing, phasing, and programming of urban development. The bearing of amenity, density, etc., on the actual development process. Prerequisite: 510.

URB P 512 Research Seminar (2) A Development and presentation of advanced topics of individual investigation.

URB P 515 Technology Assessment Methods and Analysis I (3 or 5) In-depth analysis of concept, practice, and methods of technology assessment (policy analysis concentrating on social consequences of technological development): how to evaluate social, political, economic, and environmental impacts of new technologies, options for channeling these developments, and relevant decision-making institutions and processes. Sequences with SMT 531. Offered jointly with SMT 530.

URB P 525 Evaluation in Urban Planning (3) W Methods and techniques for *a priori* assessment of physical improvement plans, program designs, public policies. Includes cost effectiveness and matrix or goal achievement, as well as more conventional cost-benefit and cost-revenue forms of analysis. Emphasis on understanding the reasoning and issues in evaluation, and gaining a working competence in at least one of the methods treated.

URB P 529 Urban Region Geocoding and Land-Based Information Systems (3) *Horwood* Multipurpose street network and land-based information systems. The U.S. census geocoding system, automated map overlay systems, and cadastral file information use. Applications to land surveying, urban and transportation planning, and geographic analysis. Offered jointly with GEOG 529 and CETS 529.

URB P 530 Land-Use/Transportation Models (3) A Review of theoretical basis of several existing models used to forecast urban growth patterns and their associated land-use, transportation, and energy requirements. Model validation studies in relation to empirical studies of urban growth and change. Environmental implications of alternative urban growth patterns. Offered jointly with CETS 570.

URB P 534 Airport Systems Planning (3) W Investigation of environmental, sociopolitical, and economic features of air transportation system planning. Emerging technologies, intermodal relationships, the decision-making process. Scenarios of anticipated conflict and resolution problems.

URB P 540 Seminar in Citizen Participation (3) W Modes of citizen participation in public decision making, advocacy planning, participant democracy, and community development are considered in terms of contemporary problems.

URB P 545 Minority Community Development (2) Sp Problems associated with the directed and planned development of urban minority communities: analysis of planning policy and its role in the development process; examination of specific areas of development, such as health, education, housing, and economics; and evaluation of certain current developmental programs.

URB P 546 Practicum (4, max. 8) AWSp Off-campus experience under academic supervision in situations useful to the education of planners, such as planning offices, public bureaucracies, projects related to the environment, cross-cultural matters, and decision making. Assistance in identifying appropriate projects. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

URB P 550 Urban Planning: Financial Planning and Management (3) Sp Practical application of benefit-cost methodology to the decision-making process for urban development. In a "workshop" format, benefit-cost analysis procedures are applied to urban development projects or programs, including urban renewal as defined by legislation. Theory or methodology is utilized as necessary to determine objectives, to identify and to measure benefits and costs, and to specify decision criteria in terms of the public interest.

URB P 551 Allocation Processes in Urban and Regional Planning (3) A General economic context of planning analysis and social decision making. Priorities and public budgets. Measurement of collective needs. Allocative processes applied to land use. Offered jointly with UDRE 551.

URB P 552 Urban Development and the Real Estate Market (3) A Topical survey of urban development. Provides substantive information, methodology, theory, and base for additional courses and seminars in area. Includes urban economy and determinants of land use, capital investment in urban development, land tenure, urban functions and public sector, urban development policy and strategy. Prerequisite: permission of instructor.

URB P 553 Urban Real Estate Finance and Investment (3) W Develops principles for evaluating opportunities to invest in urban real estate, discusses the question of determining the cost of capital for such investments, investigates some problems in the application of an appropriate investment criterion to specific types of opportunities, and explores some aspects of the urban renewal problem. Prerequisite: 552, UDRE 505, or permission of instructor.

URB P 554 Location Determinants of Urban Real Estate Investment (3) Sp Advanced workshop on empirical methods to conduct and evaluate locational studies. Offered jointly with UDRE 525. Prerequisite: FIN 515 or permission of instructor.

URB P 557 Economics of Land-Use Regulation (3) W Taxation, subsidy, and other means to further public purposes in land utilization and development. Open space, transfer of development rights, tax allocation financing. Resource use, distributive and market effects of controls. Prerequisite: 551 or 552 or permission of instructor.

URB P 565 Comparative Urbanism (3) W Characteristics and problems of urbanization in the world; comparisons of origins and development; physical form, land utilization, and planning. Selected major cities. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

URB P 570 Urban Design Process (3) W The study of concepts, methods, and processes basic to planning, design, and effectuation. Offered on credit/no credit basis only. Prerequisite: specialization in urban design or permission of instructor.

URB P 571 Research and Analytical Methods for Urban Design (3) Sp Studies of the various arrangements of urban forms that affect perceptual experiences. Urban design considerations of the location of structures, open space, movement channels, and methods of implementing public policy decisions affecting urban design. Prerequisite: specialization in urban design or permission of instructor.

URB P 580 Legal and Administrative Framework for Planning (3) A Political, legal, and administrative institutions closely related to the planning process. Issues of devolution of authority and public representation and participation. Legal basis for planning and associated regulation.

URB P 591-592-593 Doctoral Seminar I, II, III (4-4-4) A,W,Sp Researchable issues and research methodology. Discussion and critique of selected pieces of recent research work. Presentation and critique of research proposed by members of the seminar. Prerequisite: master's degree or the equivalent in a planning discipline.

URB P 598 Special Topics (1-6, max. 15) AWSpS Systematic study of specialized subject matter. Topics vary for each quarter, depending upon current interest and needs, and are announced in the preceding quarter. Prerequisite: permission of instructor.

URB P 600 Independent Study or Research (*) AWSpS

URB P 700 Master's Thesis (*) AWSpS

URB P 800 Doctoral Dissertation (*) AWSpS

College of Arts and Sciences

Dean

Ernest M. Henley
B110 Padelford

Associate Deans

Herbert L. Costner
Joe S. Creager
David McCracken
David Prins

The departments and schools of the College of Arts and Sciences offer nearly one hundred curricula leading to the degrees of either Bachelor of Arts, Bachelor of Fine Arts, Bachelor of Music, or Bachelor of Science, as well as graduate study leading to master's and doctoral degrees.

Undergraduate Study

Graduation Requirements

To be awarded a baccalaureate degree, a student in the college must fulfill a basic proficiency requirement, a distribution requirement, and a major requirement. In addition, the student must present at least 90 credits outside the major department and must meet minimum grade-point-average requirements as specified below.

Basic Proficiency Requirement

New Proficiency Requirement: To receive a degree from the College of Arts and Sciences, students entering any college or university Autumn Quarter 1985, or thereafter, will be required to satisfy minimum proficiency standards in all three of the following areas: English composition, foreign language, and quantitative and symbolic reasoning. English proficiency may be satisfied by successful completion of college courses. The foreign-language and the quantitative and symbolic reasoning proficiencies may be satisfied by successful completion of college courses or proficiency examinations. Until the new standards are implemented, the requirement shown below will remain in effect.

Current Proficiency Requirement: Students of the college are expected to have developed, either in their high school study or early in their college study, fundamental verbal and quantitative skills. Although achievement of these skills is made a part of the degree requirements, many entering students will already have demonstrated an acceptable level of achievement in their high school study. Students whose high school preparation included four years of English, three years of a single foreign language, and three years of college preparatory mathematics are considered to have satisfied the basic proficiency requirement. They may, of course, wish to take additional courses in these fields as electives.

Students who do not satisfy the basic proficiency requirement in this way are expected to complete early in their college study 15 credits in the areas of verbal or mathematical skills, or both, as considered most appropriate to their needs and interests. Students may choose to emphasize one skill or refurbish more than one skill, as assessment of their own capabilities may dictate. Courses used to satisfy this requirement are chosen from English composition, foreign language, and mathematics. Credit awarded in English, foreign languages, or mathematics on the basis of advanced placement examinations may be used to satisfy this requirement.

Students who enter college or university prior to Autumn Quarter 1985, then transfer to the College of Arts and Sciences with 85 or more acceptable credits, are exempt from the proficiency requirement.

Distribution Requirement

The distribution requirement is the means by which the college seeks to develop a student's breadth of knowledge and appreciation for subjects different in content and method from the one in which the student will major. The college has identified courses especially suited for meeting this requirement. These courses are currently divided into three large fields of knowledge: the humanities, social sciences, and natural sciences. Each student must select, from the Distribution List, at least 20 credits in courses from each of the three fields. (As an alternative, students may take 15 credits from the distribution area under which the major falls and 25 credits in one of the other two groups. All other aspects of the distribution requirement, as mentioned below, must be met.)

Humanities courses have been subdivided into Part A (Language and Literature) and Part B (Fine Arts). Social Science courses have been subdivided into Part A (Social Science) and Part B (History, Philosophy, Civilization). In humanities and in social sciences, students must complete at least 5 credits from Part A and at least 5 credits from Part B. In the natural sciences, students must complete at least one approved sequence. Approved sequences, and all other courses that apply toward the distribution requirement, are shown on the distribution list, which follows. (Students entering any college or university Autumn Quarter 1985, or thereafter, must complete at least two approved sequences, totaling 18 or more credits, as opposed to the one sequence currently required. Of the two sequences, one must be taken in the natural sciences, and the other may be completed in any one of the three distribution areas mentioned above.) Courses listed on the distribution lists may change. If a course changes distribution categories, students who took it before the change may use it for either the old category or the new, but students who take it after the change may use it only for the new category. (Courses are not likely to be removed from the distribution lists altogether unless they are being dropped from the curriculum.) It is recommended that students pick up an updated copy of the distribution list once a year, at B10 Padelford or at other advising offices on campus.

Students must also complete 10 credits of courses that emphasize the development of writing skills in the context of an academic discipline. These courses are designated *W* in the Time Schedule. *W* courses, if they apply, may also count toward distribution or major

requirements. Under certain circumstances, *W* courses may also apply to the proficiency requirement. Students should consult advisers for restrictions and details.

No course from the department in which the student is pursuing a major may be used to satisfy this requirement. Courses presented to satisfy the basic proficiency requirement may not be counted toward the distribution requirement.

Students who began their college careers before Autumn Quarter 1983 are under a different set of requirements and should consult advisers for information on requirements that apply to them.

Major Requirement

In fulfilling the requirements for a major, the student engages in thorough study of a discipline or subject, aimed at developing knowledge in depth. This part of the student's program is determined by the department, school, or faculty committee with which the major study is pursued. Measured in academic credits, the "major" required of each student consists of 50 or more prescribed credits in a department of the college or a closely related group of departments. Descriptions of major programs are printed below.

Credits Required Outside Major Department

So that the student will not be tempted to specialize prematurely, the college limits to 90 the number of credits from a single department that the student may elect to count in the 180 credits required for the baccalaureate degree. A department itself may require no more than 70 credits from courses within the department, and no more than 90 credits from within the department and other fields combined, as constituting its major program for the baccalaureate degree. These limits may be exceeded only by the amount that a department elects to require credits in addition to the 180 minimum for graduation. Exceptions to these restrictions may be granted by the Dean under very unusual circumstances.

Grade-Point Average Required for Graduation

To be eligible to receive the baccalaureate degree, the student must achieve at least a 2.00 cumulative grade-point average in the major (some departments prescribe a higher minimum grade-point average for the major), as well as a 2.00 cumulative grade-point average for all work done in residence at the University.

Applying for Graduation

Students should apply for the baccalaureate degree no later than the first quarter of their final year. They may choose to graduate under the graduation requirements of the *General Catalog* published most recently before the date of entry into the college, provided that no more than ten years have elapsed since that date and provided that approval of the major department has been obtained. As an alternative, a student may choose to fulfill the graduation requirements as outlined in the catalog published most recently before the anticipated date of graduation. All responsibility for fulfilling graduation requirements rests with the student concerned.

Limits on Physical Education and ROTC Courses Allowed Toward Graduation

A student graduating from the College of Arts and Sciences may count a maximum of three 1-credit, 100-level physical education courses taken at the University of Washington, or their equivalents at other collegiate institutions, as elective credits toward graduation. At present, 1-credit physical education courses are not offered at the University. Up to 18 credits in upper-division ROTC courses also may be counted as elective credits toward graduation, but no lower-division ROTC credits may be counted.

Certification for Teaching

Students following programs that lead to a baccalaureate degree in the College of Arts and Sciences may qualify for certification for public schools teaching in the state of Washington by including in their degree programs the courses required for certification as determined by the faculty of the College of Education.

Information on the requirements for certification and admission to the certification program is available in the College of Education section of this catalog and from an education adviser in 211 Miller.

Special Services and Programs for Undergraduates

Premajor and Preprofessional Advising

B10 Padelford

Students who do not make a definite choice of major when entering the University are designated premajor students. An adviser in the Central Advising Office will assist them in designing a program of studies that will meet the general requirements of the college and provide them with information about possible major fields. The Central Advising Office also provides the following: assistance in exploring academic options; information about degree programs; preprofessional advising for such areas as medicine, dentistry, law; options for students on academic probation; preliminary career counseling; a wide range of information on registration, course offerings, degree requirements, and administrative procedures. Premajor students should make a selection of major whenever they are reasonably confident of their educational objectives. Ordinarily, a student will want to select a major by the end of the sophomore year to ensure completion of degree requirements in the normal period. Transfer to a department major from premajor status sometimes requires completion of prerequisite courses, attainment of a minimum specified grade-point average, or selection by the department from among a group of prospective majors.

College Honors Program

B10 Padelford

This four-year program features special counseling, honors courses, honors sections of regular courses, faculty/student colloquia, and opportunities for independent study. It provides expanded opportunities for undergraduate education to those students who show exceptional intellectual promise. For additional information, see Honors—Arts and Sciences section.

Distribution List

This list applies to students who enter the University or any other college or university Autumn Quarter 1983 or later. (Students who start community college before Autumn Quarter 1984 *and* enter the University with an Associate of Arts degree may choose to follow an earlier distribution list.)

Humanities

20 credits required, including at least 5 credits from Part A and 5 from Part B.

Part A: Language and Literature

Afro-American Studies.*

American Indian Studies:* AIS 215.

Anthropology: ANTH 203.

Asian American Studies: AAS 400.

Asian Languages and Literature:* ASIAN 263; CHIN 293; JAPAN 321, 322, 323, 425, 426.

Classics:* CLAS 101, 205, 210, 322, 424, 427, 428, 430, 435.

Comparative Literature: C LIT 200, 240, 250, 251, 252, 300, 301, 302, 310, 357, 396, 401, 405, 407, 410, 415, 424, 440, 472, 480, 496.

English: ENGL 111, 121, 200, 201, 202, 203, 204, 205, 231, 267, 271, 301, 302, 309, 310, 311, 313, 314, 315, 321, 322, 325, 326, 327, 328, 330, 332, 333, 334, 335, 340, 341, 342, 343, 347, 351, 352, 353, 354, 355, 356, 358, 359, 361, 364, 365, 366, 367, 368, 369, 370, 371, 372, 375, 376, 379, 382, 383, 384, 390, 394, 407, 408, 413, 415, 416, 450.

Germanics:* GERM 340, 341, 342, 343, 344, 345, 346, 349, 350, 351, 352, 390, 497, 498.

Humanistic-Social Studies: HSS 450.

Linguistics: LING 200, 401.

Middle Eastern Studies: SISME 210.

Near Eastern Languages and Civilization:* N E 210, 230, 240.

Philosophy: PHIL 347.

Religious Studies/Comparative Religion: RELIG 220.

Romance Languages and Literature:* ROMAN 200; ITAL 481.

Scandinavian Languages and Literature:* SCAND 232, 251, 309, 312, 330, 331, 332, 335, 365, 480, 481.

Slavic Languages and Literature:* RUSS 321, 322, 323, 324, 341, 342, 421, 423, 426, 427, 428, 429; CZECH 420; POLSH 420; SER C 420.

South Asia: SISSA 210.

Speech Communication: SPCH 102, 140, 220, 305, 334.

Part B: Fine Arts

American Indian Studies: AIS 110, 170.

Anthropology: ANTH 333, 334, 335.

Architecture and Urban Planning: ARCH 150, 151, 250; L ARC 352, 361.

Art: ART 105, 109, 129.

Art History: ART H 199, 200, 201, 202, 203, 204, 205, 302, 311, 315, 316, 321, 330, 333, 334, 335, 337, 340, 341, 342, 343, 350, 351, 352, 361, 371, 372, 380, 384.

Asian Languages and Literature: JAPAN 427.

Classics: CL AR 340, 341, 342, 343.

Dance: BANCE 345.

Drama: DRAMA 101, 102, 371, 372, 373, 374, 377, 378, 416, 472, 473, 476.

Humanistic-Social Studies: HSS 451.

Landscape Architecture: L ARC 352, 361.

Music: MUSIC 116, 117, 118, 120, 121, 122, 123, 124, 160, 161, 162, 316, 317, 318, 322, 331, 332, 339, 429.

Philosophy: PHIL 445.

Scandinavian Languages and Literature: SCAND 360, 484.

Social Sciences

20 credits required, including at least 5 credits from Part A and 5 from Part B.

Part A: Social Science

American Indian Studies: AIS 230, 240.

Anthropology: ANTH 100, 202, 301, 350, 353, 360.

Asian American Studies: AAS 205, 206.

Communications: CMU 202.

Economics: ECON 100, 200, 201.

Environmental Studies: ENV S 101, 205, 301.

Forest Resources: FOR M 100; FOR B 301.

Geography: GEOG 100, 200, 207, 277, 300, 342.

Humanistic-Social Studies: HSS 421.

International Studies: SIS 426.

Linguistics: LING 333.

Political Science: POL S 101, 202, 203, 204, 351, 426.

Psychology: PSYCH 101, 205, 257, 305, 306, 345, 355.

Sociology: SOC 110, 240, 271, 330, 347, 350, 364, 366.

Speech Communication: SPCH 373, 471.

Urban Planning: URB P 300.

Women Studies: WOMEN 257, 353, 364.

Part B: History, Philosophy, Civilization

African Studies: SISAF 265.

Afro-American Studies: AFRAM 200.

American Indian Studies: AIS 102.

Anthropology: ANTH 230; ARCHY 105, 205.

Architecture and Urban Planning: URB P 460, 471.

Biomedical History: BI HS 401, 403, 417, 418, 419, 422, 430, 432, 433.

Business Administration: BG&S 101.

Chicano Studies: CHSTU 102.

Classics: CLAS 320.

Communications: CMU 201, 203, 377, 479, 483.

East Asia: SISEA 101, 210, 234.

Economics: ECON 260, 306.

Geography: GEOG 202, 301, 303.

History: HST 111, 112, 113, 207, 242, 250, 307, 310, 311, 312; HSTAA 201, 202, 301, 302, 303, 421, 454; HSTAM 201, 202, 203, 336; HSTAS 201, 202, 211, 212, 213; HSTEU 275, 370, 401, 405, 406, 407, 410, 476.

Humanistic-Social Studies: HSS 310, 419, 425, 465.

International Studies: SIS 200, 201, 202; SISAF 265; SISEA 101, 210, 234; SISRE 220, 243, 324.

Near Eastern Languages and Civilization: N E 220, 350, 430.

Philosophy: PHIL 100, 101, 102, 104, 105, 106, 110, 206, 240, 267, 320, 322, 327, 330, 332, 350, 363.

Political Science: POL S 201, 311.

Religious Studies/Comparative Religion: RELIG 201, 202, 203, 210, 301, 310, 311, 313, 315, 320, 321, 322, 352, 354, 430.

Romance Languages and Literature: SPAN 231.

Russia and Eastern Europe: SISRE 220, 243, 324.

Scandinavian Languages and Literature: SCAND 100, 370.

Sociology: SOC 410.

Speech Communication: SPCH 222, 310, 329, 424.

Urban Planning: URB P 460, 471.

Women Studies: WOMEN 200, 206, 283.

Natural Sciences

20 credits required, including at least one approved sequence.

Anthropology: PHY A 201, 382, 387.
Astronomy: ASTR 101, 102, 110, 150, 201, 301.
Atmospheric Sciences: ATM S 101, 301, 321.
Biology: BIOL 100, 101-102, 103, 104, 210, 211, 212, 454.
Biomedical History: BI HS 421.
Botany: BOT 110, 113, 310, 320, 371, 372.
Chemistry: CHEM 100, 101, 102, 140, 145, 150, 151, 155, 157, 160, 164, 167, 231, 232, 235, 236, 241, 242, 335, 336, 337, 346, 347.
Civil Engineering: CEWA 450.
Computer Science: C SCI 210.
Engineering: ENGR 190.
Environmental Studies: ENV S 204.
Fisheries: FISH 101.
Food Science: FD SC 300.
Forest Resources: FOR B 300, 350.
Genetics: GENET 351, 451, 453, 455.
Geography: GEOG 205.
Geological Sciences: GEOL 101, 205, 308.
Mathematics: MATH 106, 124, 125, 126, 134, 135, 136, 156, 157, 170, 171.
Microbiology: MICRO 101, 301, 302.
Nutrition: NUTR 421.
Oceanography: OCEAN 101, 102, 203.
Philosophy: PHIL 120, 160.
Physics: PHYS 101-102, 103, 110, 111, 112, 114, 115, 116, 117, 118, 119, 121, 122, 123, 131, 132, 133, 205,† 207, 210, 211, 212, 214, 215, 216, 224, 225.
Psychology: PSYCH 102, 200, 209, 222, 357.
Speech and Hearing Sciences: SPHSC 300.
Statistics: STAT 220, 311.
Women Studies: WOMEN 357.
Zoology: ZOOL 114, 118, 208, 220, 301.

Approved Sequences

Earth Sciences

ASTR 101 or 102, and 150 or 201.
ASTR 101 or 102, and 110 and 190.
GEOL 101 or 205, and 308.
OCEAN 101 and FISH 101.
OCEAN 101 and 102.

Biological Sciences

Human Biology

BIOL 101-102 and any one of FD SC 300, GENET 451, SPHSC 300, ZOOL 118.

Plant and Animal Kingdoms

BIOL 101-102 and any one of BOT 320, FISH 101, GENET 451, MICRO 301, ZOOL 220.
BIOL 100 and any two of BOT 320, FISH 101, ZOOL 220.

Animal Behavior, Ecology

BIOL 101-102 and any one of BIOL 454, BOT 310, ENV S 204, PHY A 201, PYSCH 102, PYSCH 200, ZOOL 220.
PSYCH 102 and 200.

Botany

BOT 110 and 113.

Physical Sciences

CHEM 101 and 102.
10 credits from among CHEM 140 (or 145), 150 (or 155), 151 (or 157 and 167), 160 (or 164) 231 and 232.
PHYS 101-102.
PHYS 110 and 111.
PHYS 114 and 115 and 116.
PHYS 121 and 122 and 123.
PHYS 214 and 215 and 216.

* Language instruction courses, except those designed primarily for conversational practice, may be used for language and literature distribution credit at the second-year level and beyond. First-year language courses are eligible for distribution only if taken before Autumn Quarter 1985 and only upon completion of the third quarter. All literature courses taught in a foreign language, except independent study projects (e.g., FREN 499), may be used for language and literature credit.

† Not always eligible for distribution, because content varies. See your adviser.

Graduate Study

Students who intend to work toward advanced degrees must apply for admission to the Graduate School and must meet the general requirements outlined in the Graduate School section of this catalog, as well as the requirements established by the graduate faculty in the department or unit offering the degree program. Graduate students must satisfy the requirements for an advanced degree that are in force at the time the degree is to be awarded.

African Studies

See International Studies.

Afro-American Studies

B504 Padelford

Afro-American Studies is an interdisciplinary program that offers a variety of courses, often in cooperation with related traditional disciplines on campus, covering the numerous aspects of the Afro-American experience. The program is designed to provide students with a broad, in-depth understanding of the historical, linguistic, esthetic, social, political, and economic dimensions of Afro-American life and culture from a Black perspective. Special attention is given to theories of social change that have been offered by renowned thinkers for community development, the liberation of all oppressed peoples, and global humanism.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: 70 credits distributed as follows—20 credits in courses at the 100 and 200 levels; 15 credits in courses at the 300 and 400 levels; 5 credits in an ethnic studies program other than Afro-American Studies; 30 credits in a single department relevant to the Afro-American Studies curriculum. Students should consult the Afro-American Studies office for courses offered outside the program that are relevant to this area of study.

Faculty

Director

Wayne R. Williams

Lecturers

Black, Albert W., Jr., Ph.D., 1976, California (Berkeley); sociology.
Jones, Edward L., J.D., 1963, Gonzaga; Afro-American studies.
Williams, Wayne R.,* (Linguistics), Ph.D., 1976, Indiana; linguistics/African studies.

Course Descriptions

Courses for Undergraduates

AFRAM 105 The Sociology of Black Americans (5) *Black* Evaluates the sociocultural context of the Black person's environment and consequences of interaction with that environment. Offered jointly with SOC 105.

AFRAM 200 Proseminar in Afro-American Studies (5) AWSp *Black, Williams* Interdisciplinary survey of Afro-American Studies, presenting the unique Black perspective on the relevant disciplines in arts and sciences.

AFRAM 210 Perspectives on Black Language (3) AWSp *Williams* Aspects of the dialect spoken by the majority of Americans of African descent. History, linguistic description, and exploration of its artistic uses. Recommended: introduction to linguistics, Afro-American literature, and/or African literature.

AFRAM 220 Third World Images in Film (5) Historical and contemporary portrayals of Third World people in American and foreign full-length commercial and documentary film. Legitimation and maintenance functions of film; formation and elaboration of stereotypes; emergence of postcolonial film traditions in Latin America, Africa, and Asia. Sociology of film, images of the colonized and the colonizer, film as an emancipatory vehicle for social transformations.

AFRAM 230 Resources in Afro-American Research I (3) *Wright* Compilation of annotated subject bibliography of Afro-American Studies topics, with emphasis on secondary sources, general reference sources, and social sciences.

AFRAM 250 The Afro-American and the U.S. Supreme Court (5) Laws passed by Congress, and the Constitution as interpreted by the Supreme Court, dealing with the conditions of Afro-Americans in the United States.

AFRAM 270 The Black Orator's Workshop (5) Basic elements of oratory, studied through orations of Afro-American orators and others. Research, practice, and presentation of orations, with emphasis on structure, form, content, and delivery.

AFRAM 280 Creative Expression for African-American Children (5) AWSp *Young* New and developing theories and practices of creative expression for African-American children. Students demonstrate techniques and practices learned.

AFRAM 301 Community Practica (3-5, max. 15) Internship in various Seattle community service agencies (e.g., CAMP, Planned Parenthood). Students contribute their newly acquired skills and knowledge to the Afro-American community. Experience in working with professional community organizers. Recommended: junior or senior standing.

AFRAM 303, 304, 305 Basic Krio (5,5,5) A,W,Sp *Williams* Elementary structures of Krio with emphasis on the acquisition of basic conversational and reading skills. Prerequisites: 303 for 304; 304 for 305.

AFRAM 306, 307, 308 Basic Swahili (5,5,5) A,W,Sp *Eastman* Structure of spoken and written Swahili. Concentration on the acquisition of elemental conversational skill and an introduction to written texts of graded difficulty. Prerequisites: 306 for 307; 307 for 308.

AFRAM 310 Philosophy of West Africa (3) Bantu and Yoruba philosophical systems in the context of cultural relativism. Belief systems as an adaptive tool for solving social and environmental problems. African philosophy as an esthetic system, approached from historical and cross-cultural perspectives.

AFRAM 320 Black Women in Drama (5) *Young* Character types of Black women as represented in plays by Black women. Some Black male playwrights are juxtaposed with Black female writers for comparative analysis. Playwrights include Georgia Douglas Johnson, Angelina Grimke, Alice Childress, Lorraine Hansberry, Ira Aldridge, LeRoi Jones. Prerequisites: 200, 280 or permission of instructor.

AFRAM 330 The Social Psychology of the Black Community (5) Internal dynamics of the African American community. Sociocultural factors influencing psychological development of African Americans; social origins, institutional formation, and impact of white racism; social stratification in, and the political economy of, the African American community; structural and psychological characteristics of domination; social determinants for social transformations.

AFRAM 362 Race Relations (5) Interracial contacts and conflicts. Offered jointly with SOC 362. Prerequisite: SOC 110.

AFRAM 370 Afro-American Political Thought (5) *Black* Political ideologies and philosophies of pivotal Afro-American historical figures and the conditions under which these ideologies are developed, rejected, and transformed. How ideologies relate to solution of Afro-American political problems. Prerequisites: SOC 362, PHIL 110, or permission of instructor.

AFRAM 400 The Black Esthetic (3) The Black esthetic as distinct from the mainstream of American culture. Problems and issues of being Black in America. Focuses on the various art forms (e.g., theatre, music, and literature) from historical, social, and political perspectives.

AFRAM 401, 402, 403 Intermediate Swahili (3,3,3) A,W,Sp *Eastman* Readings from prose to traditional poetry. Emphasis on acquiring an ability to manipulate ideas in Swahili. Review of structure. Prerequisites: 308 or equivalent for 401; 401 for 402; 402 for 403.

AFRAM 406, 407, 408 Intermediate Krio (3,3,3) A,W,Sp *Williams* Advanced structures of Krio with further emphasis placed upon conversational skills and reading. Prerequisites: 305 for 406; 406 for 407; 407 for 408.

AFRAM 410 Bantu Linguistics (3) *Eastman* Development of Bantu linguistics; emphasis on comparative Bantu phonology, morphology, and syntax. Prerequisite: permission of instructor.

AFRAM 490 Research in the Black Community (1-5, max. 10) AWSp *Black, Williams, Young* Identification and investigation of the problems and needs of the Black community. Methods and alternatives of approaching these problems and needs. Students designate their areas of interest and subsequently pursue research and problem solving. Prerequisite: permission of instructor.

AFRAM 492 Special Topics in Afro-American Studies (3-5, max. 15) AWSpS Topics in which students and faculty have developed an interest as a result of work done in other classes or as a result of the need to investigate in greater depth Afro-American Studies issues. Topics vary. Prerequisite: 200 or permission of instructor.

American Indian Studies

C514 Padelford

The American Indian Studies program offers interdisciplinary courses dealing with the history, culture, language, literature, art, music, and contemporary problems of American Indians. The curriculum has two major purposes: (1) to provide general education courses to interest students in the life and culture of American Indians and their role in American history and society; (2) to offer courses that specialize in aspects of Northwest Coast Indian culture to enlarge the understanding of the native peoples and their contribution to the heritage and culture of this region. An undergraduate degree in American Indian Studies is not offered, but a General Studies degree is available to students interested in following a program in this area. Consult a General Studies adviser in B10 Padelford.

Faculty

Acting Director

Marilyn G. Bentz

Lecturers

Bentz, Marilyn G., M.S.W., 1967, Illinois; social work.

Duncan, Kate C., (Art History),† Ph.D., 1982, Washington; art history.

Hilbert, Violet G., Salish language.

Lane, Barbara S., Ph.D., 1953, Washington; anthropology.

Oliver, Marvin E., M.F.A., 1973, Washington; Northwest Coast Indian art.

Wapp, Edward, Jr., B.A., 1972, Utah State; music.

Welch, James, B.A., 1965, Montana; liberal arts, author, and poet.

Course Descriptions

Courses for Undergraduates

AIS 102 Survey of American Indian Studies (5) ASp *Bentz* Origins, history, cultures, and contemporary life of American Indians; special focus on Northwest Coast; taught by interdepartmental team.

AIS 110 American Indian Song and Dance Traditions (3) A *Wapp* Vocal technique, instrumental accompaniment, and song and dance traditions from different cultural areas of native North America.

AIS 151 Indian Art of Northwest Coast (3) Sp *Oliver* Studio course on Northwest Coast Indian/Eskimo art. Traditional and contemporary forms; principles of form, style, and techniques; values that influence Indian/Eskimo art styles. Not open for credit to students who have taken ART 101.

AIS 170 Survey of North American Indian Art (5) Sp Major Indian art traditions of North America. Precontact and early-contact-era traditions, and the evolution of Indian art forms in contemporary times. Design and techniques in Indian art.

AIS 215 Puget Sound Indian Literature in English (5) W *Hilbert* Traditional and modern stories, life and tribal histories from various Indian groups of the Puget Sound area, including Tulalip, Swinomish, Skagit, Snohomish, Duwamish, Muckleshoot.

AIS 230 Contemporary Indian Issues (3) A *Lane* Legal, socioeconomic, political, and educational status of reservation and urban Indians. Problems and controversies in social service and educational programs; tribal governments and self-determination; hunting, fishing, mineral, and water rights. Not open for credit to students who have taken GIS 313.

AIS 240 American Indian Women in Society (5) Sp *Bentz* Indian women in the social structure; historical and contemporary roles; changes in male-female relationships; problems and opportunities of contemporary women; the feminist movement and Indian rights. Not open for credit to students who have taken 475.

AIS 253 Wood Design (3, max. 9) W *Oliver* Studio course in wood sculpture utilizing Northwest Indian hand tools. Properties of woods and their uses. Not open to students who have taken 475.

AIS 311 North American Indians: Pacific Northwest (5) *Lane* Traditional societies of the Pacific Northwest from southern Alaska to northern California; significant areal features, such as rank, totemic crests, guardian spirits, the potlatch, fishing, and foraging illustrated by comparisons and by selected ethnographic sketches. Continuity between past and present. Offered jointly with ANTH 311. Prerequisite: ANTH 100 or 202 or permission of instructor.

AIS 313, 314, 315 American Indian Language: Salish (5,5,5) A,W,Sp *Hilbert* Conversation, reading, writing in Salish. Oral literature and other aspects of Salish cultures integrated into language study. Prerequisites: 313 for 314, 314 for 315.

AIS 335 Legal Problems of the American Indian (5) W Legal status of the American Indian with emphasis on the reservation; heirship, land ownership and use; mineral, water, fishing, and hunting rights; and problems related to self-determination. Not open for credit to students who have taken GIS 317.

AIS 340 Indian Children and Families (3) Sp *Bentz* Psychosocial development of the Indian child and family. Historical changes in family structure; value orientations; and social adaptations to a bicultural environment.

AIS 350 Two-Dimensional Art of the Northwest Coast Indians (3, max. 9) Sp *Oliver* Studio course emphasizing principles of structure and style of two-dimensional art on the Northwest Coast; analysis of traditional pieces (painted storage boxes and chests, house panels, ceremonial screens, etc.).

AIS 377 Contemporary American Indian Literature (5) *Welch* Creative writings—novels, short stories, poems—of contemporary Indian authors; the traditions out of which these works evolved. Differences between Indian writers and writers of the dominant European/American mainstream. Offered jointly with ENGL 377.

AIS 450 American Indian Song and Dance Tradition: Performance (3) W *Wapp* Performance of various American Indian social dances, songs, and games. In-depth study of various American Indian vocal styles.

AIS 475 Special Topics in Indian Studies (1-5, max. 15) AWSpS Current research and readings in American Indian Studies content areas.

AIS 499 Independent Study (1-5, max. 15) AWSpS Readings and/or research under faculty supervision.

Anthropology

M32 Denny

Anthropology is the study of the physical, cultural, and social development; comparative biology; and variation in the customs and beliefs of human beings. The primary fields within the discipline include archaeology, physical anthropology, and sociocultural anthropology, with anthropological linguistics being included in the latter. All of these fields are represented in the department's curriculum and in the faculty's research.

Undergraduate Program

Major Requirements: PHY A 201, ANTH 202, 203, ARCHY 205, and one of the following: ANTH 445, ARCHY 496, STAT 220, STAT 301, STAT 311, plus 30 additional credits in anthropology selected from both upper- and lower-division courses, but excluding ANTH 100 and ARCHY 105, which may not be counted toward the major. At least 25 credits in the major must be with the grade of 3.0 or above. Courses in which 1.6 or less is received may not be counted toward the 55 required credits. Students who plan graduate work should elect one foreign language and ANTH 460. Transfer students are required to complete a minimum of 15 upper-division credits in anthropology at the University.

Graduate Program

Charles F. Keyes, Graduate Program Coordinator

The department recognizes three principal subfields of anthropology within its faculty, programs, and curriculum: archaeology, physical anthropology, and sociocultural anthropology (including anthropological linguistics). The department offers three distinct Ph.D. programs within the subdisciplines and a special M.A. program in museology. The M.A. degree may be earned within the Ph.D. programs as a thesis or nonthesis degree. Graduate students are admitted to, and specialize in, their chosen subfields from the beginning of their graduate studies.

Admission Requirements

Applicants are admitted to begin study only during an Autumn Quarter and are advised to have their credentials completed by the beginning of the prior February. A complete application file includes the Graduate School Application, two official transcripts, the Supplementary Information Form, three recommendations, and scores from the Graduate Record Examination (GRE). Students applying from outside of North America are not required to take the GRE for admission, but it is recommended that they take the GRE if possible. Foreign students (except for those from English-speaking countries) are required to take the TOEFL exam.

Program Requirements

For each of the respective graduate programs, completion of the core requirements and a reading knowledge of one foreign language are required. The M.A. degree may be earned with completion of a thesis or with a nonthesis program. The student elects the subfield and the particular problems or areas within it to be emphasized. Under the guidance of a supervisory committee selected from this subfield, the student shapes an individual program. The major areas emphasized in the faculty and curriculum are: aboriginal North America, Middle East, Africa, South Asia, China, Southeast Asia, New Guinea, and Micronesia. The M.A. programs usually require two years of graduate study; the Ph.D. programs usually require three years beyond the master's level, including a year of independent field research and a year to organize field materials and write a doctoral dissertation.

Financial Aid

A variable, but limited, number of teaching and research assistantships and hourly positions are offered primarily to advanced students. Modest travel grants are available for summer fieldwork under faculty grants and department-supported fellowships. Some students may be qualified for a few National Resource Fellowships for Language Studies. The Ronald J. Olson Fellowship provides one year of support for entering students with interests in North America.

Correspondence and Information

Graduate Program Coordinator
M32 Denny, DH-05

Faculty

Chairperson

Robert C. Dunnell

Professors

Dunnell, Robert C.,* Ph.D., 1967, Yale; archaeology, method and theory, eastern United States.

Eastman, Carol M.,* Ph.D., 1967, Wisconsin; language and culture, anthropological linguistics, Bantu languages and literature (especially Swahili), Northwest coast languages (especially Haida).

Grayson, Donald K.,* Ph.D., 1973, Oregon; archaeology, faunal analysis, North America (especially western United States).

Holm, Bill,‡ M.F.A., 1951, Washington; Northwest coast Indians.

Hunn, Eugene S.,* Ph.D., 1973, California (Berkeley); folk science (cultural ecology), formal methods, human ecology, human nature and culture, Northwest American Plateau, Mesoamerica.

Keyes, Charles F.,* Ph.D., 1967, Cornell; culture and meaning, religion, peasant society, ethnic group relations; mainland Southeast Asia.

Krieger, Alex D. (Emeritus), D.Sc., 1955, Universidad Nacional de Mexico; anthropology.

Nason, James D.,* Ph.D. 1970, Washington; culture contact and culture change, social organization and political development, museology, Micronesia, Polynesia, North American Indians.

Newell, Laura L.* Ph.D., 1967, Washington; physical anthropology, population studies, primate growth.

Newman, Marshall T. (Emeritus), Ph.D., 1941, Harvard; anthropology.

Nute, Peter E.,* Ph.D., 1969, Duke; molecular genetics and evolution.

Osborne, Oliver H.,‡ Ph.D., 1968, Michigan; cross-cultural health care.

Ottenberg, Simon,* (Political Science), Ph.D., 1957, Northwestern; ethnicity, political organization, esthetics, Africa.

Quimby, George I. (Emeritus), M.A., 1937, Michigan; museology, culture history, North America.

Read, Kenneth E. (Emeritus), Ph.D., 1948, London; social structure and organization, Oceania.

Schiffman, Harold F.,*‡ (Asian Languages and Literature), Ph.D., 1969, Chicago; Tamil language and linguistics.

Swindler, Daris R.,* Ph.D., 1959, Pennsylvania; physical anthropology, comparative primate anatomy, dental anthropology.

van den Berghe, Pierre,*‡ (Sociology), Ph.D., 1960, Harvard; comparative sociology, stratification.

Watson, James B.,* Ph.D., 1948, Chicago; cultural ecology, sociocultural change, primitive and peasant economic systems, Melanesia (especially New Guinea).

Winans, Edgar V.,* Ph.D., 1959, California (Los Angeles); social structure, political and legal systems, social change, Africa.

Associate Professors

Atkins, John R.,* M.A., 1954, Pennsylvania; data analysis, mathematical anthropology, cross-cultural studies, metalanguages for kinship description.

Chrisman, Noel J.,*‡ Community Health-Care Systems), Ph.D., 1966, California (Berkeley); community health-care systems.

Cooke, Joseph R.,*‡ (Asian Languages and Literature), Ph.D., 1965, California (Berkeley); Thai language and literature.

Dumont, Jean-Paul,* Ph.D., 1972, Pittsburgh; cultural and social anthropology, symbolism, structuralism, South America, France.

Eck, Gerald G.,* Ph.D., 1977, California (Berkeley); physical anthropology, paleontology, primatology, methodology, computer data analysis.

Greengo, Robert E.,* Ph.D., 1957, Harvard; archaeology, culture and natural environment, development of civilizations, methodology, Latin America, northwestern America, south central United States.

Harrell, C. Stevan,* (International Studies),† Ph.D., 1974, Stanford; family, social organization, social and economic change, peasant societies, religion, China.

Horn, Beverly M.,*‡ (Community Health-Care Systems), Ph.D., 1975, Washington; crossscultural nursing, adolescent pregnancy crossculturally; United States.

Jacobs, Sue-Ellen,*‡ Ph.D., 1970, Columbia; women studies.

Kirch, Patrick V., Ph.D., 1975, Yale; Director, Burke Memorial Washington State Museum; archaeology, ecological approaches, Oceana.

Neuman, Daniel M.,*‡ (Music), Ph.D., 1974, Illinois, ethnology, ethnomusicology; India.

Spain, David H.,* Ph.D., 1969, Northwestern; psychological anthropology, cross-cultural studies, modernization, research methods, Africa.

Wenke, Robert J.,* Ph.D., 1975, Michigan; archaeology, quantitative analysis, Near East, Mesoamerica.

Assistant Professors

Daniel, E. Valentine,* Ph.D., 1979, Chicago; cultural anthropology and religion, South Asia.

Hurlich, Marshall G.,* Ph.D., 1976, State University of New York (Buffalo); physical anthropology, adaptive human biology, human ecology, subarctic (Canada), Micronesia.

Miller, Marc L.,*‡ (Institute for Marine Sciences), Ph.D., 1974, California (Irvine); maritime and cognitive anthrology.

Muecke, Marjorie A.,*‡ (Community Health-Care Systems), Ph.D., 1975, Washington; medical anthropology, urban and minority group populations; Southeast Asia.

Rhodes, Lorna Amarasingham, Ph.D., 1973, Cornell; cultural and medical anthropology, religion; South Asia.

Smith, Eric A.,* Ph.D., 1980, Cornell; ecological anthropology, evolutionary and ecological models of social behavior, hunter-gatherer societies, Inuit, Canadian arctic.

Stein, Julie K.,* Ph.D., 1980, Minnesota; geoarchaeology, New World.

Course Descriptions

Courses for Undergraduates

General

ANTH 100 Introduction to Anthropology (5) AWSp Introduction to the subfields of archaeology, physical anthropology, and sociocultural anthropology through the examination of selected problems in human physical, cultural, and social evolution. Not recommended for students who have had other courses in anthropology, archaeology, or physical anthropology. May not be counted toward the 55 credits required for the major in anthropology.

Sociocultural Anthropology

ANTH 202 Principles of Sociocultural Anthropology (5) Comparison of lifeways of various non-Western and Western peoples. Introduction to basic theories and methods used in the field.

ANTH 203 Introduction to Linguistic Anthropology (5) A *Eastman* Linguistic approaches, methods, and theories used within anthropology. Descriptive and structural linguistics, comparative method, language change, ethnoscience, language and culture, sociolinguistics, language and culture classification, animal communication, study of social dialects (e.g., language and sex, class, geographical area).

ANTH 213 Peoples of Africa (5) *Ottenberg, Spain, Winans* Survey of the many cultures of pre- and post-colonial sub-Saharan Africa. Appreciation of the adaptability, strength, and creativity of African peoples.

ANTH 218 Oceania (3) Contemporary and traditional life in the Pacific Basin.

ANTH 230 Comparative Tribal Religion (5) World's "folk" or "little traditions" of religious belief and practice. Cosmologies, eschatologies, notions of causality and of human nature. "Little traditions" as examples of man's imaginative attempts to create a relatively closed, knowable, and more-or-less manageable cosmos.

ANTH 235 Southeast Asian Civilization: Buddhist and Vietnamese (5) *Keyes* Civilizations of Theravada Buddhist societies in Burma, Thailand, Cambodia, and Laos, and Vietnamese societies of Southeast Asia. Culture of tribal peoples who live on peripheries of these societies. Cultural transformations consequent upon the war in Indochina and resettlement of Indochinese refugees in United States. Offered jointly with SISEA 235.

ANTH 301 Human Nature and Culture (3) Comparison of various anthropological perspectives on the sources of variation in customs, values, and beliefs of human groups, including non-Western peoples and contemporary Americans.

ANTH 302 Plants, Animals, and People (3) *Hunn* Emphasis on the knowledge of, and attitudes toward, plants and animals of non-Western peoples. Role of resource species as food and medicine and in tool manufacture, myth, and ritual. Hunters and gatherers, fishermen, pastoralists, and agriculturalists studied in comparison with contemporary Western societies.

ANTH 305 Anthropology of the Body (5) *Atkins* Biosociocultural approach to the human body as universal object—and agency—for human minds. How cross-cultural contrasts in ways of construing the body affect self-regard and social interaction. Body shapes, sizes, colors, exudia, signals, symbolism, esthetics, metaphysics, rituals, lore, and politics.

ANTH 310 Native North American Societies (5) W *Smith* Traditional cultures of America north of Mexico, emphasizing diversity of North American Indian and Eskimo societies. Origins of Native Americans' culture areas and language groupings; subsistence systems; levels of social organization; European conquest and colonialism; and description of representative cultures from the ten culture areas. Recommended: 100 or 202.

ANTH 311 North American Indians: Pacific Northwest (5) Traditional societies of the Pacific Northwest from southern Alaska to northern California; significant areal features such as rank, totemic crests, guardian spirits, the potlatch, fishing, and foraging illustrated by comparisons and by selected ethnographic sketches; continuity between past and present. Offered jointly with AIS 311. Prerequisite: 100 or 202 or permission of instructor.

ANTH 316 South Asia (3) *Daniel* Major cultural features of the Indian and Pakistan subcontinent.

ANTH 317 Southeast Asia (3) *Dumont, Keyes* Cultures of Southeast Asian societies: Burma, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, and the Philippines. Emphasis on ethnographic cases. Prerequisite: permission of instructor.

ANTH 318 Peoples and Cultures of the Islamic Middle East (3) Survey of cultures and peoples of Islamic Middle East and North Africa. First half of the course emphasizes the integration of peasant, urban, and nomadic societies in the traditional culture and economy; the second half concentrates on the transformation of the traditional life styles through the process of westernization and modernization.

ANTH 321 Introduction to the Anthropological Study of Religion (3) Comparative study of religion as approached by anthropologists. Primarily for nonanthropology majors. RELIG 201 or 202 recommended.

ANTH 322 Peoples of South America (3) *Dumont* Contemporary societies of South America: economic, political, ethnic, and cultural characteristics; historical background. Prerequisite: permission of instructor.

ANTH 333 Art of the Northwest Coast Indian (3) A *Holm* Emphasis on the structure and style of two-dimensional art of the northern tribes. Offered jointly with ART H 333.

ANTH 334 Art of the Northwest Coast Indian (3) W *Holm* Three-dimensional art of the Northwest coast cultural area with emphasis on esthetic principles, techniques, and cultural functions. Offered jointly with ART H 334.

ANTH 335 Art of the Northwest Coast Indian (3) Sp *Holm* Northwest coast Indian art as related to drama and dance with special attention to the Kwakiutl Indians. Offered jointly with ART H 335.

ANTH 350 Ecological Anthropology: Civilized and Primitive (3) *Spain, Watson* Evolution of culture and society with emphasis on ecology. Development of urban life in light of common and distinctive character of cities, peasantries, and tribal groups or bands. Process of urbanization, disappearance of truly primitive peoples, emergence of peasant, rise of a world system. Selected case studies, past and present.

ANTH 352 Buddhism and Society: The Theravada Buddhist Tradition in South and Southeast Asia (5) *Keyes* Introduction to the religious tradition of Theravada Buddhism (as practiced in Sri Lanka, Burma, Thailand, Laos, and Cambodia) and examination of the variations in ethical orientations developed through Theravada Buddhist ideas. Offered jointly with RELIG 350. Recommended: RELIG 202 or knowledge of one Eastern religious tradition.

ANTH 353 Anthropological Studies of Women (5) *Jacobs* Cross-cultural and comparative survey of the varieties of women's cultural experiences, statuses, and roles in cultural context and the anthropological theories used to account for them. Topics include biological factors, studies of primates, woman the gatherer, work in preindustrial and industrial societies, women in folklore and music, matriarchy and matrilineal kinship, childbirth, and women's roles in economic development. Offered jointly with WOMEN 353. Prerequisites: 202 and WOMEN 200, or permission of instructor.

ANTH 354 The Comparative Study of Societies (3) *van den Berghe* Compares entire societies at various levels of technological complexity to explore problems of their development and structural organization. Examines both historical and contemporary, and Western and non-Western societies. Offered jointly with SOC 354. Prerequisite: 202 or SOC 110.

ANTH 355 Aging in Cross-Cultural Perspective (3) Survey of strategies for dealing with the fact of aging in various sociocultural systems. Relates the varieties of cultural solutions to the theories on aging, drawn from psychology and medicine, with emphasis on non-Western societies. Prerequisite: 202 or permission of instructor.

ANTH 356 Visual Anthropology (3) The place of photography and films in ethnography; their use in the documentation and interpretation of cultural and social systems.

ANTH 359 Theory and Method in Linguistic Anthropology (5) *Eastman* Language use in cultural contexts. How language reflects world view. Language use in culturally significant settings. Analyzes sets of culturally specific terms in semantic domains. Projects demonstrating application of theory and method to data addressing specific problems. Workshop format.

ANTH 360 Ecological Anthropology: Introduction to Cultural Ecology (5) Survey of anthropological research on interaction between human societies and their environments. Logic of different subsistence systems; intensification and transformation of subsistence strategies; population regulation; ecological aspects of human nutrition, disease, spatial organization, ethnicity, social stratification, conflict, and cooperation; historical roots of current ecological crisis. Prerequisite: permission of instructor.

ANTH 371 Political Anthropology (3) *Ottenberg, Winans* Theories of the development of political forms and of the social structural analysis of political organization. Authority, power, and concepts of politics and administration. Prerequisite: 202.

ANTH 372 Anthropology of Law (3) *Ottenberg, Winans* Major theories and studies in legal anthropology. Dispute settlement, juridical processes, and concepts of law and legal activities. Prerequisite: 202.

ANTH 401 West African Societies (3) *Ottenberg, Spain* Social and cultural features of coastal and interior West African societies, including the Western Sudan. Detailed study of selected societies. Prerequisite: 202 or permission of instructor.

ANTH 402 Societies of Eastern and Southern Africa (3) *Winans* Historical background and contemporary life of cultural groups in eastern and southern Africa with special study of selected cases of political and economic organization and cultural change. Prerequisite: 202 or permission of instructor.

ANTH 403 Traditional Chinese Society (5) *Harrell* Late traditional (Ming-Qing) China as a social system. Systematic analysis of temporal and spatial variation in family, kinship, local organization, social class, government, and antigovernment activity. Offered jointly with SISEA 443. Prerequisite: 202, HSTAS 454, graduate standing, or permission of instructor.

ANTH 408 New Guinea Societies (5) *Watson* Peoples and cultures of coastal and interior New Guinea and adjacent islands. Deals intensively with selected general problems of ethnographic method and ethnological and sociological interpretation. Character of small autonomous societies in Melanesia: ecology, economics, gender, systems of exchange, social organization, magic and ritual, warfare. Prerequisite: 202 or permission of instructor.

ANTH 409 Micronesian Societies (3) *Nason* Comparative social anthropology of the social systems of high islands and coral atolls of Micronesia. Intensive treatment of the kinship, religion, ecology, and politics in both traditional and contemporary periods. Prerequisites: 202, and either 216 or permission of instructor.

ANTH 410 Polynesian Societies (3) Comparative social anthropology of the high and low islands of Polynesia, including the Polynesian outliers in Melanesia and Micronesia. Covers history, ecology, economics, political organization, and ritual systems. Special topics include colonialism, land tenure in relation to kinship, and child adoption. Prerequisites: 202, and either 216 or permission of instructor.

ANTH 411 Australian Aboriginal Societies (3) Examination of archaeological and linguistic evidence of distribution of, and relationships among, aboriginal groups before White contact. Ethnographic comparisons of local organization and land tenure, kinship, law, and religion. Past and present use of aboriginal data in social science theory. Prerequisites: 202, and either 216 or permission of instructor.

ANTH 412 South Asian Social Structure (5) Caste dynamics, political control, economic organization, and religion in Hindu village India. Prerequisite: 202 or permission of instructor.

ANTH 418 Meso-American Society and Culture (3) *Hunn* Indian civilization of Mexico and Guatemala, their origins and ecological foundations. Contemporary communities of Mexico and Guatemala, focusing on creative adaptation of pre-Columbian traditions to modern national realities. Prerequisite: 202 or permission of instructor.

ANTH 419 Peoples and Cultures of the Iranian Plateau (3) Survey of the cultural features of the Iranian Plateau with particular attention to modern problems of cultural change. Prerequisite: permission of instructor.

ANTH 421 Belief, Ritual, and the Structure of Religion (5) Systematic survey of concepts, models, and theories that characterize the anthropological study of religion. Consideration of the human universal basis of religion and of diverse ways in which religions are constructed and related to social experience. Prerequisites: 202 or 321, or RELIG 201 and 202.

ANTH 422 Religious Systems (5) Intensive examination of selected type of religious system with reference to the anthropological approach to study of religious phenomena. Type of system chosen for study varies. Prerequisite: 421 or RELIG 380 or permission of instructor.

ANTH 424 Hunter-Gatherer Societies (3) Comparative examination of human foraging societies, emphasizing ethnographic cases and socioecological analysis. Foraging and human evolution; rationality of foraging societies; population and reproductive strategies; variability in social organization and land use; power relations between the sexes; ritual and belief; contemporary status of hunter-gatherer populations. Prerequisite: 202 or permission of instructor.

ANTH 426 Peasant Culture and Society (5) Place of peasants in state, civilization, and global economy, especially as seen from peasants' perspective. Consideration of cases drawn from anthropological studies. Prerequisite: 202 or permission of instructor.

ANTH 427 Anthropology in Urban Settings (3) Sp *Chrisman* Cross-cultural examination of theoretical issues in anthropology as studied in urban places. Focuses on ethnic identity and the formation of urban ethnic groups; migration and its rural and urban consequences; family and kinship organization as an adaptation to urban complexity; the nature of urban voluntary associations; law and politics; and the developments in anthropological method. Prerequisite: 202 or permission of instructor.

ANTH 428 Anthropological Perspectives on Ethnicity (3) *Keyes, Ottenberg* Anthropological approaches to ethnicity and ethnic group relations, with reference to other models including race, caste, class, regional groupings, nations, religion, and stratification. Data drawn from precolonial, colonial, and postcolonial periods. Prerequisite: 202 or permission of instructor.

ANTH 429 Expressive Culture (5) *Ottenberg* Anthropological view of one expressive aspect of culture: plastic-graphic arts, myth and folktale, music, dance, humor and tragedy, or play and games. Prerequisite: 202 or permission of instructor.

ANTH 431 Oral Traditions (3) *Dumont, Smith* Oral traditions and verbal expression, examined anthropologically and in relation to student interests. Critical examination of relevant theories and methods of analysis. Prerequisite: 100 or 202.

ANTH 433 Culture and Homosexuality: U.S.A. (3) *Read* Descriptive and analytical treatment of homosexuality and culture. Cultural bases for the stigma of homosexuality; heterosexual fores of the "masculine" and "feminine"; cultural definitions of intra- and inter-sexual roles and their relationship to the homosexual stigma. Homosexuality and cultural alienation. Homosexual modes of communicating and expressing the stigmatized preference; institutionalized settings. Symbolism of homosexual ritualized behaviors. Prerequisite: 202 or permission of instructor.

ANTH 434 Comparative Morals and Value Systems (3) Moral basis of human society and comparison of value systems based on anthropological studies. Prerequisite: 202 or permission of instructor.

ANTH 435 Economic Anthropology (5) *Watson* Chief features of nonmonetary and simple monetary economics. Impact of central or metropolitan market economy and industrial technology as peripheral systems, especially of small-scale and limited monetary circulation. Development and application in anthropology of economic concepts, including Marxian. Prerequisites: 202 or permission of instructor.

ANTH 436 Comparative Family Organization (5) *Harrell* Function and structure of family developmental processes in band, tribal, peasant, and modern societies. Illustrates inter- and intro-societal variation and provides data for construction of formal models of process and variation in family systems. Prerequisite: 202.

ANTH 437 Political Anthropology and Social Change (5) *Ottenberg, Winans* Anthropological studies of local-level politics in colonial, modernizing, and encapsulated societies. Processual approaches to the study of political change. Prerequisites: 202, 371, or permission of instructor.

ANTH 438 The Analysis of Kinship Systems (5) Data, theories, and analytical technique used in the study of kinship systems, including our own, from around the world. Prerequisite: 202 or permission of instructor.

ANTH 439 Law in Changing Societies (5) Anthropological viewpoints on legal aspects of colonial, modernizing, and encapsulated societies. Problems of plural legal systems and of conflicts in judicial systems. Prerequisites: 202, 372, or permission of instructor.

ANTH 440 Child-Rearing, Culture, and Health (3) Cross cultural study of the child-rearing practices, cultural norms, and health behavior of children and adolescents in different societies. Comparative approaches, diverse theoretical postures, and empirical research findings are used. Offered jointly with CHCS 495. Recommended: courses in child development or introductory anthropology.

ANTH 441 Introduction to Culture and Personality (5) *Spain* Assessment of mutual relevance of cultural and psychological variables in anthropology. Historical development of principal topics (e.g., cognition, national character, enculturation, personality and social change, crosscultural psychiatry, sex and temperament, deviance, and psychoanalytic studies of culture). Prerequisite: 212 or introductory psychology or personality theory or permission of instructor.

ANTH 442 Anthropological Aspects of Communication (5) *Daniel* Introduction to communicational aspects of culture. Prerequisite: 202.

ANTH 444 Contemporary Chinese Society (5) *Harrell* Analysis of society in the People's Republic of China as a product of traditional Chinese society and the changes wrought upon it by the impact of the West and by the revolutionary policies and practices of the Chinese Communist Party. Offered jointly with SISEA 444. Prerequisite: 403 or SISEA 443 or another acceptable course on Chinese society, or permission of instructor.

ANTH 445 Quantitative Methods in Anthropology (5) Basic statistical techniques useful for anthropologists. Elementary computer processing of anthropological data. Intended for students of anthropology. Prerequisites: 202, ARCHY 205 or PHY A 201 and STAT 301 or 311 or permission of instructor.

ANTH 446 Structural Anthropology (3) *Dumont* Contributions of Levi-Strauss and others to anthropology, with concentration on the holistic analysis of culture through myth, ritual, society, and cosmology. Prerequisite: 202 or permission of instructor.

ANTH 447 Religion in China (5) Sp *Harrell* Place of religion in Chinese society, examining the doctrines, practices, and social consequences of the eclectic folk religion, the elite Confucian, Taoist, and Buddhist traditions, syncretistic sects, and imported Christianity. Offered jointly with SISEA 445. Prerequisite: one course in Chinese society, politics, or history, or permission of instructor.

ANTH 451, 452, 453 Phonology (3,3,3) A,W,Sp *Brame, Contreras, Kaisse* Speech sounds, mechanism of their production, and structuring of sounds in languages; generative view of phonology. Offered jointly with LING 451, 452, 453. Prerequisite: LING 200 or 400, either of which may be taken concurrently, or permission of instructor.

ANTH 454 Women, Words, Music, and Change (5) Sp *Jacobs* Comparative analysis of use of myths, tales, music, and other forms of expressive culture to account for, reinforce, and change women's status and roles; cross-cultural analysis of planned change and development. Offered jointly with WOMEN 454. Prerequisite: 353 or permission of instructor.

ANTH 455 Areal Linguistics (3, max. 6) *Eastman* Issues involved in classification of languages. Systems of classification based on structure, word order, areal features. Ways in which languages may be classified for different purposes. Borrowing vocabulary specialization, lexical change, language death and revival. Offered jointly with LING 455.

ANTH 458 Cross-Cultural Perspectives on Textiles and Costumes (3) *Ryesky* Technological, economic, social, ideological, esthetic, and communicative aspects of textiles and costume of non-Western societies, analyzed from perspectives derived from anthropology and other social sciences. Modifications in the design and use of textile products due to the impact of industrial society. Prerequisites: 10 credits in anthropology or sociology.

ANTH 460 History of Anthropology (5) *Keyes, Ottenberg* Sources and development of leading concepts, issues, and approaches in anthropology. Findings of anthropology in relation to scientific and humanistic implications and to practical application. Main contributors to field; their work and influence. Past, present, and future perspectives, including anthropology of modern life. Prerequisites: 202 and 15 additional credits in anthropology.

ANTH 461, 462, 463 Syntax (3,3,3) *Newmeyer* Study of the structural properties of language; introduction to generative transformational syntax. Offered jointly with LING 461, 462, 463. Prerequisite: LING 200 or 400, which may be taken concurrently, or permission of instructor.

ANTH 464 Language Policy and Cultural Identity (3) *Eastman, Schiffman* Decision making regarding language in sociopolitical contexts. Language and ethnicity, educational policy, and use of language in developing nations. Plans to modernize, purify, standardize, reform, and revive language. Language loyalty and motives for second-language acquisition: Offered jointly with LING 433. Prerequisite: LING 200 or 400.

ANTH 469 Special Studies in Anthropology (3) Delineation and analysis of a specific problem or related problems in anthropology. Offered occasionally by visitors or resident faculty. May be repeated for credit by permission. Prerequisite: 202 or permission of instructor.

ANTH 470 Articulatory Phonetics (3) S Theory and practice of articulatory phonetics. Intensive drill in definition, recognition, production, and transcription of the whole range of human speech sounds.

ANTH 471 Problem Solving in Phonology (5) S Problem-solving approach to phonological analysis. Contrast, complementation, and hierarchy as basic analytical concepts for discovering significant units of phonological systems. Introduction to tone and morphophonemics. Prerequisite: 470 or equivalent, which may be taken concurrently.

ANTH 472 Problem Solving in Grammar (5) S Grammatical analysis of previously unstudied languages. Practice in solving grammatical problems, using non-Indo-European languages. Eclectic theoretical approach. Prerequisite: upper-division standing or permission of instructor.

ANTH 473 Principles of Literacy (5) S Principles of introducing literacy to preliterate societies with focus on the field worker as agent of change. Motivational factors, stimulation of indigenous authorship, orthography design, reading methodology, and alternative strategies for literacy programs. Prerequisites: 470, 471, and 472, or equivalents.

ANTH 474 Linguistic Principles of Translation (5) S Cross-language transfer procedures with emphasis on idiomatic translation and fidelity to message of original text; implicit and explicit information: semantic structure of words; lexical equivalents between languages. Prerequisites: 470, 471, 472, or equivalents.

ANTH 475 Comparative Systems of Healing (5) S Medical anthropology. Ways in which and extent to which "health" and "sickness" are culturally constituted. Epistemological, as well as pragmatic, limitations of the organism-centered, cartesian, biomedical approach to sickness, medicine, and health.

ANTH 476 Advanced Phonological Analysis (5) S Analytical and descriptive techniques of problem areas in phonology, including tone, stress, morphophonemics. Theoretical discussions augmented by problem materials drawn from numerous non-Indo-European languages. Prerequisites: 470 and 471 or equivalents.

ANTH 477 Advanced Grammatical Analysis (5) S Theory of structure of discourse, paragraph, sentence, and clause, both in reference to surface and underlying semantic structures; application of the theory to text data. Prerequisite: 472 or equivalent.

ANTH 478 Anthropological Linguistic Field Methods (5) S Field techniques for cross-cultural linguistic research. Field problem with native speaker of non-Indo-European language. Methodology for designing and implementing language learning programs in the field. Prerequisites: 470, 471, and 472, or equivalents.

ANTH 480 Introduction to Museology (3) *Nason* Museum history, philosophy, and basic operations, including organization, income, collection management, conservation, exhibition, security, education, research, and ethics. Prerequisite: upper-division standing or permission of instructor.

ANTH 481 Museum Collection Management: Ethnology (3) Lecture and work experience in museum collection management in the ethnology collections of the Burke Memorial Washington State Museum, including identification, cataloging, fumigation, storage, cleaning, inventory, and specimen preparation for exhibition of archival and nonarchival museum specimens from North America, the Pacific, and Pacific Rim areas. Prerequisite: 480 or permission of instructor.

ANTH 482 Museum Conservation (5) Lecture and laboratory work in the recognition and treatment of museum conservation problems for specimens of wood, fiber, stone, metal, and bone. Application of basic principles to specific conservation and restoration problems faced by curatorial personnel. Prerequisites: 480, 481 or permission of instructor.

ANTH 483 Women in Evolutionary Perspective (5) W Critical appraisal of major theories accounting for evolution of sex and gender roles and status differences; cross-cultural testing for sociobiological, biocultural, cultural materialist, structural, and symbolic explanations for "female power and male dominance." Offered jointly with WOMEN 453. Prerequisite: 353 or permission of instructor.

ANTH 486 Human Family Systems: Biological and Social Aspects (3) *van den Berghe* Biological bases for human mating and reproduction, and an examination of the range of cross-cultural variability in human systems of kinship and marriage: comparisons between a wide range of human and nonhuman species, and between Western and non-Western human societies; interplay of biological, ecological, and sociocultural factors in determining the structure and function of human family systems. Offered jointly with SOC 486. Prerequisite: 100 or PHY A 201 or SOC 110.

ANTH 488 Advanced Topics in Museology (3) Selected current topics in museology. Prerequisite: 480 or permission of instructor.

ANTH 489 Anthropology Practicum (3-9, max. 15) AWSpS Faculty-supervised off-campus internships in organizations utilizing anthropological skills in nonacademic settings. Establishing educationally valuable individual projects for internships with faculty sponsor. Organizations include museums, social service and other governmental agencies, and private nonprofit service agencies. Prerequisites: major in anthropology and permission of instructor.

ANTH 490 Problems in Social Structure (3, max. 6) Selected current problems in the study of social structure. Prerequisites: 202, 20 additional credits in anthropology, and permission of instructor.

ANTH 492 Anthropology of Refugees (3) W *Muecke* The refugee phenomenon, its emergence in the postcolonial world, and the structure of the life history of refugees. Ethnic change, involuntary deculturation, and acculaturation as they occur in refugee life histories. Offered jointly with CHCS 492. Prerequisite: 202 or permission of instructor.

ANTH 493 Advanced Topics in Expressive Culture (3, max. 6) Analysis and testing of special domains of esthetic expression, such as graphic arts, oral literature, dance, and humor among non-Western peoples. Prerequisites: 202, 429, or permission of instructor.

ANTH 494 Problems in the Anthropology of Law and Politics (3, max. 6) *Ottenberg, Winans* Seminar in the interrelationships of law and politics. Political aspects of procedural and substantive law. Law as a basis of political power and authority. The intertwining of political and legal processes. Prerequisites: 371 or 439 and 372 or 437, or permission of instructor.

ANTH 495 Advanced Problems in Ethnology (3, max. 6) Current problems in ethnology. Seminar format. Prerequisites: 25 credits in anthropology and permission of instructor.

ANTH 496 Problems in Psychological Anthropology (3, max. 6) Problem areas and new approaches to the study of culture and personality. Prerequisite: 441 or permission of instructor.

ANTH 497 Cognitive Anthropology (3) *Hunn* Discussion and practical experience in the collection and analysis of data. Exemplary cognitive anthropological studies are replicated as class projects. Each project provides a starting point for debating the central theoretical issues in this specialty. Prerequisites: 202 and major in anthropology, or permission of instructor.

ANTH 499 Undergraduate Research (*, max. 12; max. 18 for honors students only) Prerequisite: permission of instructor.

Archaeology

ARCHY 105 World Prehistory (5) W *Stein, Wenke* Prehistoric human ancestors from three million years ago: their spread from Africa and Asia into the Americas, survival during ice ages, development of civilizations. Well-known archaeological finds (e.g., Olduvia Gorge; Neanderthals; Jericho; Egyptian pyramids; Mexican temples; Mesa Verde; Ozette, Washington. May not be counted toward the 55 credits required for the major in anthropology.

ARCHY 205 Principles of Archaeology (5) AWSpS Techniques, methods, and goals of archaeological research. Excavation and dating of archaeological materials. General problems encountered in explaining archaeological phenomena.

ARCHY 270 Field Course in Archaeology (12) S Introduction to field acquisition of archaeological data through survey and excavation. On-going field projects; recovery and recording techniques. Prerequisite: permission of department.

ARCHY 303 Old World Prehistory (3) Old World prehistory from beginnings of human culture to rise of civilizations. First tools made by humans, spread of humans out of Africa, origins of agriculture, rise of state society. Africa, Near East, Egypt, China, India, Europe.

ARCHY 304 New World Archaeology (3) History of earliest Americans, beginning with crossing of land bridge between Asia and North America and eventual spread over the Americas. Highlights prehistory and best examples of western hemisphere's civilizations. Mexico, Yucatan, Peru, southwestern and eastern United States, Washington.

ARCHY 320 Prehistory of the Northwest Coast (5) Origin, development, and variation of Pacific Northwest cultures from early migrations to nineteenth century. Adaptation to maritime and interior environments; artifacts and art.

ARCHY 371 Analysis of Archaeological Data (3) A *Stein* Analyzing archaeological data by measuring and describing such artifacts as stone tools and ceramics. Analysis of such environmental data as bones, plant remains, and sediments. Prerequisite: 205, or permission of instructor.

ARCHY 468 Issues in Cultural Resource Management (1) Sp *Dunnell, Grayson, Nason* Review of federal and state cultural resource management policies and the effects of these policies on the conduct of projects that may impact cultural resources on public lands. Survey of related issues in museum management. Prerequisite: 205, ANTH 202, or permission of instructor.

ARCHY 469 Special Studies in Archaeology (3, max. 6) Consideration in detail of specific archaeological topics, either methodological or substantive in content, of current interest. Offered occasionally by resident, new, or visiting faculty. For advanced undergraduates and graduate students. Prerequisites: 205 and permission of instructor.

ARCHY 473 Prehistoric Cultures of Mexico (3) Development of ancient Mexican civilization from early hunter-gatherers to the Aztecs. Origins of agriculture; mysterious Olmec; development of complex societies in the Valley of Mexico, Oaxaca, and Gulf Coast. Prerequisite: 205, or 304, or permission of instructor.

ARCHY 474 Prehistoric Cultures of South America (3) Sp *Stein* Archaeological history of South American continent. Andean region: earliest evidence of humans, origin of agriculture, development of civilization. Amazon, Brazilian coast, Columbian-Ecuadorian coasts. Prerequisite: 304, or permission of instructor.

ARCHY 475 The Mayan Civilization (3) Evolution of Mayan civilization in tropical lowlands of Yucatan and Guatemala, and Guatemalan Highlands. Olmec heritage; rise of complex societies; sudden collapse of ceremonial centers and ceramics. Prerequisite: 304, or 205, or permission of instructor.

ARCHY 478 Prehistoric Cultures of North America: Western North America (3) W *Grayson* Ecological account of prehistoric cultural developments in North America west of the Rocky Mountains. Cultural and environmental change from appearance of people in New World to collapse of indigenous cultural systems. Prerequisite: 304, or permission of instructor.

ARCHY 479 Prehistoric Cultures of North America: Eastern North America (3) Sp *Dunnell* Ecological and evolutionary account of prehistoric cultural developments in North America east of the Rocky Mountains. Cultural and environmental change from appearance of people in New World to collapse of indigenous cultural systems. Prerequisite: 304, or permission of instructor.

ARCHY 480 Advanced Archaeological Analysis: Tools (6) W *Dunnell, Wenke* Combination of lecture and practical laboratory instruction in the presentation of archaeological data for analysis, emphasizing stylistic and functional analyses of lithic, ceramic, and other artifacts, attribute recognition, and standard techniques for data manipulation. Theoretical bases for techniques and their uses and limitations in cultural, historical, and processual accounts. Prerequisite: 371 or permission of instructor.

ARCHY 481 Advanced Archaeological Analysis: Biological Remains (6) A *Grayson* Seminar on techniques and methods employed in analysis of floral and faunal remains from wide range of late Pleistocene and Holocene settings, including archaeological sites, coupled with laboratory focusing on identification of faunal remains from these settings. Prerequisite: 371, or permission of instructor.

ARCHY 482 Advanced Archaeological Analysis: Geoarchaeology (6) Sp *Stein* Identification, analysis, and interpretation of sediments and soils associated with archaeological remains. Laboratories deal with sediment description and chemical analysis; field trips and student projects focus on archaeological applications of these subjects. Prerequisite: 371, or permission of instructor.

ARCHY 491 Museum Collection Management: Archaeology (3) W *Greengo* Lecture and work experience in museum collection management in the archaeology collections of the Washington State Burke Memorial Museum, including identification, cataloging, storage, cleaning, inventory, and exhibit preparation. Involves both archival and nonarchival specimens from North America, Oceania, South America, and Europe. Prerequisite: 480 or permission of instructor.

ARCHY 496 Quantitative Archaeological Analytic Techniques (3) A *Wenke* Introduction to quantitative approaches to archaeological problems; data screening, numeric methods of classification and identification, graphical and computer-based seriation techniques, and the analysis of spatial patterning in artifact distributions. Prerequisites: 205, an introductory descriptive statistics course, and permission of instructor.

ARCHY 497 Archaeological Method and Theory I: Formal Theory (5) A *Dunnell* Examination of theoretical constructs in the analysis of archaeological data. Terminology, typologies, and interregional comparisons. Prerequisites: 205, 20 additional credits in anthropology, and permission of instructor.

ARCHY 498 Archaeological Method and Theory II: Explanatory Theory (5) W *Dunnell* Conceptual frameworks employed by archaeologists in obtaining explanation in the three major areas of culture history, cultural reconstruction, and explanatory prehistory, considering the nature of explanation as conceived in these areas, the basic assumptions employed in achieving these aims, and an introduction to the methods employed. Prerequisites: 205 and 497.

ARCHY 499 Undergraduate Research (*, max. 12; max. 18 for honors students only) Prerequisite: permission of instructor.

Physical Anthropology

PHY A 201 Principles of Physical Anthropology (5) AWSpS Evolution and adaptation of the human species. Evidence from fossil record and living populations of monkeys, apes, and humans. Interrelationships between human physical and cultural variation and environment; role of natural selection in shaping our evolutionary past, present, and future.

PHY A 370 Introduction to Primates (4) *Eck, Newell, Swindler* Origins, major evolutionary trends, and modern taxonomic relationships of the nonhuman primates. Their distribution and habitat in relation to behavioral and morphological adaptations and their status as endangered species. Prerequisite: 201.

PHY A 371 Evolutionary Perspectives on the Human Condition (4) *Newell* The human species—past, present, and future. Biological uniqueness of the human species; its role in biological and cultural extinctions. Conceptions and misconceptions of species behavior. Evidence for ongoing human evolution evaluated in relation to present population redistribution and reorganization.

PHY A 375 Biology of Human Race (3) Sp *Hurlich* Worldwide distribution of variation in human biology: shape, size, skin color, body composition, human performance. Natural selection, historical factors, random biological events. History of attempts to classify people into racial groups and problems associated with such efforts. Prerequisite: 201 or permission of instructor.

PHY A 382 Human Population Biology (3) A *Nute* Human population biology with reference to capacity for growth in population size. Interaction of human biology, population structure, and culture in promoting such growth. Effects of economic, demographic, medical, and ecological factors.

PHY A 387 Ecological Anthropology: Ecological and Biological Adaptation in Human Populations (5) A *Hurlich* Biological adaptability derived from our history as hunter/gatherers. Biological consequences of our past examined by studying how living populations respond to environmental stress. Relationships between biological and behavioral responses. Application of theoretical models derived from evolutionary and ecological approaches. Prerequisite: 201, or permission of instructor.

PHY A 388 Human Fossils and Evolution (3) W *Eck* Evolution of human anatomy and behavior. Human fossils: their geological context, age, ecological setting. Use of this information to reconstruct early human history. Changes in anatomical and behavioral characteristics as adaptations to environment. Prerequisite: 201, or BIOL 210, 211, 212.

PHY A 390 Ecological Impact of Cities on People (3) *Hurlich* Effects of urban stresses upon the biobehavioral characteristics of city people in both developed and underdeveloped countries: pollution, poor nutrition, disease, social breakdown, maladaptive lifestyles, anonymity, and overstimulation. The multifactorial nature of these stresses is emphasized, as well as the mechanisms behind the responses to them. Prerequisite: 201.

PHY A 469 Special Topics in Physical Anthropology (3, max. 6) *Eck, Hurlich, Newell, Nute, Swindler* Delineation and analysis of a specific problem or a more general area in physical anthropology. Offered occasionally by visitors or resident faculty. Prerequisite: permission of instructor.

PHY A 473 Biological Adaptability of Human Populations (5) W *Hurlich* Mechanisms enabling humans to maintain homeostasis in extreme environments: high altitude, heat, cold, nutritional deficiency, radiation. Adaptive process operating at levels of physiology, metabolism, and population, including the strategies of fertility and birth spacing. Prerequisites: 201 and physiology, or permission of instructor.

PHY A 478 Dental Anthropology (5) *Swindler* Intensive survey of the dentitions of primates from tree shrews to man. Emphasis placed on the range of metric and morphologic variability existing in the teeth of these animals, both in fossil and living groups. Environmental and genetic factors are considered within this ontogenetic and phylogenetic framework. Prerequisite: 201.

PHY A 480-481 Primate Anatomy: Structure and Function (5-5) W,Sp *Swindler* Anatomy of various primates studied in detail with special reference to structural and functional relationships. The evolution and present ecology of primates as they relate to the total anatomical picture. The laboratory consists of dissection of a specified primate and a study of the dentition and osteology. Prerequisite: 201 or permission of instructor.

PHY A 482 Human Population Genetics (5) Sp *Nute* Micro-evolutionary changes in human populations. Effects of mutation, selection, inbreeding, gene flow, and genetic drift as causes of evolutionary change. Mathematics beyond high school not required. Prerequisite: 201, or permission of instructor.

PHY A 484 Human Life Cycle (3) Sp *Newell* Human growth and physical/social development: fetal life to old age. Cultural, ecological, and evolutionary aspects of the life cycle—population differences in age and sex related to morbidity and mortality. Prerequisite: 201, or permission of instructor.

PHY A 485 Research in Growth and Development (2, max. 8) *Newell* Discussion and research on topic relating to primate growth and development, using either published materials or data from on-going studies at this university. Prerequisites: permission of instructor and 484, which may be taken concurrently.

PHY A 486 Primate Socioecology (3) Focus on the variety of social systems exhibited by nonhuman primates and adaptive significance of these societies; social systems in terms of the present ecology and evolutionary past of the species; the function of communicatory gestures and vocalizations, tradition, kinship, and social roles in maintaining and structuring groups over generations; the relationship among mating systems, foraging strategies, ranging patterns, and ecological separation/resource partitioning and their contribution to species-typical social organization. Prerequisite: 201.

PHY A 487 Human and Comparative Osteology (3) *Swindler* Introduction to the vertebrate skeleton. The skeleton is described in detail, and various methods of determining age and sex are presented, as well as osteometry and modern statistical methods for handling such data. Prerequisite: permission of instructor.

PHY A 488 Primate Evolution (5) *Eck* Major trends in nonhominid primate evolution through the Cenozoic. Discussion of the specimens, geological context, and age of the fossil taxa and their relationship to modern taxa. Practical experience in analyzing fossil material. Prerequisite: 201 or permission of instructor.

PHY A 489 Early Evolution of the Hominidae (5) A *Eck* Data and interpretations basic to the Pliocene and early Pleistocene evolution of the family *Hominidae*. Presentation of the geological contexts, ages, faunal associations, fossil and cultural remains of the hominid lineages. Practical experience with the hominid fossil material, and explanation of the morphological and contextual similarities and differences. Prerequisite: 201 or permission of instructor.

PHY A 490 Later Evolution of the Hominidae (3) W *Eck* Data and interpretations basic to the middle and late Pleistocene evolution of the family *Hominidae*. Presentation of the geological contexts, ages, faunal associations, fossil and cultural remains of the hominid images. Practical experience with the hominid fossil material and explanation of the morphological and contextual similarities and differences. Prerequisite: 201 or permission of instructor.

PHY A 499 Undergraduate Research (*, max. 12; max. 18 for honors students only) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

General

ANTH 600 Independent Study or Research (*) AWSp

ANTH 700 Master's Thesis (*) Offered on credit/no credit basis only.

ANTH 800 Doctoral Dissertation (*) Offered on credit/no credit basis only.

Sociocultural Anthropology

ANTH 500 Preceptorial Reading (6) For beginning graduate students who have not had adequate training in the problems, principles, and methods involved in the analysis and comparison of social and cultural systems. Not open to graduate students in the sociocultural anthropology program.

ANTH 503 Preceptorial Reading in Linguistic Anthropology (6) For beginning graduate students who have not had prior training in the problems, principles, and methods involved in linguistic anthropology. See also course description for 203. Not open to graduate students in the linguistics program.

ANTH 507-508-509 Methods of Sociocultural Research (5-5-5) Core-course sequence intended for first-year graduate students in sociocultural anthropology. Survey of major issues, alternative strategies, and selected special topics in the design of anthropological research and the collection, processing, and analysis of anthropological data. Prerequisite: graduate standing in anthropology or permission of instructor.

ANTH 510 Seminar on North American Indians (3) Advanced comparative treatment of selected aspects of the Indian cultures and societies of North America.

ANTH 514 Regional Seminar (3, max. 12) Comparative treatment of selected aspects of cultures and societies of a particular region or area.

ANTH 517 Seminar on South Asia (3) Advanced analysis of selected problems in South Asian ethnology and social structure. Prerequisite: 412.

ANTH 520 Ecology, Evolution, and Anthropological Theory (3) *Smith* Critical examination of models and theories from evolutionary ecology, sociobiology, and ecological anthropology. Potential and actual utility of such models in explaining aspects of human social behavior, cultural evolution, and cross-cultural variation in strategies of production and reproduction.

ANTH 521 Seminar on the Anthropological Study of Religion (3, max. 9) Advanced seminar in the anthropological study of religion designed for students who have a background in the theory and applications of theory developed in the anthropological study of religion. Seminar topics vary each quarter. Prerequisites: 422 and graduate standing; permission of instructor for graduate students in Comparative Religion.

ANTH 522 Seminar on South American Indians (3) Sp *Dumont* Advanced comparative treatment of selected aspects of the Indian cultures and societies of South America.

ANTH 525 Seminar in Culture Processes (3, max. 6) The concept of process and its application to the study of culture.

ANTH 527 Acculturation and Ethnicity (3) Systematic analysis of psychological, social, and cultural implications of the contact of peoples.

ANTH 529 Seminar in Expressive Culture (3) Detailed study of selected topics in expressive culture from an anthropological point of view. Prerequisite: 429 or permission of instructor.

ANTH 530 Dialectology (3) Principles of dialect deviation as related to linguistic structure and usage. Offered jointly with LING 530. Prerequisite: 452 or permission of instructor.

ANTH 534 Cultural Influences Upon Parenting (3) Sp *Kotchek* Data from several cultures to compare cross-cultural similarities and differences in definitions of ideal parenting; socializations into a parent role; social support for, and controls upon, parenting. Analyses of additional effects of changes in ideology, technology, and demography upon cultural parenting roles. Offered jointly with PCN 534. Prerequisite: permission of instructor.

ANTH 536 Seminar in Visual Anthropology (3) A *Dumont* Significance of anthropological cinema and photography placed in historical perspective. Screening of films to determine the role of the anthropologist as filmmaker, as well as the role of the filmmaker as anthropologist.

ANTH 537 Political Anthropology and Law (3, max. 6) Seminar on special topics in politics and law and their interrelationships. Prerequisites: 437, 439, or permission of instructor.

ANTH 541 Seminar in Psychological Aspects of Culture (3) Selected problems in the relation of culture and personality types. Prerequisite: 441 or permission of instructor.

ANTH 553 Analysis of Linguistic Structures (3, max. 6) Syntactic and/or phonological analysis. Language varies. Offered jointly with LING 553. Prerequisite: permission of instructor.

ANTH 554 Field Techniques in Ethnography (3) Techniques of collecting, ordering, and utilizing ethnographic data in the field. Problems of rapport, elicitation, observation, interpretation, and ethics.

ANTH 555 Techniques of Network Analysis (5) *Atkins* Theory and technique in analysis of social networks and other relational structures as formal nets or digraphs, with applications to anthropological problems. Key concepts and experience in using APL to analyze relational matrices. No prior background in computers or advanced mathematics assumed.

ANTH 558 Types and Techniques of Transcription (3) Analysis of aims and problems in the written symbolization of structured data. Emphasis on field transcription of human movement, music, and language. Prerequisite: 202 or permission of instructor.

ANTH 559 Seminar in Language and Culture (3, max. 9) Theoretical and methodological problems in language and culture.

ANTH 561 Seminar in Methods and Theories (3, max. 9)

ANTH 564 Formal Methods of Analysis for Social Anthropology (3) Seminar on selected nonstatistical mathematical methods and models of relevance to various problems in social anthropology.

ANTH 565-566-567 History and Theory of Sociocultural Anthropology (5-5-5) Core course sequence for the beginning graduate student in sociocultural anthropology in which the development of theory is analyzed and emphasis is placed on the relation between theory and a growing body of ethnographic data. Prerequisites: graduate standing in anthropology or permission of instructor; 565 for 566; 566 for 567.

ANTH 571 Communicational Anthropology (3-9) Introduction to communicational aspects of culture. Prerequisite: permission of instructor.

ANTH 575 Cultural Construction of Illness: Seminar in Medical Anthropology (5) Sp Historical and comparative examination of depression, neurasthenia, somatization, hypochondriasis, and hysteria. Anthropology of psychosomatics and psychiatry, including cultural analysis of selected biomedical, indigenous folk medical, and popular common-sense conceptualizations of illness.

ANTH 590 Seminar in Museum Theory (3) *Nason* Fundamental theoretical issues involved in current museum administrative and operations work, including administrative structure, organizational conflicts, museum-community relations, and museum educational programming. Prerequisite: permission of instructor.

ANTH 591 Seminar in Museum Operations (3) *Nason, Quimby* Designing hypothetical museums and creating a first year of operations. Design elements include architectural plan, staffing plan, initial and recurring budgets, security system, records system, educational plan, and policy making. Prerequisite: 590 or permission of instructor.

ANTH 592 Seminar in Museum Specimen Documentation (3) Seminar discussion of museum specimen documentation research approaches, including technological and raw material analyses, contextual studies, and esthetic studies. Documentation of a collection and reference work. Prerequisites: 590, 591, or permission of instructor.

Archaeology

ARCHY 501 Preceptorial Reading (6) For beginning graduate students who have not had adequate training in the problems, principles, and methods involved in the reconstruction of prehistory. Not open to graduate students in the archaeology program.

ARCHY 570 Seminar in Theory and Method in Archaeology (3, max. 12)

ARCHY 571 Field Course in Archaeology (5) S Introduction to field acquisition of archaeological data through survey and excavation. On-going field projects; instructional emphasis on recovery and recording techniques and on management of field projects. Prerequisite: permission of department.

ARCHY 572 Seminar in North American Archaeology (3, max. 6) Selected problems in the archaeology of America north of Mexico. Prerequisite: permission of instructor.

ARCHY 573 Seminar in Middle American Archaeology (3, max. 6) Selected problems in the archaeology of Middle America. Prerequisite: 473 or 475 or permission of instructor.

ARCHY 574 Seminar in South American Archaeology (3, max. 6) Selected problems in the archaeology of South America and southern Central America. Prerequisite: 474 or permission of instructor.

ARCHY 575 Archaeological Field Research Design (6) Sp *Dunnell* Nature of the archaeological record, and methods and techniques of field research, to illustrate range of data sources and modern techniques of general applicability. Practical experience in mapping, map interpretation, sampling design, remote sensing, photogrammetry, and research proposal writing. Prerequisite: permission of instructor.

ARCHY 591 Advanced Field Course in Archaeology (6-9) For students with previous field experience and graduate work in archaeology. Emphasis on decision making in field and project management. Prerequisites: 497, 498, 571, 575, or permission of instructor.

ARCHY 600 Independent Study or Research (*) Prerequisite: permission of instructor.

ARCHY 601 Internship (3-9, max. 9)

Physical Anthropology

PHY A 502 Preceptorial Reading (6) For beginning graduate students who have not had adequate training in the study of primate principles, and methods involved in the study of evolution, human genetics, and the evolution of modern populations. Not open to graduate students in the physical anthropology program.

PHY A 570 Principles of Primate Taxonomy (3) Problems in primate classification involving consideration of living and fossil forms and the extent to which application of taxonomic principles can aid in both the definition and solution of these problems. Prerequisite: 488 or 489 or permission of instructor.

PHY A 583 Topics in Growth and Development (3, max. 9) *Newell* Seminar on various topics of human or nonhuman primate growth and physical/behavioral development. Subject matter varies by quarter. Prerequisite: 484 or permission of instructor.

PHY A 584 Topics in Ecology and Adaptation (3, max. 9) Seminar dealing with various aspects of ecology and adaptation. Topics vary from quarter to quarter. Prerequisite: permission of instructor.

PHY A 588 Topics in Primate Evolution (3) *Eck* Emphasis on fossil taxa and their importance in understanding the morphologies and distributions of members of modern taxa. Prerequisites: 488 and permission of instructor.

PHY A 589 Topics in Hominid Evolution (3) A *Eck* Emphasis on the fossil taxa and their importance in understanding the evolutionary history of the modern genus. Prerequisites: 489 and permission of instructor.

PHY A 590 Current Issues in Human and Non-Human Primate Evolution (1, max. 15) Biweekly presentation by participants and guest lecturers of current literature and ongoing research in topics pertaining to human and nonhuman primate evolution, biology, anatomy, genetics variation, and behavior. Prerequisite: graduate standing in physical anthropology or permission of instructor.

PHY A 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

Art

102 Art

The School of Art is concerned with the practice, history, and teaching of the graphic and plastic arts. It offers undergraduate programs in ceramic art, fiber arts, graphic design, industrial design, metal design, painting, photography, printmaking, sculpture, and general art. In addition, the school offers graduate programs leading to the degrees of Master of Fine Arts in studio disciplines and Master of Arts and Doctor of Philosophy in art history.

Undergraduate Program

Admission Policy for Initial-Degree-Seeking Applicants

The Office of Admissions admits entering freshmen as art majors if regular University admissions requirements have been met. Transfer students indicating an art major are admitted initially as premajors in the College of Arts and Sciences. Those with a minimum grade-point average of 2.50 are accepted as art majors during the first meeting with an art adviser.

So that placement within art programs can be determined, transfer students with college-level art experience must submit representative examples of studio work in slide or photograph form with transcripts to the School of Art advisory office at least two weeks before the initial advisory appointment. Art majors may follow the General Art curriculum without further review of work or record of accomplishment if a minimum grade-point average of 2.00 is maintained. All other studio majors are subject to the continuation policies appropriate to their major options.

Admission Policy for Postbaccalaureate Applicants

Postbaccalaureate art applicants must file an application through the Office of Admissions by the following deadlines: Autumn Quarter, July 1; Winter Quarter, November 1; Spring Quarter, February 1; Summer Quarter, May 15.

A supplementary information form is provided by the School of Art. By the above deadlines this form and slides of studio work must be submitted by studio art applicants to the School of Art advisory office for an admission review. Following the review, applicants are notified by the Office of Admissions regarding their admissibility.

Postbaccalaureate applicants who hope to transfer to art from other schools, departments, or colleges on the campus may pick up a supplementary information form from the School of Art advisory office. For an applicant to be considered for admission, this supplementary form, a complete academic record, and slides of studio work are required and may be submitted to the School of Art advisory office at any time.

Bachelor of Arts Degree

MAJOR REQUIREMENTS

General Art: ART 105, 106, 107, 109, 110; ART H 201, 202, 203; 55 credits chosen from the following optional fields so that one option includes no more than 15 credits and the others no more than 10 credits each: all undergraduate art history courses; ART 201, 202, 203, 353; 250, 252, 255, 330, 340, 405; 265; 258, 357, 358, 359, 457, 458, 459; 256, 257, 259, 260, 307, 360; 230, 370, 371, 372; 345, 346, 347, 348, 349, 450, 451, 452, 453, 454; 272, 274, 332.

Bachelor of Fine Arts Degree

A minimum of 198 credits is required for graduation with a Bachelor of Fine Arts degree.

MAJOR REQUIREMENTS

Ceramic Art: ART 105, 106, 107, 109, 110, 201, 202, 203, 353 (15 credits), 485 (15 credits), 486 (15 credits); 13 credits selected from the following: ART 255, 258, 272, 335, 337, 357; 26 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Fiber Arts: ART 105, 106, 107, 109, 110, 250 (10 credits), 252, 253, 255 (10 credits), 259, 330, 340 (10 credits), 405, 425 (15 credits); 25 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Graphic Design: ART 105, 106, 109, 111, 113, 205, 206, 207, 230, 366, 367, 368, 376, 377, 378, 466, 467, 468, 478, 479, 480; 13 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Industrial Design: ART 105, 106, 107, 109, 110, 254, 261, 262, 263, 316, 317, 318, 321, 322, 422, 423, 445, 446, 447, 25 studio art or related elective credits. ARCH 310, 311, 312; SPCH 220; PHYS 110, 111. ART H 201, 202, 203; 3 elective credits.

Metal Design: ART 105, 106, 107, 109, 110, 258, 357, 358, 359, 457, 458, 459, 460 (15 credits); 13 credits from: 201, 202, 255, 272, 335, 337; 30 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Painting: ART 105, 106, 107, 109, 110, 265 (15 credits); 256, 257, 260, 307 (10 credits), 309, 360 (10 credits), 463 (15 credits) or 5 credits of 325 and 10 credits of 463; 23 studio art or related elective credits. ART H 201, 202, 203, 391.

Photography: ART 105, 106, 107, 109, 110, 230, 370, 371, 372, 411 (15 credits), 412, 413, 414, 415 (10 credits); 33 studio art or related elective credits. ART H 201, 202, 203, 232.

Printmaking: ART 105, 106, 107, 109, 110; 20 credits from 345, 346, 347, 348, 349; 40 credits from 450, 451, 452, 453, 454; 256, 257, 259, 265; 13 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Sculpture: ART 105, 106, 107, 109, 110, 272 (6 credits), 274, 332 (15 credits), 335, 337, 436 (15 credits); 253, 256 or 259, 265; 3 courses selected from 201, 202, 255, 258, 357; 18-20 studio art or related elective credits. ART H 201, 202, 203; 3 elective credits.

Graduate Program

Mary L. Hu, Graduate Program Coordinator

Students accepted for admission into the Master of Fine Arts degree program in ceramic art, fiber arts, graphic design, industrial design, metal design, painting, photography, printmaking, or sculpture will be required to complete a minimum of 63 credits of scheduled class work and 9 credits of thesis for a total of 72 credits for the degree. No foreign language is required or the Graduate Record Examination. The thesis is in the nature of a studio project, such as a series of paintings, prints, ceramic objects, or sculptures.

A selection of the student's thesis work must be included in the annual studio master's exhibition of the School of Art.

Graduate students may participate in the School of Art's study abroad program.

Admission Requirements

Graduate standing is granted only on presentation of credentials from art schools or university art departments whose standards are recognized by this school. Samples of work done in these schools or art departments also must be presented by applicants for admission to the Master of Fine Arts degree program.

Students who desire to pursue a course of study leading to the master's degree must have a grade-point average of 3.00 or better in the undergraduate art major and must have completed the equivalent of the undergraduate degree requirements in the School of Art, University of Washington. Undergraduate work beyond the basic minimum may be required if it is necessary to make up deficiencies or inadequacies.

Financial Aid

The studio divisions offer several scholarship and financial aid programs for students who qualify. These programs include endowments and organizational and privately supported scholarships. Information concerning scholarships is available from the graduate program coordinator. Also available to graduate students are teaching assistantships, usually awarded to a limited number of candidates.

Correspondence and Information

Graduate Program Coordinator
102 Art, DM-10

Faculty

Director

Richard R. Arnold

Associate Director

Mary L. Hu

Division Heads

Constantine G. Christofides (Art History)
Robert C. Jones (Painting/Printmaking
Charles W. Smith (3-Dimensional Design)
Douglas J. Wadden (Design)

Studio Faculty

Professors

Alps, Glen E. (Emeritus), M.F.A., 1947, Washington; printmaking.

Anderson, Frederick N.,* M.F.A., 1954, Minnesota; painting.

Arnold, Richard R.,* M.F.A., 1948, Cranbrook Academy of Art (Michigan); photography, drawing.

Carraher, Ronald,* M.A., 1961, San Jose State; photography.

Celentano, Francis M.,* M.A., 1957, Institute of Fine Arts (New York); painting, drawing.

Dahn, Richard F.,* M.F.A., 1959, Yale; graphic design.

Dailey, Michael D.,* M.F.A., 1963, State University of Iowa; painting, drawing.

DuPen, Everett (Emeritus), B.F.A., 1937, Yale; sculpture.

Erickson, John W. (Emeritus), M.F.A., 1951, Illinois; painting.

Gonzales, Boyer (Emeritus), B.S., 1931, Virginia; painting.

Hixson, William J.,* M.F.A., 1950, Oregon; painting.

Johnson, Pauline (Emeritus), D.F.A. (Hon.), 1968, Moore; art education.

Jones, Robert C.,* M.S., 1959, Rhode Island School of Design; painting, drawing.

Kottler, Howard,* Ph.D., 1964, Ohio State; ceramics.

Lawrence, Jacob A. (Emeritus), D.F.A. (Hon.), 1981, Carnegie-Mellon; painting, drawing.

Lundin, Norman K.,* M.F.A., 1963, Cincinnati; painting, drawing.

Marshall, John C.,* M.F.A., 1968, Syracuse; metal design.
Mason, Alden C. (Emeritus), M.F.A., 1947, Washington; painting.
Moseley, Spencer A.,* M.F.A., 1951, Washington; painting, drawing.
Penington, Ruth E. (Emeritus), M.F.A., 1929, Washington; metal design.
Pizzuto, Eugene C.,* M.F.A., 1951, Cranbrook Academy of Art (Michigan); painting, drawing.
Ritchie, William H.,* M.A., 1966, San Jose State; printmaking, video art.
Smith, Charles W.,* M.F.A., 1956, Cranbrook Academy of Art (Michigan); sculpture.
Solberg, Ramona (Emeritus), M.F.A., 1967, Washington; art education, metal design.
Spafford, Michael C.,* M.A., 1960, Harvard; painting, drawing.
Sperry, Robert (Emeritus), M.F.A., 1955, Washington; ceramics.
Tsutakawa, George (Emeritus), M.F.A., 1950, Washington; sculpture.
Warashina, Patricia,* M.F.A., 1966, Washington; ceramics.

Associate Professors

Berger, Paul E.,* M.F.A., 1973, State University of New York (Buffalo); photography.
Fuller, Steven (Emeritus), M.F.A., 1948, Washington; art education.
Hafermehl, C. Louis (Emeritus), M.F.A., 1955; Cranbrook Academy of Art (Michigan); painting, drawing.
Hennessey, James M.,* M.F.A., 1971, California Institute of the Arts; industrial design.
Hu, Mary L.,* M.F.A., 1967, Southern Illinois; metal design.
Kehl, Richard L.,* M.F.A., 1961, Kansas City Art Institute; drawing, design.
Koenig, Hazel L.,* M.F.A., 1950, Washington; fiber arts.
Patterson, Viola H. (Emeritus), M.F.A., 1947, Washington; painting.
Pawula, Kenneth J.,* M.A., 1962, California (Berkeley); painting, drawing.
Praczukowski, Edward L.,* M.F.A., 1965, Cranbrook Academy of Art (Michigan); painting, drawing.
Proctor, Richard M.,* M.A., 1962, Michigan State; fiber arts.
Taylor, Norman J.,* M.F.A., 1967, State University of Iowa; sculpture.
Wadden, Douglas J.,* M.F.A., 1970, Yale; graphic design, photography.
Welman, Valentine S. (Emeritus), M.F.A., 1954, Colorado; painting, drawing.
Whitehill-Ward, John,* M.S., 1974, Institute of Design (Chicago); graphic design.

Assistant Professors

Goldsmith, Layne, M.F.A., 1979, Cranbrook Academy of Art (Michigan); fiber arts.
Ozubko, Christopher,* M.F.A., 1981, Cranbrook Academy of Art (Michigan); graphic design.

Lecturer

Dunthorne, Stephen, M.F.A., 1950, Washington.

Art History Faculty

Professors

Bravmann, Rene A.,* Ph.D., 1971, Indiana; African.
Christofides, Constantine G.,* (Comparative Literature, Romance Languages and Literature)† Ph.D., 1956, Michigan; Romanesque.
Grossman, Friedrich G. (Emeritus), Ph.D., 1931, Vienna Faculty of Philosophy; art history.
Hildebrand, Grant,* (Architecture),† M.A. Arch., 1964, Michigan; architectural history.
Holm, Bill,* (Anthropology),† M.F.A., 1951, Washington; Northwest Coast Indian.
Kingsbury, Martha,* Ph.D., 1969, Harvard; nineteenth and twentieth centuries.
Opperman, Hal,* Ph.D., 1972, Chicago; seventeenth-and eighteenth-century European.
Pascal, Paul.*‡ (Classics), Ph.D., 1953, North Carolina; Roman.
Pundt, Hermann,* (Architecture),† Ph.D., 1969, Harvard; architectural history.
Rogers, Millard B. (Emeritus), Ph.D., 1965, Chicago; Asian.

Associate Professors

Bliquez, Lawrence J.,* (Classics),† Ph.D., 1968, Stanford; Greek and Roman.
Langdon, Merle K.,* (Classics),† Ph.D., 1972, Pennsylvania; Greek.
Prussin, LaBelle,*‡ (Architecture), Ph.D., 1973, Yale; Third World architecture.
Silbergeld, Jerome,*,Ph.D., 1974, Stanford; Chinese.
Webb, Glenn T.,* Ph.D., 1970, Chicago; Japanese.

Assistant Professors

Clausen, Meredith L.,* Ph.D., 1975, California (Berkeley); esthetics and contemporary architecture.
Kartsonis, Anna D., Ph.D., 1982, Institute of Fine Arts (New York); medieval, Byzantine.
Reed, T. Gervais, B.A., 1949, Yale; American.
Snow-Smith, Joanne L.,* Ph.D., 1976, California (Los Angeles); Italian Renaissance.

Course Descriptions

Courses for Undergraduates

ART 105, 106, 107 Drawing (3,3,3) Perspective, light and shade, composition. Prerequisites: 105 for 106; 106 for 107.

ART 109, 110 Design (3,3) Art structure as the basis for creative work. Organization of line, space, and color. Prerequisite: 109 for 110.

ART 111 Basic Visual Analysis (3) Symbolic representation of forms and ideas. Investigative drawing and varied photomechanical manipulation as fundamental components in visual analysis. Prerequisite: 109.

ART 113 Basic Color Theory and Form (3) Fundamental investigations into the synthesis of basic two- and three-dimensional design principles. Color theory and analysis for predesign majors. Prerequisites: 111, which may be taken concurrently, and 109.

ART 129 Appreciation of Design (3) Lectures on design fundamentals, illustrated with slides of paintings, pottery, textiles, etc. Reading and reference work.

ART 201, 202, 203 Ceramic Art (3,3,3) Hand-building processes, wheel throwing; glazing, kiln firing. Prerequisites: 107, 110 for 201 or 202; 201 and 202 for 203.

ART 204 Graphic Design: Context, Formulation, Performance (3) Lectures and assignments exploring graphic design and its function in the context of specific visual situations. Primarily for nonmajors.

ART 205, 206 Graphic Design (5,5) Problem solving in basic graphic design, consisting of a sequence of applied visual projects intended to present a wide range of design experiences. Prerequisites: 106, 113 for 205 and permission of Art advisory office; 205 for 206 and permission of Art advisory office.

ART 207 Typographic Design: Methods and Processes (5) Operational typographic and reproduction methods as a foundation for two-dimensional design and laboratory assignments. Computerized phototypesetting, offset lithography, and photomechanical techniques as they relate to the design process. Prerequisite: 206.

ART 219 Design Methods (3) Current design methodologies that emphasize a systems approach. Prerequisite: sophomore standing in Industrial design.

ART 230 Introductory Photography (5) Introduction to theory, techniques, and processes of still photography. Darkroom procedures and camera use. Visual and creative potential of the medium. Students must provide a camera with lens, shutter, and aperture controls. Prerequisites: art major standing and permission of Art advisory office.

ART 250 Design and Materials: Surface Design for Fabric (5, max. 15) Techniques include block printing, batik, tie and dye, discharging. Prerequisites: 107, 110.

ART 252 Fiber Arts: Introductory Weaving (5) Basic techniques and processes of four-harness loom woven structures. Fundamentals of drafting, loom design and operation, including study of fiber technology and dye chemistry. Experimental problem solving. Prerequisites: 107, 110, art major standing, and permission of Art advisory office.

ART 253 Design and Materials: Wood (3) Shaping and forming of wood. Lamination and fabricating techniques. Usage of hand and power tools. Prerequisites: 107, 110.

ART 254 Design and Materials: Metal (3) Basic techniques in manipulation and construction of metals. Prerequisites: 107, 110.

ART 255 Design and Materials: Fabric Construction (5, max. 15) Knotting, hooking, stitching, and other nonwoven constructional techniques with a variety of textile fibers. Prerequisites: 107, 110.

ART 256 Painting (5) Beginning oil painting. Prerequisites: 107, 110.

ART 257 Painting (5) Oil painting. Prerequisite: 256.

ART 258 Jewelry Design (5) Introduction to jewelry design and construction through techniques of sawing, filing, soldering, forging, and casting in silver, copper, bronze, and brass, as well as simple stone setting. Prerequisites: 107, 110.

ART 259 Water-Soluble Media (5, max. 15) Prerequisites: 107, 110.

ART 260 Art Works on Paper (5, max. 15) Combines experiments and projects in various techniques of drawing, assemblage, and painting on paper. Prerequisite: 257.

ART 261, 262, 263 Introduction to Environmental Design (5,5,5) A,W,Sp Design methodology, structures, graphics, materials. Prerequisites: permission of Art advisory office for 261; 261 for 262; 262 for 263

ART 265 Intermediate Drawing (5, max. 15) Prerequisites: 107, 110.

ART 272 Beginning Sculpture Composition (3, max. 6) Fundamentals of composition in the round and in relief. Prerequisites: 107, 110.

ART 274 Life Sculpture (5, max. 15) Work in clay from the posed model. Prerequisites: 107, 110.

ART 307 Intermediate Painting (5, max. 10) Prerequisite: 257.

ART 309 Portrait Painting (5, max. 10) Prerequisite: 10 credits in 307.

ART 316, 317, 318 Design for Industry (5,5,5) Product design, working drawings, models, presentation drawings, product analysis, display, marketing. Prerequisites: junior standing in Industrial design for 316; 316 for 317; 317 for 318.

ART 321 Furniture Design (5) Design of a furniture piece. Methodologies and construction, types of hardware, special shop techniques, scale modeling and full-scale functional designs. Prerequisite: junior standing in Industrial design.

ART 322 Industrial Design Materials and Methods (3) Product form development of current design practice examined in the context of new materials and processes. Prerequisite: junior standing in Industrial design.

ART 325 Advanced Drawing (5, max. 15) Study on the advanced level involving history, practice, and theory of drawing as an art form. Prerequisite: 15 credits in 265.

ART 328 The Film as Art (3) Historical development of film as an esthetic medium with an emphasis on pivotal filmmakers and their unique contribution to the art of film.

ART 330 Intermediate Weaving (5) Introduction to weaver-controlled structures and tapestry weaving. Alternative weaving tools and loom construction; studio dyeing processes. Development of original textile forms. Prerequisites: 252 and permission of Art advisory office.

ART 332 Intermediate Sculpture Composition (5, max. 15) Advanced work in various media and techniques. Prerequisite: 6 credits in 272.

ART 335 Metal Casting (5, max. 15) Foundry techniques as applied to fine arts casting of ferrous and nonferrous material. Prerequisite: 3 credits in 272 or permission of Art advisory office.

ART 337 Welding (3, max. 6) Study and application of welding methods as a sculpture technique making use of oxyacetylene, electric arc, and heliarc. Prerequisite: 6 credits in 272.

ART 340 Design for Printed Fabrics (5, max. 15) Hand-block and silk-screen printing; mass-production design. Prerequisite: 250 or permission of Art advisory office.

ART 345 Etching (5) Traditional and contemporary methods of etching as a creative art form. Included are aquatint, hard-soft and lift ground mezzafint, burin, engraving, dry point, niello, crible, and others. Techniques, such as intaglio, relief, stencil, and others. Prerequisites: 107, 110.

ART 346 Collagraph (5) Fundamentals of positive plate buildup with hard, soft, and pliable materials. The interrelationship of individual graphic ideas, plate making, and various techniques of printing. Prerequisites: 107, 110.

ART 347 Lithography (5) General survey of historical and contemporary lithography. Studio problems using a variety of stone, plates, papers, inks, and presses. Hand-drawn and photochemical methods. Prerequisites: 107, 110.

ART 348 Woodcut (5) Basic Eastern and Western approaches to the art of the woodcut. Various woods, tools, papers, inks, color, printing techniques. Prerequisites: 107, 110.

ART 349 Silk-screen (5) Studio problems employing the techniques of paper, glue, lacquer, film, and stencils. Prerequisites: 107, 110.

ART 350 Survey of Printmaking (3) Study of printmaking from the first forms of incised surfaces through Chinese and European artists, the Japanese woodcut, the Expressionists, and twentieth-century artists. Prerequisites: 107, 110.

ART 353 Advanced Ceramic Art (5, max. 15) Advanced work in forming, decorating, and glazing. Prerequisites: 203 and permission of Art advisory office.

ART 357 Metal Design (5) Processes of raising, soldering, forging in copper, pewter, silver. Prerequisites: 107, 110.

ART 358 Jewelry Design (5) Intermediate jewelry design, such as etching, reticulation, makume, electroforming, repousse, chasing, and advanced stone-setting methods. Prerequisite: 258.

ART 359 Enameling (5) Enamel design for metal work or jewelry, Champleve, Plique-a-jour, Limoges, cloissonne on copper, silver, or gold. Prerequisite: 357 or 358.

ART 360 Life (5, max. 10) Drawing and painting from the model. Prerequisites: 257 and 15 credits in 265.

ART 361 Art Techniques (5, max. 15) Study of the materials and techniques of the artist and their application to painting and drawing. Prerequisite: 257.

ART 366 Graphic Design (5) Visualizations: nonapplied problems requiring expression, illustration, or manipulation of ideas in any visual medium, with emphasis on innovative image development. Prerequisites: 207, 230.

ART 367 Graphic Design (5) Basic three-dimensional design: translation of form into three dimensions. Problems in packaging, requiring analysis of material and form, and product identification. Prerequisite: 366.

ART 368 Graphic Design (5) Persuasive communications: applied problems exploring the potential for persuasive verbal/visual communications. Responsibility of the designer to analyze and influence audience response, especially in the area of public service. Prerequisite: 367.

ART 370 Intermediate Photography I (5) Individual projects in photography combining technical and conceptual objectives. Emphasis on visual organization and contemporary photographic directions. Prerequisites: 230 and permission of Art advisory office.

ART 371 Intermediate Photography II (5) The photo essay. Thematic investigation of time and space, using the photographic image. In-depth treatment of a single topic. Prerequisites: 230 and permission of Art advisory office.

ART 372 Intermediate Photography III (5) Detailed investigation of the negative and print in black-and-white photography. Emphasis on creative application of exposure, development, and printing techniques. Includes preparation of prints for exhibition. Prerequisites: 230 and permission of Art advisory office.

ART 376 Graphic Design (5) Fundamentals of typography: functions and procedures, including the study of legibility, proportions, typesetting, and grid formulation. Prerequisites: 207, 230.

ART 377 Graphic Design (5) Two-dimensional composition: problems in typographic, symbolic, and pictorial composition that explores two-dimensional relationships and organizational principles. Prerequisite: 376.

ART 378 Graphic Design (5) Intermediate visual communications: specific applied design projects incorporating basic elements of printed communications. Prerequisite: 377.

ART 405 Advanced Weaving (5, max. 10) Loom- and weaver-controlled structures. Topics may include warp patterning, warp painting, printing and dyeing, Ikat, multiple-harness weaves, and selected design problems for architectural textiles, utilitarian textiles, or experimental interpretation of traditional structures and materials. Prerequisites: 330 and permission of Art advisory office.

ART 411 Advanced Photography (5, max. 15) Topics in advanced photography, including: color printing, large-format photography, artificial lighting, and photographic image transformation. Prerequisites: 370, 371, 372 and permission of Art advisory office.

ART 412 Extended Photographic Processes (5) Creative use of extended photographic processes such as high-contrast, infrared, and recording film. Prerequisites: 370, 371, 372 and permission of Art advisory office.

ART 413 Documentary Photography (5) Projects in photographic documentation involving either large- or small-format photography. Technical, conceptual, and historical considerations in documentary photography. Prerequisites: 370, 371, 372 and permission of Art advisory office.

ART 414 Non-Silver Photographic Processes (5) Gum-bichromate printing, Van Dyke printing, black-and-white and color xerography. Projects in each area. Prerequisites: 370, 371, 372 and permission of Art advisory office.

ART 415 Senior Thesis in Photography (5, max. 10) Development of a coherent photographic theme or topic over two consecutive quarters resulting in a finished thesis portfolio. Prerequisites: 411 and permission of Art advisory office.

ART 421 Video Art (5, max. 15) Discussion, demonstrations, and practical experiments in closed-circuit television and videotape as creative media. Prerequisites: extensive work in printmaking and film and permission of Art advisory office.

ART 422 Industrial Design Computer Graphics I (3) Utilizes the microcomputer as a tool for the industrial designer's development of graphic solutions to two- and three-dimensional problems. Prerequisite: senior standing in industrial design.

ART 423 Industrial Design Computer Graphics II (3) Continuation of 422. Includes utilization of microcomputer intelligent products and robotics for effective design problem solving. Prerequisite: 422.

ART 425 Advanced Individual Projects in Fiber Arts (5, max. 15) Specialized investigation involving surface design and/or fabric structures. Prerequisites: upper-division standing in fiber arts and permission of Art advisory office.

ART 436 Sculpture Composition (5, max. 15) Individual compositions in various media in large scale. Prerequisites: 15 credits in 332 and permission of Art advisory office.

ART 445, 446, 447 Advanced Industrial Design (5,5,5) Market analysis and selected professional problems in industrial design. Consultation techniques; psychological, sociological, and economic factors involved in designing for consumer acceptance. Prerequisites: 318 for 445; 445 for 446; 446 for 447.

ART 450 Advanced Etching (5, max. 10) Prerequisite: 345.

ART 451 Advanced Collagraph (5, max. 10) Prerequisite: 346.

ART 452 Advanced Lithography (5, max. 10) Prerequisite: 347.

ART 453 Advanced Woodcut (5, max. 10) Prerequisite: 348.

ART 454 Advanced Silk-screen (5, max. 10) Prerequisite: 349.

ART 457 Advanced Metal Design (5) Individual problems in metal design and construction. Prerequisite: 357.

ART 458 Advanced Jewelry Design (5) Individual problems in jewelry design and construction. Prerequisite: 358.

ART 459 Advanced Enameling (5) Individual problems in enameling. Prerequisite: 359.

ART 460 Advanced Metal Design (5, max. 15) Advanced individual projects in metal design. Prerequisite: permission of Art advisory office.

ART 463 Advanced Painting (5, max. 15) Development of individuality in painting through creative exercises. Prerequisites: 10 credits each in 307 and 360 and permission of Art advisory office.

ART 464 Advanced Painting/Drawing (5, max. 15) Advanced problems in composition. Prerequisite: 15 credits of 463.

ART 466 Graphic Design (5) Advanced two-dimensional design: integration of design elements in complex applied problems. Uses publications as the primary means of esthetic and organizational investigations. Prerequisites: 368, 378.

ART 467 Graphic Design (5) Exhibition design: fundamental problems of communications through environmental installations. Prerequisite: 466.

ART 468 Graphic Design (5) Independent study. Prerequisite: 467.

ART 478 Graphic Design (5) Information design I: investigations into the components of information design, with emphasis on signs, maps, charts, and diagrams. Prerequisites: 368, 378.

ART 479 Graphic Design (5) Information design II: objective transmittal of complex information in structured communications situations. Prerequisite: 478.

ART 480 Graphic Design (5) Design programs: a comprehensive presentation by the student requiring the analysis of a large-scale identity, institutional, or environmental problem. Prerequisite: 479.

ART 485 Advanced Ceramic Art (5, max. 15) Pottery design and construction, stoneware, clay bodies, glazes. Prerequisites: 15 credits in 353 and permission of Art advisory office.

ART 486 Advanced Individual Projects in Ceramics (3-5, max. 15) AWSp Advanced individual projects in ceramics with emphasis on pottery, sculpture, kiln building. Presentation of historical and contemporary directions in clay. Prerequisite: 15 credits in 485 and permission of Art advisory office.

ART 495 Graphic Design Seminars (5, max. 15) Independent and group work in graphic design theory. Prerequisites: fifth-year standing in graphic design and permission of Art advisory office.

ART 498 Individual Projects—Painting/Sculpture (3 or 5, max. 15) Prerequisite: permission of Art advisory office.

ART 499 Individual Projects—Design (3 or 5, max. 15) Prerequisite: permission of Art advisory office.

Courses for Graduates Only

ART 512 Graduate Seminar (3, max. 9)

ART 513 Contemporary Studio Theories and Problems (3)

ART 515 Photography (3-15, max. 60)

ART 522 Sculpture (3-15, max. 60)

ART 540 Fiber Arts (3-15, max. 60)

ART 547 Industrial Design (3-15, max. 60)

ART 550 Printmaking (3-15, max. 60)

ART 553 Ceramic Art (3-15, max. 60)

ART 558 Metal Design (3-15, max. 60)

ART 563 Painting (3-15, max. 60)

ART 580 Graphic Design (3-15, max. 60)

ART 600 Independent Study or Research (*)

ART 700 Master's Thesis (*)

Art History

209 Art

Art history is the study of the creation and meaning of works of art in relation to the artists and societies that produce them. Comparative in nature, the history of art involves the interaction of styles, techniques, and ideas from different centers over long periods of time; hence, its study requires many different skills, including languages, bibliography, connoisseurship, and historic, iconographic, and stylistic analysis. Art History is a division of the School of Art.

Undergraduate Program

Bachelor of Arts Degree

Admission Requirements: The Office of Admissions admits entering freshmen and transfer students into art history. Postbaccalaureate applicants must file an application to the Office of Admissions and complete the supplementary information form provided by the School of Art advisory office by the following deadlines: Autumn Quarter, July 1; Winter Quarter, November 1; Spring Quarter, February 1; Summer Quarter, May 15.

Major Requirements: ART H 201; 47 additional art history credits, including at least 5 upper-division credits in each of the following areas: Asian, Primitive and Tribal, Classical, Medieval, Renaissance, Baroque-Rococo, and Nineteenth-Twentieth Centuries; plus *one* of the following options: (1) ART 105, 106, 107, 109, 110; or (2) 15 upper-division credits in *one* of the following (exclusive of courses offered jointly with Art History): Ancient and Medieval History, Anthropology, Asian Languages and Literature, Classics, Comparative Literature, English (literature courses only), Germanics, History of the Americas, History of Asia, Modern European History, Near Eastern Languages and Literature, Romance Languages and Literature, Scandinavian Languages and Literature, or Slavic Languages and Literature.

Graduate Program

Jerome Silbergeld, Graduate Program Coordinator

Admission to the Master of Arts program requires: (1) Bachelor of Arts degree with major in the history of art, or equivalent; (2) three letters of recommendation; (3) statement of professional objectives in the field; and (4) samples of the applicant's written work. Graduation requirements are: 40 credits in art history courses numbered 400 or above, of which 30 are course credits and 10 are thesis credits; at least 5 credits each must be taken in four of these areas: (1) Primitive and Tribal; (2) East and South Asian; (3) Ancient, Classical, and Medieval; (4) Renaissance and Baroque; (5) Eighteenth-twentieth Century Modern. 15 credits must be in 500-level seminars; 10 credits in related fields in courses 300 level and above may be approved to replace 10 credits in art history; passing the Graduate School Foreign Language Test in French or German, or passing a reading knowledge examination in Chinese or Japanese administered by art history faculty in conjunction with the Department of Asian Languages and Literature; 10 thesis credits in Art History 700 must be taken in preparation for the written presentation and oral defense of a thesis that demonstrates familiarity with sources and a capacity for synthesis and critical evaluation.

Admission to the Doctor of Philosophy program requires: (1) prior sound preparation at a general level, which usually means having acquired the Master of Arts degree in the history of art; students whose backgrounds are judged insufficient may be required to satisfy deficiencies before undertaking a full-scale graduate program; (2) three letters of recommendation; (3) statement of professional objectives in the discipline; and (4) samples of written research work in art history. Graduation requirements are a minimum of 90 credits, which include: (1) 60 credits in art history courses numbered 400 and above, beyond the Master of Arts degree or equivalent, and exclusive of dissertation credits; a maximum of 20 credits in related fields in numerically graded courses numbered 300 and above may be approved for credit in place of art history courses; at least 30 credits must be in 500-level seminars; (2) a reading knowledge of French or German as tested by the Graduate School Foreign Language Test or of Chinese or Japanese as tested by the art history faculty in conjunction with the Department of Asian Languages and Literature; (3) a General Examination, written and oral, taken prior to enrollment for dissertation credits; this examination covers three fields of art history chosen from the following general areas: (1) Primitive and Tribal, (2) East and South Asian, (3) Ancient, (4) Medieval, (5) Renaissance, (6) Baroque and Eighteenth Century, (7) Modern; not more than two fields may be selected from the same area; (4) 30 additional credits at the 800 level taken after the General Examination in preparation and defense of the dissertation. In most cases, the student must expect to work and travel abroad in order to acquire firsthand knowledge of the works of art involved in the dissertation research.

Financial Aid

The Art History division offers the Samuel H. Kress Foundation Fellowship of $6,000 each year to a student who is pursuing a graduate degree in the history of art. Limited Kress and other funds, as well as teaching assistantships, also are available for assistance of art history graduate students. It is a policy to award financial aid and assistantships only to students who have been in residence at the University of Washington for at least one year.

Correspondence and Information

Graduate Program Coordinator
209 Art, DM-10

Course Descriptions

Courses for Undergraduates

100- and 200-level courses in the history of art are intended for nonmajors, although they are also open to majors. They are designed to give an introduction to the subject matter of broad areas and to the history of art as a humanistic study. There are no prerequisites; each course is completely independent.

ART H 199 Vision and Form (5) Introduction to the psychology of pictorial representation through analyses of archaic, classic, and postclassic styles of Europe and Asia. Emphasis on the role of ornament and nonfigurative solutions to artistic expression.

ART H 200 Ideas in Art (5) Selected monuments of art and architecture in the Western tradition, from the Greeks to the twentieth century, studied in relation to the intellectual background of the ages and civilizations that produced them. Slide lectures accompanied by discussion of assigned readings in philosophical, religious, scientific, political, literary, and artistic texts.

ART H 201 Survey of Western Art—Ancient (5) Major achievements in painting, sculpture, architecture, and the decorative arts in Europe, the Near East, and North Africa, from prehistoric times to the beginnings of Christianity.

ART H 202 Survey of Western Art—Medieval (5) The arts of the Byzantine Empire, Islam, and Western Christendom through the fifteenth century.

ART H 203 Survey of Western Art—Modern (5) European art and its extensions from 1500 to the present.

ART H 204 Survey of Asian Art (5) Origins and interplay of major movements of South and East Asian art.

ART H 205 Survey of Tribal Art (5) Arts of Sub-Saharan Africa and Oceania from prehistoric times to the present, and to the pre-Columbian arts of the Americas.

ART H 230 Afro-American Art (3) History of Afro-American art from colonial times until the present, the African background and its extensions into the West Indies, Brazil, and Surinam.

ART H 232 Photography: Theory and Criticism (3) Art traditions of photography from its origins in the nineteenth century to the present. Emphasis on photographic traditions and photographers of the twentieth century.

ART H 296 Study Abroad: Art in London (3-5, max. 15) Art and art history through the study of objects in London's museums, of buildings in and near London, and through selected readings and research projects. Specific course content is announced in Study Abroad bulletins. Prerequisite: permission of undergraduate adviser.

300-level courses cover narrower times, spaces, and types of art than 200-level surveys and constitute the core curriculum for majors (although most enrollees come from other majors). Good basic university preparation (equivalent to upper-division standing) is needed. Relevant 200-level courses, although not required, may provide helpful background.

ART H 302 Egyptian Art (5) Arts and architecture of the Nile Valley from the Neolithic period to the end of the Coptic period.

ART H 305 Introduction to Islamic Art and Civilization (5) Islamic art and civilization as represented by five court cities (Cairo, Cordova-Granada, Istanbul, Isfahan, Dehli-Fatehpur-Sikri) and the art and architecture, literature, religious expression, and social modes characteristic of each. Field trips to various local collections.

ART H 311 Chinese Art (5) Overview of the arts of China. Emphasis on the role of the arts in Chinese culture and on the traditional styles and techniques associated with each of the major media—painting, ceremonial bronzes, architecture, sculpture.

ART H 315 The Buddhist Art of East Asia (5) Buddhist painting and sculpture of China, Korea, and Japan. Its religious meaning, artistic development, and historical significance. Examples from the sixth to the seventeenth centuries, along with paintings and contemporary carvings.

ART H 316 Japanese Painting (5) Japanese painting traditions from earliest times to the present. Examples illustrated and discussed in the context of Japanese cultural history. Analysis of painting styles as well as of the roles artists have played and the meaning their works have had in Japanese society.

ART H 317 *Chadō*: Japanese Esthetics (4) History, theory, and practice of *chadō*, or "Way of Tea," a Zen-inspired art that has had notable effects on Japanese society. Lectures on esthetics and cultural history supplemented by participation in *chadō*, with the goal of developing sufficient understanding and skill to continue *chadō* as a discipline.

ART H 321 Art of India (5) Arts and architecture of India and peripheral regions from prehistoric times to the modern period.

ART H 330 Tribal Art and Philosophy (5) Philosophical inquiry and thought in African, Ameri-Indian, and Pacific island societies as expressed through the visual, musical, choreographic, and oral arts. Natural, moral, and ethical ideas as expressed in the arts.

ART H 332 Native American Art: Prehistory to Twentieth Century (5) Native American art north of Mexico, the prehistoric and historic periods. Regional examination of types and styles, with emphasis on esthetics, cultural function, and factors of change.

ART H 333 Art of the Northwest Coast Indian (3) Emphasis on the structure and style of two-dimensional art of the northern tribes. Offered jointly with ANTH 333.

ART H 334 Art of the Northwest Coast Indian (3) Three-dimensional art of the Pacific Northwest coast culture area, with emphasis on esthetic principles, techniques, cultural functions. Offered jointly with ANTH 334.

ART H 335 Art of the Northwest Coast Indian (3) Northwest coast Indian art as related to drama and dance, with special attention to the Southern Kwakiutl. Offered jointly with ANTH 335.

ART H 337 African Art and Society (5) Explores the ideas and notions expressed visually in sculpture, painting, ceramics, textiles, and architecture and describes their relationships to man and culture in Africa.

ART H 340 Pre-Classical Art and Archaeology (3) Art and the other material remains of the civilizations in the Aegean from the Neolithic period to the end of the Bronze Age, with special emphasis on Minoan Crete and the Mycenaean kingdoms of mainland Greece; illustrated by slides. The history, techniques, and results of significant excavations. Offered jointly with CL AR 340.

ART H 341 Greek Art and Archaeology (3) Material remains and the developing styles in sculpture, vase painting, architecture, and the minor arts from the Geometric to the Hellenistic periods; illustrated by slides. Principal sites and monuments, as well as techniques and methods of excavation, are examined in an attempt to reconstruct the material culture of antiquity. Offered jointly with CL AR 341.

ART H 342 Roman Art and Archaeology (3) Roman architecture and art, with emphasis on the innovations of the Romans; illustrated by slides. Offered jointly with CL AR 342.

ART H 343 Hellenistic Art and Archaeology (3) Art of Greece and the eastern Mediterranean from the time of Alexander the Great to the Roman conquest. Principal sites with their sculpture, painting, mosaics, and minor arts examined in lectures with slides. Offered jointly with CL AR 343.

ART H 350 The City of Cairo (3) Development of Fustat and Cairo, 600-1800, with special emphasis on art and architecture. Economic, social, and geographic influences on the creation of the distinctive Egyptian styles of Islamic art. Offered jointly with N E 350.

ART H 351 Early Medieval and Byzantine Art (5) Christian art and architecture of the Roman and Byzantine empires and of western Europe through the eighth century.

ART H 352 High and Late Medieval Art (5) Art and architecture of Western Christendom from the time of Charlemagne to the Renaissance.

ART H 361 Italian Renaissance Art (5) Sculpture, painting, and architecture from 1300 to 1600.

ART H 371 Baroque Art (5) Arts and architecture of Europe from the end of the sixteenth century to the first years of the eighteenth century.

ART H 372 Rococo to Romanticism (5) Mainstream of European art and architecture from about 1710 to about 1830. Attention is also given to central and eastern Europe, Scandinavia, and the colonial Americas.

ART H 380 Nineteenth- and Twentieth-Century Art (5) Arts and architecture of Europe and America from Realism to the present, with emphasis on stylistic and thematic changes in painting.

ART H 381 Art Since World War II (5) Art of Europe and the United States in the decades since World War II: painting, sculpture, and architecture, multiplication of new forms (video, performance pieces, land and installation pieces, etc.), changing context of patronage, publicity, and marketing.

ART H 382 Theory and Practice of Art Criticism (3) Major issues in art and architectural criticism: nature of art criticism, aims of the critic, differences between art and architectural criticism. Works by major critics and artists, mostly twentieth century.

ART H 384 American Art (5) Major achievements in painting, sculpture, printmaking, the decorative arts, architecture, urban design, and folk art in the United States from about 1600 to the present.

ART H 391 Painting Since the Renaissance (3) Illustrated lectures. Prerequisite: 203.

ART H 396 Study Abroad: Art in London (3-5, max. 15) Advanced or specialized work in art history based on materials available in the museums, private collections, libraries, and buildings of London, conducted through lectures, reading and research projects. Specific course content is determined by the assigned faculty member and is announced in Study Abroad bulletins. Prerequisite: permission of undergraduate adviser.

ART H 398 Study Abroad: Art in Provence (5, max. 15) Monuments in and around Avignon. Emphasis on Roman and Romanesque architecture and sculpture, later medieval French painting, great works of all periods and countries in regional museums, and the Provencal landscape of Cezanne, Van Gogh, and Gauguin. Prerequisite: permission of undergraduate adviser.

ART H 399 Study Abroad: Individual Projects (3-10, max. 20) For participants in Study Abroad programs. Prerequisite: permission of undergraduate adviser.

400-level courses are intensive, quite narrow in scope, and addressed to current scholarly problems. A relatively high level of sophistication is needed. In general, sound prior humanistic training and knowledge of at least one of the following are required: art of the period or region at a general level (such as that provided by the relevant 200- or 300-level course); social or cultural history of the subject area; literature and thought of the area; or an appropriate foreign language.

ART H 400 Art History and Criticism (3, max. 9) Courses on special topics, frequently by visiting faculty, which cannot be offered on a continuing basis. Consult Art History office for subjects offered.

ART H 406 Islamic Art: The Book (3) Qur'anic calligraphy, illumination, Arab, Persian, Turkish and Indian painting, bookbinding, and papermaking. Prerequisite: permission of undergraduate adviser.

ART H 407 Islamic Religious Art: Mosques (3) Islamic religious art as seen primarily in the mosque and its decoration. Emphasis on the development of the mosque form and its various manifestations throughout the Islamic world. Attention is paid to the language and function of pattern and decoration as embodied in the mosque.

ART H 408 Royal Images: Byzantium, Sasanid Iran, Islam (3) Signs and symbols of royal kingship in Byzantium, Sasanid Iran, and Islam; three major Middle Eastern dynasties organized on principles of religious ideology; origins of royal symbols and their iconography in Mesopotamian and classical culture.

ART H 410 Chinese Figure Painting (3) Styles, content, and cultural role of Chinese figure painting, from historical narratives to religious icons.

ART H 413 Selected Topics in Chinese Art (3, max. 9) Specific theme or area of Chinese art, such as the art of Bronze Age China or Chinese painting under Communist rule.

ART H 414 Early Chinese Painting: Neolithic Period to Five Dynasties (3) Emergence and development of Chinese painting, its styles, esthetic theories, and cultural content, from earliest times through the tenth century A.D.

ART H 415 Chinese Painting: The Sung Period (3) "Golden age" of Chinese painting, emphasizing the monumental, romantic, and Zen Buddhist landscape painting traditions of the tenth through thirteenth centuries.

ART H 416 Chinese Painting: The Yuan Period (3) Chinese painting under Mongol rule, in the fourteenth century: a period of political and social crisis that gave rise to a revolution in painting styles.

ART H 417 Later Chinese Painting: Ming, Ch'ing, and Modern Periods (3) Major masters and traditions, esthetic attitudes, and social role of Chinese painting from the fifteenth century to the present day.

ART H 418 Political Aspects of Chinese Painting (3) Examination of the close link between painting and politics in China, focusing on such aspects as imperial patronage and propaganda, paintings by Chinese courtiers and the arts of political protest and lament, Chinese painting under Communist rule.

ART H 419 Chinese and Japanese Architecture (3) Religious and secular architecture of China and Japan, with emphasis on Japanese temples and shrines.

ART H 420 Art of the Japanese Print (3) Foundations of Ukiyo-e in Japanese genre from the twelfth through the mid-seventeenth centuries; woodblock technique from the Heian period through the early Edo period. Emphasis on the changing styles and subject matter in Ukiyo-e Hanga from Moronobu through Kuniyoshi.

ART H 421 The Yamato-e Tradition (3) Oldest (twelfth-to-fourteenth-century) narrative handscrolls and their descendants, the paintings of Tosa and other court artists from the fifteenth century onward, and the art of the Rimpa movement from Koetsu and Sotatsu (seventeenth century) to the present.

ART H 422 The Kan-ga Tradition (3) Ink paintings of Japanese Zen priests from the fourteenth century onward, and the works of professional artists belonging to those families (Kano, Hasegawa, Unkoku, and Kaiho) in which Chinese academic painting has been the principal inspiration, from the sixteenth century to the present.

ART H 423 Japanese Genre Painting (3) Various types of "popular" painting in Japan, including the *Namban-e* and townsman-painter art of the sixteenth and seventeenth centuries, the entire spectrum of *ukiyo-e*, and the "realistic" art of the Maruyama-Shijo school, from the eighteenth century to the present.

ART H 424 The Nanga Tradition (3) Works of painting and calligraphy by Japanese artists who have been part of the Chinese scholar-painting tradition from the late seventeenth century to the present.

ART H 425 Modern Japanese Painting (3) Painting of the Meiji, Taisho, and Showa eras (1868 to the present) by artists working in the modern idiom of either *Yoga* or *Nihonga*.

ART H 428 East Asian Calligraphy (3, max. 9) Classical calligraphy tradition of China and Japan in history and practice. Prerequisite: permission of undergraduate adviser.

ART H 431 Pre-Columbian Art (3) Arts of pre-Columbian cultures of Central and South America from prehistoric times to European contact.

ART H 432 Oceanic Art (3) Arts of Oceania, studied through cultures of Polynesia, Micronesia, Melanesia, and Australia.

ART H 436 Arts of Sub-Saharan Africa I (3) Traditional arts of the Western Sudan and the Western Guinea coast with their archaeological antecedents.

ART H 437 Arts of Sub-Saharan Africa II (3) Traditional arts of the Central Guinea coast, Nigeria, Cameroon, and Gabon, from precontact times to the present.

ART H 438 Arts of Sub-Saharan Africa III (3) Arts of Zaire, Angola, the Swahili coast, and southern Africa.

ART H 442 Greek and Roman Painting (3) A Painted decoration on Greek vases, and Roman wall painting, with emphasis on the historic and stylistic development of each. Offered jointly with CL AR 442. (Offered alternate years; offered 1984-85.)

ART H 444 Greek and Roman Sculpture (3) History and development of Greek sculpture and sculptors, their Roman copyists, and Roman portraits and sarcophagi. Emphasis on Greek sculpture of the fifth century B.C. Offered jointly with CL AR 444. (Offered alternate years; offered 1984-85.)

ART H 446 Greek Architecture (3) Detailed study of Greek architecture from its beginnings, with special emphasis on the Periclean building program in fifth-century Athens. Offered jointly with CL AR 446 and ARCH 454. (Offered alternate years; offered 1984-85.)

ART H 454 Romanesque Art (3) Western European art in the eleventh and twelfth centuries, focusing on monuments along the pilgrimage roads to Compostela in France and Spain.

ART H 455 Special Studies in Gothic Art and Architecture (3) Detailed study of Gothic architecture and its accompanying sculpture and stained glass, with special emphasis on the twelfth and thirteenth centuries in France and England. Offered jointly with ARCH 455. Entry card required.

ART H 459 Late Medieval Art of Germany and Central Europe (3) Painting, printmaking, sculpture, and architecture of the fourteenth and fifteenth centuries.

ART H 460 Netherlandish Art—Late Medieval and Renaissance (3) Arts and architecture of the northern and southern Netherlands from the last half of the fourteenth century through Pieter Bruegel.

ART H 461 Early Renaissance Painting in Italy (3) Painting of the fourteenth and fifteenth centuries in central and northern Italy.

ART H 462 High Renaissance Painting in Italy (3) Painting in central and northern Italy, from about 1480 to about 1530: Leonardo, Raphael, the early Michelangelo, Sarto, Correggio, Bellini, Giorgione, and the early Titian.

ART H 463 Italian Renaissance Sculpture (3) From Nicola Pisano to Giambologna.

ART H 464 Late Renaissance Painting in Italy (3) Painting in central and northern Italy, from about 1515 to about 1580: Pontormo, Rosso, Parmigianino, Beccafumi, the later Michelangelo, Vasari, Bronzino, Salviati, the later Titian, Tintoretto, and Veronese.

ART H 465 Italian Renaissance Architecture (3) From the cathedral of Florence to St. Peter's in Rome: the style, symbolism, and theory of architecture.

ART H 466 High Renaissance Painting in Venice (3) Painting in Venice, *circa* 1480 to *circa* 1580: Bellini, Carpaccio, Giorgione, Titian, Lotto, del Piombo, Tintoretto, and Veronese.

ART H 467 The German Renaissance (3) Painting, printmaking, sculpture, and architecture of the sixteenth century in Germany, Alsace, Austria, and Switzerland.

ART H 470 English Art, 1500-1800 (3) English art, principally painting, and, to a lesser extent, architecture. Emphasis on patronage, on the conditions that produced the decided peculiarities of English art, and on the final triumph of the native tradition.

ART H 471 Rome in the Seventeenth Century (3) Painting, sculpture, and architecture; concentration on Caravaggio, Bernini, Poussin, and Borromini.

ART H 472 French Art—Seventeenth Century (3) Painting, sculpture, and prints. Special attention given to relations with Italy and the lowlands.

ART H 473 Age of Rembrandt and Vermeer (3) Art of the Dutch Republic in the late sixteenth and seventeenth centuries, concentrating on painting, prints, and drawings.

ART H 474 Studies in American Colonial Art (3, max. 6) Architecture, town design, painting, sculpture, and decorative arts in the eastern and southwestern colonies from original European settlement until the Revolutionary War. Key figures and developments in English art and architecture. Content varies from quarter to quarter.

ART H 475 The Age of Rubens (3) Flemish art from the late sixteenth century to about 1650, concentrating on the sources, influence, and European cultural milieu of the art of Peter Paul Rubens.

ART H 476 French Art—Eighteenth Century (3) Painting, sculpture, and prints; emphasis on the successive phases of Rococo style and iconography and the emergence of Neoclassicism.

ART H 481 Romanticism (3) Romantic tendencies of the late eighteenth and early nineteenth centuries, with emphasis on stylistic and iconographic study of painting in Spain, England, Germany, France, and the United States to about 1830.

ART H 482 Realism and Impressionism (3) Art and the world, 1830-80: high Romanticism through Realism and Impressionism, with emphasis on painting in France.

ART H 483 Post-Impressionism to 1918 (3) Post-Impressionism and the great revolution of early twentieth-century art, with emphasis on painting. From the first revisions of Impressionism around 1880 to Fauvism, Cubism, Futurism, the Blaue Reiter, and Dadism.

ART H 484 Thematic Studies in Modern Art (3, max. 9) Approach to art of the nineteenth/twentieth centuries through thematic content. Focus varies from year to year: for example, development of landscape painting; treatment of the figure; woman in art; the crisis in portraiture.

ART H 485 Art Since World War I (3) Aspects of art in Europe and the United States 1918 to the present, from the point of view of style and iconography.

ART H 487 American Art From the Revolution to the Civil War (3) Painting, sculpture, and architecture during the federal and early industrial periods. Developments in printmaking, the decorative arts, and folk art.

ART H 488 American Architecture (3) American architecture from the seventeenth-century colonial period to the present. Emphasis on architects and buildings, including features of urban development.

ART H 489 Washington Architecture (3) History of architecture in Washington State from prepioneer days to the present. Broad perspective includes vernacular (popular, industrial, commercial) as well as fine architecture. Field trips encouraged.

ART H 491 Esthetics of Modern Architecture (3) Twentieth-century esthetic issues; artistic aims and accomplishments of particular individuals (e.g., Wright, Mies, Kahn, Ph. Johnson), effect of their art on trends in architecture, and conflicts that occur when artistic sensibilities of the individual are at odds with those of the public that the architect must please. Prerequisite: upper-division standing.

ART H 499 Individual Projects (3, max. 9) Prerequisite: permission of undergraduate adviser.

Courses for Graduates Only

Most 500-level courses are specialized seminars oriented to new research, intended for graduate students in art history, but open to others who possess the necessary qualifications. Since specific content varies, all students must obtain the permission of the instructor or the art history graduate coordinator.

ART H 500 Methods of Art History (5) Introduction to the specialized bibliography of art historical research and to the wide variety of approaches to art historical problems of all periods and regions.

ART H 501 Seminar in the General Field of Art (5, max.15)

ART H 511 Seminar in Chinese Art (5, max. 15) Critical appraisal of the principal research methods, theories, and types of literature dealing with the art of China.

ART H 515 Seminar in Japanese Art (5, max. 15) Critical appraisal of the principal research methods, theories, and types of literature dealing with the art of Japan.

ART H 521 Seminar in Indian Art (3, max. 9) Critical appraisal of the principal rsearch methods, theories, and types of literature dealing with the art of India.

ART H 531 Seminar in Tribal Art (5, max. 15) Methodological and cross-disciplinary problems in the visual arts of precolonial Africa, Oceania, and America. Specific content varies.

ART H 533 Seminar in North American Indian Art (5, max. 15) Problems in North American Indian visual arts. Content varies.

ART H 541 Seminar in Greek and Roman Art (3) *Langdon* In-depth study of selected topics and problems of the art of ancient Greece and Rome. Offered jointly with CL AR 541.

ART H 561 Seminar in Italian Renaissance Art (5, max. 15) Problems and in-depth study of selected topics of the art of the Italian Renaissance.

ART H 565 Seminar in North European Art (5, max. 15) Deals with problems of style and iconography of the northern European masters of the fourteenth through seventeenth centuries.

ART H 577 Seminar in Baroque Art (5, max. 15) Iconographic and stylistic problems of the art of the Baroque period, with emphasis on the principal research methods, theories, and types of literature dealing with the art of the seventeenth and eighteenth centuries in Europe.

ART H 581 Seminar in Modern Art (5, max. 15) Art-historical problems of the nineteenth and twentieth centuries.

ART H 590 Seminar in Criticism of Contemporary Art (5, max. 15) Contemporary art and appropriate critical methodology.

ART H 599 Reading and Writing Projects (2) Art historical issues, methods, and materials. Required of all graduate majors registered in 400-level art history courses. Open also to graduate nonmajors. May be repeated for credit.

ART H 600 Independent Study or Research (*)

ART H 700 Master's Thesis (*)

ART H 800 Doctoral Dissertation (*)

Asian American Studies

B501 Padelford

Asian American Studies is an interdisciplinary program designed to study and transmit the experience of persons of Asian descent in America. Instruction is offered in three areas: (1) a general survey and contemporary issues class on the history and culture of Asian Americans; (2) courses focused on specific Asian American groups; (3) special topics courses, as well as courses listed jointly with other departments. A General Studies degree in Asian American Studies and an Asian American Studies major and minor degree in education are available.

Faculty

Director

Tetsuden Kashima

Lecturer

Bacho, Peter, J.D., LL.M., 1983, Washington; law.

Kashima, Tetsuden,* Ph.D., 1975, California (San Diego); sociology.

Course Descriptions

Courses for Undergraduates

AAS 205 Asian American Cultures (5) A *Kashima* Asian American subcultures; evolution of Asian American cultures in the United States from 1850 to 1950—immigration patterns, evolution of subcultures, evacuation, interracial relations, assimilation, and signs of social disorganization. Not open to students who have taken GIS 305.

AAS 206 Contemporary Problems of Asian Americans (5) W Recent Asian American issues from 1950 to the present. Topics include ghetto communities, civil rights, identity problems and ethnicity, social organizations, political movements, bilingualism/biculturalism, and recent immigration.

AAS 305 Asian American Cultures for Teachers (5) Specially designed for teachers who wish to learn more about the history, culture, and current concerns of Asians in the United States. Implications for elementary and secondary school are considered. Not open to students who have taken 205 or GIS 305. Prerequisite: permission of instructor.

AAS 350 Chinese American History and Culture (3) Sp Experience of the Chinese in America from 1850 to the present. Transformation from an immigrant to Chinese American community: immigration patterns, anti-Chinese movements, ethnic sociopolitical and economic institutions, community issues, Chinese American culture. Prerequisite: 205 or equivalent or permission of instructor.

AAS 360 Filipino American History and Culture (3) Sp History and culture of the Filipino in America and the influence of an admixture of Filipino, Spanish, and American traditions on the Filipino immigrant and his or her descendants. Not open to students who have taken GIS 360. Prerequisite: 205 or permission of instructor.

AAS 370 Japanese American History and Culture (3) Sp *Kashima* Historical roots and subsequent changes in the Japanese American group examined through an interdisciplinary approach. Topics include historical events, culture, values, social and community structures, institutions, occupations, and future orientations. Prerequisite: 205 or equivalent or permission of instructor.

AAS 400 Asian American Literary Expression (5) Representative writings, essays, fiction, drama, and poetry by Asian Americans. The writer's role in a minority culture, the relation of literature to self and society, and the experiences and perceptions of the Asian American writer. Prerequisite: 205 or equivalent or permission of instructor.

AAS 442 Social Policy and the Asian American Community (5) Theoretical bases of a variety of social policies. Organizational and power structures in a variety of social institutions. Real-life examples enable students to see the implications of social policies for an ethnic community. Prerequisite: 205 or equivalent or permission of instructor.

AAS 443 Undergraduate Field Experience (3-5, max. 15) AWSpS *Kashima* Faculty-supervised practicum experience in a variety of community settings and agencies dealing with Asian Americans. Prerequisites: 205 or 206 or 442, or equivalent, and permission of instructor.

AAS 490 Asian American Studies—Special Topics (3, max. 9) AWSpS Prerequisite: 205 or permission of instructor.

AAS 499 Undergraduate Independent Study (1-5, max. 10) AWSpS Prerequisites: 205 or equivalent and permission of instructor.

Asian Languages and Literature

223 Gowen

The Department of Asian Languages and Literature offers instruction in the principal languages and literatures of Asia, including the Far East, Southeast Asia, and Central and South Asia. Emphasis is placed on the roles of these languages within the cultures they serve as well as on linguistic (particularly historic) and literary analysis. Several courses on Asian literature are offered in English for both majors and nonmajors.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: Chinese—55 credits in the language, 10 beyond third-year level, including CHIN 451; 10 credits in Chinese literature, excluding 499, 5 credits in Chinese linguistics, 5 credits in area-related humanities or social science courses. *Japanese*—45 credits in the language, 15 beyond second-year level; 30 credits in area-related humanities or social science courses, including a sequence in either Japanese literature or linguistics. *Korean*—45 credits in the language, 15 beyond second-year level; 30 credits in literature and area-related humanities or social science courses. *South Asian languages*—60 credits in languages, 45 in the major language, including 30 beyond first-year level, 15 in the minor language; 30 credits in area-related humanities or social science courses to be chosen in consultation with adviser, including HSTAS 201, 202, and ASIAN 401. *Thai*—45 credits in the language, 15 beyond second-year level; 20 credits in area-related humanities or social science courses to be chosen in consultation with adviser. *Tibetan*—55 credits in the language, including TIB 304, 305, 306, 307, 308, 309 (Colloquial Tibetan) and 18 credits in TIB 311, 312, 313, 411, 412, 413 (Literary Tibetan); 20 credits in area-related humanities or social science courses, including ASIAN 401, HSTAS 431, RELIG 450. *Turkic*—55 credits in the language, 10 credits beyond the second year including TKIC 301, 302, 303, 401, 402, 403, 411, 412, 413 (Uzbek), TKIC 304, 305, 306 (Kazakh), TKIC 341, 342, 343 (Uighur and/or Kirghiz and/or Tatar, etc.), TKISH 311, 312, 313; 20 credits in area-related humanities or social science courses, including 10 credits from literature, 10 credits from culture/history. Suggested courses: TKIC 363, SISRE 410, C LIT 496, SISRE 375, N E 210, HSTEU 439, HSTEU 444. Students intending to pursue graduate degrees should begin the study of Russian or German during their undergraduate programs.

Graduate Program

Jay Rubin, Graduate Program Coordinator

The Department of Asian Languages and Literature offers programs of study leading to the Master of Arts and Doctor of Philosophy degrees in a variety of East, Southeast, Central, and South Asian languages with disciplinary specialization in either literature or linguistics. These programs include Chinese, Japanese, Korean (M.A., linguistics only), Tibetan, Turkic, and South Asian languages (Sanskrit, Pali, Hindi, and Tamil). Buddhist studies, and instruction in other languages, such as Thai, Mongolian, and Manchu. The department does not offer study in language pedagogy.

The departments of History, Comparative Literature, and Linguistics and the Henry M. Jackson School of International Studies offer instruction complementary to that provided by the department. This includes study of the history and geography of a given area, its social and political institutions and systems of thought, methods and concepts of comparative literature, study of historical texts and textual criticism, and the methods and concepts of linguistic analysis.

Admission Requirements

Applicants for admission should present the equivalent of an undergraduate major in the language and literature of specialization. Students without such a background may be qualified for admission but will need initially to acquire the expected program prerequisites for graduate study.

Besides an application and two original sets of transcripts of prior postsecondary education, which are to be sent directly to Graduate Admissions, the department requires a statement of academic goals and three letters of recommendation addressed to the Graduate Program Coordinator.

Degree Requirements

The research component of the Master of Arts degree may be satisfied by the writing of either a thesis or two research papers. The Doctor of Philosophy degree requires a dissertation. In addition to the language of specialization, reading knowledge of a second (usually Western) language is required for the Master of Arts degree, and of a third (Asian) language for the Doctor of Philosophy degree. Neither English nor the student's native language may be used to fulfill these additional requirements.

Financial Aid

Financial assistance for students newly entering the department is limited and is awarded on a competitive basis. A small number of teaching assistantships in Chinese and Japanese are available to qualified graduate students. The Chester Fritz Endowment offers fellowship assistance to students for the study of Chinese. National Resource Fellowships are also awarded to graduate students for the study of Chinese, Japanese, Korean, Hindi, Tamil, Tibetan, and Uzbek.

Research Facilities

The East Asia Library, located in Gowen Hall, is one of the top ten in the nation and houses three hundred thousand volumes in East Asian languages. Resource material in South Asian studies is located in Suzzallo Library. Graduate students have the opportunity to further their language studies at the Inter-University Program for Chinese Language Studies in Taipei and the Inter-University Center for Japanese Language Studies in Tokyo, and they also may participate in the Chinese Language Program at Peking University through the Council on International and Educational Exchange language study program. The University also is affiliated with the American Institute of Indian Studies in New Delhi.

Correspondence and Information

Graduate Program Coordinator
223A Gowen, DO-21

Faculty

Chairperson

Harold F. Schiffman

Professors

Hawley, John S.,* Ph.D., 1977, Harvard; Hindi language and literature.

Knechtges, David R.,* Ph.D., 1968, Washington; Chinese literature.

Li, Fang-kuei (Emeritus), Ph.D., 1928, Chicago; Chinese.

McKinnon, Richard N.,* (Comparative Literature),† Ph.D., 1951, Harvard; Japanese literature.

Miller, Roy A.,* Ph.D., 1953, Columbia; Japanese language and linguistics.

Norman, Jerry L.,* Ph.D., 1969, California (Berkeley); Chinese language and linguistics.

Poppe, Nicholas N. (Emeritus), Ph.D., 1934, Leningrad; Altaic.

Potter, Karl H.,*‡ (Philosophy), Ph.D., 1955, Harvard; South Asia.

Rubin, Jay,* Ph.D., 1970, Chicago; Japanese literature.

Ruegg, David S.,* D.Litt., 1969, Paris; Indology, Tibetology, and Buddhist studies.

Schiffman, Harold F.,* (Anthropology, Linguistics), Ph.D., 1969, Chicago; Tamil language and linguistics.

Serruys, Paul L-M. (Emeritus), Ph.D., 1955, California (Berkeley); classical Chinese.

Shih, Vincent Y. C. (Emeritus), Ph.D., 1939, Southern California; Chinese.

Wang, Ching-Hsien,* (Comparative Literature),† Ph.D., 1971, California (Berkeley); Chinese literature.

Wilhelm, Hellmut (Emeritus), Ph.D., 1932, Berlin; Chinese.

Wylie, Turrell V.,* Ph.D., 1958, Washington; Tibetan language and literature.

Associate Professors

Brandauer, Frederick P.,* Ph.D., 1973, Stanford; Chinese language and literature.

Cirtautas, Ilse D.,* (Near Eastern Languages and Civilization), Ph.D., 1958, Hamburg; Turkic language and literature.

Cooke, Joseph R.,* (Anthropology and Linguistics), Ph.D., 1965, California (Berkeley); Thai language and literature.

Lukoff, Fred,* Ph.D., 1954, Pennsylvania; Korean language and linguistics.

Niwa-Kano, Tamako (Emeritus), Ph.D., 1956, Radcliffe; Japanese language.

Shapiro, Michael C.,* Ph.D., 1974, Chicago; Hindi language and linguistics.

Suh, Doo Soo (Emeritus), Ph.D., 1953, Columbia; Korean.

Tatsumi, Henry S. (Emeritus), M.A., 1935, Washington; Japanese.

Yen, Isabella Y. (Emeritus), Ph.D., 1956, Cornell; Chinese.

Assistant Professors

Boltz, William G.,* Ph.D., 1974, California (Berkeley); classical Chinese.

Salomon, Richard G.,* Ph.D., 1975, Pennsylvania; Sanskrit language and literature.

Treat, John Whittier,* Ph.D., 1982, Yale; Japanese language and literature.

Yue-Hashimoto, Anne O.,* Ph.D., 1966, Ohio State; Chinese language and linguistics.

Lecturer

Hsia, Huang-yi, B.S., 1953, National Taiwan University; Chinese.

Course Descriptions

Courses for Undergraduates

Altaic

ALTAI 401, 402, 403 Written Mongolian (3,3,3) A,W,Sp *Norman* Introduction to Mongolian written in the vertical script. Texts of different periods and genres. Prerequisite: permission of instructor. (Offered alternate years.)

ALTAI 405, 406, 407 Manchu (3,3,3) A,W,Sp *Norman* Introduction to Manchu, with principal focus on the structure of the language. Reading of texts of different genres. Prerequisite: permission of instructor. (Offered alternate years.)

Asian

ASIAN 401 Introduction to Asian Linguistics (5) A *Cooke, Schiffman, Shapiro* Linguistic analysis, with emphasis on the languages of East, Southeast, South, and Central Asia. Includes phonetics, phonemics, morphology, syntax lexicography, historical reconstruction, linguistic typology, and comparative grammar. Survey of major languages and language families of Asia. Diverse Asian languages used as subjects of linguistic analysis. No prior knowledge of linguistics is required. Prerequisite: two years of an Asian language or permission of instructor.

ASIAN 404 Writing Systems (3) Sp *Boltz, Salomon, Shapiro* Nature and development of writing systems. Alphabets, syllabaries, and logographic systems; relationship of writing systems to spoken languages; decipherment of previously undeciphered scripts. Prerequisite: 401 or equivalent or permission of instructor. (Offered even-numbered years.)

ASIAN 498 Special Topics (1-5, max. 15) AWSp Offered occasionally by permanent or visiting faculty members. Topics vary.

Chinese

CHIN 111, 112, 113 First-Year Chinese (5,5,5) A,W,Sp Introduction to the standard language. Emphasis on learning correct pronunciation and basic structure. Drill in oral use of the language. No credit for 111, 112 if 121 taken, or for 111, 112, 113 if 134 taken, or for 113 if 222 taken.

CHIN 121 Accelerated Chinese (10) A Covers same material as 111 and 112. In conjunction with 222 and 223, allows completion of two years' language study in one school year. No credit if 111, 112 taken.

CHIN 134 First-Year Intensive Chinese (15) S *Norman* Equivalent of 111, 112, 113. Introduction to the standard language; correct pronunciation and basic structure; drill in oral use of the language. Especially recommended for students (particularly graduate students) who plan to devote more time to other subjects during the regular academic year. No credit if 111, 112, 113 taken.

CHIN 211, 212, 213 Second-Year Chinese (5,5,5) A,W,Sp *Hsia, Norman* Continuation of 111, 112, 113. Advanced grammar and vocabulary expansion stressed. Oral practice and structural drills continued. No credit for 211 if 222 taken, for 212, 213 if 223 taken, or for 211, 212, 213 if 234 taken. Prerequisite: 113 or equivalent.

CHIN 222 Accelerated Chinese (10) W Covers same material as 113 and 211. In conjunction with 121 and 223, allows completion of two years' language study in one school year. No credit if 113, 211 taken. Prerequisite: 121 or equivalent.

CHIN 223 Accelerated Chinese (10) Sp Covers same material as 212 and 213. In conjunction with 121 and 222, allows completion of two years' language study in one school year. No credit if 212, 213 taken. Prerequisite: 222 or equivalent.

CHIN 234 Second-Year Intensive Chinese (15) S Equivalent of 211, 212, 213. No credit if 211, 212, 213 taken. Prerequisite: 113 or equivalent. (Offered Summer Quarter only.)

CHIN 280 The Chinese Novel in English (5) Sp *Brandauer* The Chinese novel from the Ming dynasty to the present. Readings in English translation. Literary values of works and their tradition. Historical and social contexts and thought and value systems of the Chinese.

CHIN 281 Literature in Modern China (5) A *Brandauer* Literature in China from the 1911 revolution to the present. May fourth literature, Taiwan literature, and post-1949 People's Republic of China literature. Readings in English translation.

CHIN 301, 302, 303 Advanced Chinese Conversation (5,5,5) A,W,Sp *C. N. Wang* Extensive practice in conversational Chinese, as if the students were in a native environment. Primarily for majors in Chinese language and literature and related fields. Prerequisites: 213 or equivalent, and permission of department.

CHIN 311, 312, 313 Third-Year Chinese (5,5,5) A,W,Sp *Yue-Hashimoto* Reading of unedited texts—newspaper articles, essays, short stories. Oral practice, composition, and listening comprehension. No credit if 334 taken. Prerequisite: 213 or equivalent.

CHIN 334 Third-Year Intensive Chinese (15) S Equivalent of 311, 312, 313. Reading of unedited texts—newspaper articles, essays, short stories. Oral practice and structural drill. No credit if 311, 312, 313 taken. Prerequisites: 213 or equivalent and permission of instructor.

CHIN 342 The Chinese Language (3) W *Norman, Yue-Hashimoto* (teaching alternate years) Nature and structure of the Chinese language, covering structural characteristics, genetic and typological affinity with other groups, sound system of standard Mandarin, Chinese writing system and language reforms, brief survey of the history of the Chinese language, and aspects of language in relation to culture. Prerequisite: 213 or equivalent.

CHIN 344 Intensive Chinese in Beijing (15) S *Beijing University Teaching Staff* Eight weeks of intensive instruction in modern Chinese, including readings in modern Chinese texts, oral conversation drill, an introduction to past and present Chinese culture, and weekly lectures on such topics as Chinese literature, art, economics, politics, and history. Informal visits with artists, writers, and scholars; weekend excursions to cultural and historic sites in and around Beijing; and a final two-week study tour of selected cities of north and east China. Prerequisite: permission of department.

CHIN 345 Spoken Chinese in Beijing (6, max. 18) AWSp *Beijing University Teaching Staff* Designed to increase active vocabulary, to enhance the student's understanding of Chinese grammar, to further the student's control of idiomatic Chinese, and, in general, to develop oral skills. Prerequisite: 313 or 344.

CHIN 346 Chinese Readings in Beijing (6, max. 18) AWSp *Beijing University Teaching Staff* General readings in textbooks prepared by Beijing University and specially selected readings in modern or traditional vernacular literature or in the social sciences. Prerequisite: 313 or 344.

CHIN 407 Chinese Reference Works and Bibliography (3) A *Lo* Introduction to the search of library information on Chinese studies through the use of basic reference works and modern library methods, with twenty-five percent of class time dealing with individual student's subject interest. Prerequisite: 313 or equivalent.

CHIN 415, 416, 417 Readings in Social Science Texts (5,3,3) A,W,Sp *Yue-Hashimoto* Readings of social science materials from contemporary China. Development of oral and writing skills. Student discussions. Prerequisite: 313 or equivalent.

CHIN 443 Structure of Chinese (3) Sp *Yue-Hashimoto* Outline of the major syntactic structures of Chinese. Focus on learning and teaching problems. Prerequisite: 313 or equivalent.

CHIN 451, 452, 453 First-Year Classical Chinese (5,5,5) A,W,Sp *Boltz* Selected texts of pre-Han literary works. Focus on systematic sentence analysis and distinctive functions of grammatical particles. To be taken in sequence. Prerequisite: 213 or equivalent for 451; 451 for 452; 452 for 453.

CHIN 481, 482, 483. Modern Chinese Literature (5,5,5) A,W,Sp *Brandauer* Modern literary texts in the original language, concentrating on the short story and the essay. Works studied come from May Fourth writers and from writers in the People's Republic of China and Taiwan. Literary, historical, and social significance with an introduction to bibliographic and reference resources. Prerequisite: 313 or equivalent.

CHIN 499 Undergraduate Research (3-5, max. 15) AWSpS For Chinese language and literature majors. Prerequisite: permission of instructor.

Hindi

HINDI 311, 312, 313 Elementary Hindi (5,5,5) A,W,Sp *Shapiro* Modern literary Hindi. Reading, writing, and conversation. Introduction to devanagari script.

HINDI 321, 322, 323 Intermediate Hindi (5,5,5) A,W,Sp *Hawley, Shapiro* Systematic expansion of vocabulary and grammar. Intermediate-level prose and poetry readings. Oral drills. Prerequisite: 313 or equivalent.

HINDI 401, 402, 403 Advanced Hindi (5,5,5) A,W,Sp *Hawley, Shapiro* Rapid reading of contemporary Hindi prose, poetry, and drama. Advanced conversation and composition. Prerequisite: 323 or equivalent.

HINDI 499 Undergraduate Research (3-5, max. 15) AWSpS Primarily for Hindi language and literature majors. Prerequisite: permission of instructor.

Indian

INDN 400 Practicum in South Asian Languages (3, max. 18) AWSp *Schiffman, Shapiro* Introduction to any one of various South Asian languages (e.g., Kannada, Nepali, Punjabi, Sinhala, Marathi, Telugu, Braj) not taught on a regular basis. Students may receive credit for more than one such language. Prerequisite: permission of instructor.

INDN 401, 402 Pali (3,3) W,Sp *Ruegg* Introduction to Pali language and literature. Prerequisite: SNKRT 401 or equivalent, or specialization in a relevant South/Southeast Asian language.

INDN 499 Undergraduate Research (3-5, max. 15) AWSpS Primarily for South Asian language and literature majors. Prerequisite: permission of instructor.

Japanese

JAPAN 111-112-113 First-Year Japanese (5-5-5) A,W,Sp *Treat* Introduction to modern Japanese conversation and grammar. Script, including three hundred Sino-Japanese characters, taught in 112 and 113. Prerequisite: permission of instructor.

JAPAN 134 First-Year Intensive Japanese (15) Equivalent of 111-112-113. Prerequisite: permission of instructor.

JAPAN 211-212-213 Second-Year Japanese (5-5-5) A,W,Sp Reading and translation of modern Japanese. Extensive memorization of Sino-Japanese characters and continued oral practice. Prerequisites: 113 or equivalent and permission of instructor.

JAPAN 234 Second-Year Intensive Japanese (15) S Equivalent of 211-212-213. No credit if 213 taken. Prerequisites: 113 or equivalent and permission of instructor.

JAPAN 311, 312, 313 Third-Year Japanese (3,3,3) A,W,Sp *Miller* Reading and translation of modern Japanese at a more advanced level. Prerequisite: 213 or equivalent for 311, permission of instructor for 312 and 313.

JAPAN 314, 315, 316 Advanced Japanese Conversation (2,2,2) A,W,Sp *Treat* Optional oral practice only for students currently enrolled in 311, 312, 313. Free conversation based on third-year materials; formal presentation in Japanese required of each student. Prerequisite: concurrent registration in third-year Japanese.

JAPAN 405, 406 History of the Japanese Language (3,3) W,Sp *Miller* Introduction to the history of Japanese, including phonology, morphology, syntax, and lexicon. Prerequisites: 213 or equivalent, and ASIAN 401. (Offered alternate years.)

JAPAN 431, 432, 433 Readings in Modern Japanese Literature (5,5,5) A,W,Sp *Rubin* Reading and discussion of selected modern literary texts in the original language, concentrating on the short story and novel. Close attention to grammar and syntax. Prerequisite: 313 or equivalent. (Offered alternate years.)

JAPAN 451, 452, 453 Readings in Japanese for China and Korea Specialists (5,5,5) A,W,Sp *Hiraga* Reading of scholarly prose on China and Korea. Past fifty years, with emphasis on grammar and style. Introduction to reference works useful to China and Korea specialists, and needs of the individual student. Prerequisites: 113; and (for China specialists) CHIN 313 and 453, or (for Korea specialists) permission of instructor. (Offered alternate years.)

JAPAN 461, 462, 463 Advanced Japanese Readings (5,5,5) A,W,Sp *Rubin* Directed readings and translation of modern Japanese prose selections in such fields as language, literaure, and the social sciences. Prerequisite: 313 or equivalent for 461; permission of instructor for 462 and 463..

JAPAN 471, 472 Classical Japanese Grammar (5,5) A,W Introduction to the classical grammatical forms and translation of classical literary texts. Prerequisites: 313 or equivalent for 471; 471 for 472.

JAPAN 473 Readings in Classical Japanese Literature (5) Sp Readings in prose, poetry, and drama, antiquity to nineteenth century. Prerequisite: 472.

JAPAN 499 Undergraduate Research (3-5, max. 15) AWSpS For Japanese language and literature majors. Prerequisite: permission of instructor.

Korean

KOR 301, 302, 303 Introduction to Korean (5,5,5) A,W,Sp *Lukoff, Staff* Fundamentals of the Korean language. Emphasis on Korean alphabet and spelling, pronunciation, and basic grammar.

KOR 304 Spoken Korean (10) S *Lukoff, Staff* The Korean language as spoken in ordinary conversational situations. Phonetic accuracy and appropriateness of idiom. May be taken any summer after completion of first-year Korean. Prerequisite: 303 or permission of instructor.

KOR 311, 312, 313 Introduction to Korean Writing in Mixed Script (5,5,5) A,W,Sp *Lukoff, Staff* Introduction to Chinese characters as used in Korean mixed script. Systematic expansion of vocabulary and grammatical forms of standard Korean. Prerequisite: 303 or equivalent.

KOR 411, 412, 413 Readings in Contemporary Korean (5,5,5) A,W,Sp *Lukoff* 411 completes the introduction to Korean writing in mixed script of 311, 312, 313. 412 and 413 provide experience in reading a variety of contemporary styles. Materials from published works include informal essays, short stories, one-act plays, academic essays, and newspaper editorials. Prerequisite: 313 or equivalent.

KOR 415 Social Science Literature in Korean (3) A *Lukoff* Readings in selections from contemporary Korean publications in social science topics. Prerequisite: 413 or equivalent.

KOR 416 Korean Narrative and Dramatic Literature (3) W *Lukoff* Linguistic features rather than purely literary qualities of modern Korean literature. Includes figures of speech and sophisticated linguistic expression. Prerequisite: 413 or equivalent.

KOR 417 Readings in Korean Journals (3) Sp *Lukoff* Selections from Korean newspapers, news magazines, and other journals. Topics from international and domestic affairs, including politics, business, and problems of everyday life. Prerequisite: 413 or equivalent.

KOR 499 Undergraduate Independent Study (3-5, max. 15) AWSpS For students who have completed 417 or equivalent. Prerequisite: permission of instructor.

Sanskrit

SNKRT 301, 302, 303 Introduction to Sanskrit (5,5,5) A,W,Sp *Salomon* Basic grammatical structure and vocabulary of the classical language; reading of elementary texts from the epic and classical periods written in the Devanagari script.

SNKRT 401, 402, 403 Intermediate Sanskrit (5,5,5) A,W,Sp *Salomon* Advanced classical grammar; rapid reading of a kāvya text or texts, ordinarily a drama or major verse work. Prerequisite: 303.

SNKRT 411, 412, 413 Advanced Sanskrit (5, max. 15; 5, max. 15; 5, max. 15) A,W,Sp *Salomon* Intensive reading and analysis of classical texts, chosen from the Śāstra or Kāvya literatures. Prerequisite: 403 or permission of instructor.

SNKRT 491, 492, 493 Vedic Studies (3,3,3) A,W,Sp *Salomon* Readings of selected Vedic texts, with linguistic, religious, and historical analyses. Includes extensive background material on Vedic religion, literature, and culture. Prerequisite: 303 or equivalent. (Offered alternate years.)

SNKRT 494 Readings in Religious Classics of India (5) Sp *Potter, Salomon* Introduction to the older religious literature, with emphasis on the Upanisads, the Dharmaśāstras, and the Bhagavad Gītā. Rapid reading of the texts, plus content analysis of the developing religious forms. Prerequisite: 402.

SNKRT 495 Studies in Indian Thought (3, max. 9) A *Ruegg* Religious and philosophical traditions in South Asia. The original documents studied vary from year to year. Prerequisite: ability to undertake the study of original documents.

SNKRT 499 Undergraduate Research (3-5, max. 15) AWSp Primarily for Sanskrit language and literature majors. Prerequisite: permission of instructor.

Tamil

TAMIL 311, 312, 313 Elementary Tamil (5,5,5) A,W,Sp *Schiffman* Introduction to the modern spoken language; emphasis on basic sentence types and transformation drills. The writing system and literary dialect are introduced.

TAMIL 321, 322, 323 Intermediate Tamil (5,5,5) A,W,Sp *Schiffman* Intensified use of the modern spoken language, beginning with moderately difficult conversation and drills, and working up to more advanced materials. Continuation of work with written language. Prerequisite: 313 or equivalent.

TAMIL 401, 402, 403 Advanced Tamil (5,5,5) A,W,Sp *Schiffman* Readings in modern literary Tamil, including the modern novel and short story. Work with radio plays in the colloquial dialect. Prerequisite: 323 or equivalent.

TAMIL 455 Structure of Dravidian (3) *Schiffman* Comparative analysis of the phonological and syntactic systems of the major Dravidian languages.

TAMIL 499 Undergraduate Research (3-5, max. 15) AWSpS Primarily for Tamil language and literature majors. Prerequisite: permission of instructor.

Thai

THAI 301, 302, 303 Basic Thai (5,5,5) A,W,Sp *Cooke* Introduction to modern spoken and written Thai. Emphasis on spoken language competence with additional skills in elementary reading and spelling.

THAI 401, 402, 403 Intermediate Thai (5,5,5) A,W,Sp *Cooke* Short stories; articles on Thai history, geography, culture, politics, economics, etc. Primary emphasis on reading, translation, comprehension, and grammar. Prerequisite: 303.

THAI 411, 412, 413 Readings in Thai (5,5,5) A,W,Sp *Cooke* Advanced reading and translation of selections from various Thai authors, with occasional practice in conversation and composition. Prerequisite: 403.

THAI 499 Undergraduate Research (3-5, max. 25) AWSpS For Thai language and literature majors. Prerequisite: permission of instructor.

Tibetan

TIB 304, 305, 306 Colloquial Tibetan (5,5,5) A,W,Sp *Nomang* Introduction to phonology, morphology, and syntax of spoken Tibetan, Lhasa dialect. (Offered alternate years.)

TIB 307, 308, 309 Intermediate Colloquial Tibetan (5,5,5) A,W,Sp *Nomang* Instruction and drill in advanced colloquial sentence patterns and syntactical constructions. Prerequisite: 306 or equivalent. (Offered alternate years.)

TIB 311, 312, 313 Literary Tibetan (3,3,3) A,W,Sp *Wylie* Introduction to the phonology, grammar, and syntax of written Tibetan. Materials selected for rapid development of reading knowledge.

TIB 407, 408, 409 Advanced Colloquial Tibetan (5,5,5) A,W,Sp Advanced instruction and practice in colloquial Tibetan, Lhasa dialect, intended to build on previous oral-aural experience and increase fluency in the modern spoken language. Prerequisite: 309 or equivalent.

TIB 411, 412, 413 Readings in Tibetan (3,3,3) A,W,Sp *Wylie* Selections from various Tibetan materials. Prerequisite: 313 or equivalent.

TIB 415, 416, 417 Readings in Tibetan Literature (3,3,3) A,W,Sp Reading of selections from Tibetan philosophical literature. May be taken in any sequence. Prerequisite: 413 or permission of instructor.

TIB 499 Undergraduate Research (3-5, max. 15) AWSpS For Asian languages and literature majors. Prerequisite: permission of instructor.

Turkic

TKIC 301, 302, 303 Introduction to Uzbek (3,3,3) A,W,Sp *Cirtautas* Introduction to the modern written and spoken language.

TKIC 304, 305, 306 Introduction to Kazakh (3,3,3) A,W,Sp *Cirtautas* Position of Kazakh within the community of other Turkic languages; alphabets used for Kazakh; grammar; reading of texts from the Soviet Union and China (Sinkiang); exercises. Prerequisite: 303 or permission of instructor.

TKIC 341, 342, 343 Introduction to a Second Turkic Language of Central Asia (3,3,3) A,W,Sp *Cirtautas* Introduction to phonology, morphology, and syntax of such languages as Kirghiz, Tatar, Turkmen, Uighur, or Azerbaijani. Prerequisite: permission of instructor.

TKIC 363 Oral Literature of the Turkic Peoples of Central Asia I: The Heroic Epos (3) A *Cirtautas* Representative heroic poems of Central Asian Turkic peoples now living in the USSR. Origin of the heroic epos, its relation to the romantic epos and other oral literary genres. Art of the singer and his role in nomadic Turkic society. Emphasis on Manas, the monumental epos of the Kirghiz.

TKIC 401, 402, 403 Intermediate Uzbek (3,3,3) A,W,Sp *Cirtautas* Continuation of 301, 302, 303. Oral work, grammar, and readings in Uzbek literature. Prerequisite: 303 or permission of instructor.

TKIC 404 Introduction to Turkic Studies (3) A *Cirtautas* Introduction to the bibliography, problems, and methods of research in the field of Turkic studies (language, literature, and ethnography of past and present Turkic peoples).

TKIC 411, 412, 413 Advanced Uzbek (3,3,3) A,W,Sp *Cirtautas* Continuation of 401, 402, 403. Readings from selected Uzbek writers. Prerequisite: 403 or equivalent.

TKIC 499 Undergraduate Research (3-5, max. 15) AWSpS For Turkic language and literature majors. Prerequisite: permission of instructor.

Literature Courses in English

ASIAN 263 Great Works of Asian Literature (5) Sp *Brandauer* Selected major works of Asian literature. Taught on a rotational basis with the literary traditions of China, Japan, India covered in successive years. Content varies depending on specialization and interest of instructor. Primary emphasis on literary values of works and their tradition; attention also given to historical and social contexts and the thought and value systems of the culture involved.

CHIN 293 Introduction to Literature and Ideas in China (5) Sp *Knechtges* Basic concepts of Chinese thought (Confucianism, Taoism, and Buddhism) as reflected in philosophical writings and literature. Focus on a single idea (e.g., human nature) for an entire quarter. In English; no previous course work on China required.

INDN 420 Classical Indian Literature in English (5) A *Salomon* Major classical works in Indian literature, both South and North, up to the thirteenth century: epics, dramas, and lyrics. Major themes, their philosophical and religious backgrounds, and correlation with music and the visual arts.

INDN 421 Modern Indian Literature in English (5) W *Hawley* Major works in Indian literature from the medieval period onward, considered against their cultural background. Special attention to medieval lyrics and other forms of the modern period, especially novels and short stories.

JAPAN 321 Japan in Literature and Film: I (5) A *Rubin* Literary history of Japan from the eighth to the late twelfth centuries, with readings in *The Tale of Genji* and other major works of the imperial court, plus films reflecting the architecture, life, and natural milieu of classical Japan.

JAPAN 322 Japan in Literature and Film: II (5) W *Rubin* Literary history of Japan from the thirteenth to early nineteenth centuries, with readings from Zen-influenced warrior culture, Edo townsman culture, plus films on the Nō, Bunraku puppet, and Kabuki theaters. Recommended: 321.

JAPAN 323 Japan in Literature and Film: III (5) Sp *Rubin* Literary history of Japan in the modern period, with readings in the major novelists on the clash of cultures, the generational struggle, war, and the search for inner peace, plus films that portray these themes and reflect the variety of modern Japanese life. Recommended: 321, 322.

JAPAN 425 The Japanese Novel in English (5) A *McKinnon* Close examination and discussion of several classical and modern Japanese novels, with emphasis on theme and internal structure and their relationship to the Japanese prose tradition. Prerequisites: 321, 322, 323, or permission of instructor.

JAPAN 426 Japanese Poetry in English (5) W *McKinnon* The *waka* tradition: its sources, developments, and deviations, including *Haiku*; poetic theory and criteria and their significance for the Japanese literary vision, both ancient and modern. Prerequisites: 321, 322, 323, or permission of instructor.

JAPAN 427 Japanese Drama in English (5) Sp *McKinnon* Examination of the Nō, Kyogen, Joruri, and Kubuki forms, with particular emphasis on the interrelationship of lyrical, narrative, and dramatic elements in the Japanese theater tradition. Prerequisite: 321, 322, 323, or permission of instructor.

Courses for Graduates Only

Altaic

ALTAI 579 Comparative Altaic Linguistics (3) *Norman* Comparative phonology and morphology of Mongolian, Turkic, and other Altaic languages. Offered jointly with LING 579. Prerequisite: permission of instructor.

Asian Languages and Literature

ASIAN 585 Seminar in Buddhism (3, max. 27) AWSp *Ruegg* Systems of Buddhist thought with special reference to their technical terminology. Original sources are used. Combines the methods of specialists in South, Central, and East Asian Buddhism with those of historians of religion and philosophy. Prerequisite: permission of instructor.

ASIAN 600 Independent Study or Research (*) AWSpS

ASIAN 700 Master's Thesis (*) AWSpS

ASIAN 800 Doctoral Dissertation (*) AWSpS

Chinese

CHIN 540 Seminar on Chinese Linguistics (3, max. 9) WSp *Norman* Problems of Old and Middle Chinese phonology; dialectology. Prerequisites: 453 and ASIAN 401.

CHIN 543 Texts in Ancient Script (3) Sp *Boltz* Current research in the origin and development of the Chinese writing system and the structure of Chinese characters. Readings in texts written in ancient scripts, with special attention to grammatical and phonological problems related to graph identification and analysis. Topics vary among *shuo wen* studies, bronze inscriptions, and "oracle" bone inscriptions. Prerequisites: five quarters of classical Chinese and ASIAN 401. (Offered alternate years.)

CHIN 551, 552 Second-Year Classical Chinese (5,5) A,W *Boltz* Continuation of 451, 452, 453. Problems of textual criticism and grammar. 551: focus on early Chou texts. 552: focus on texts of Han times. Prerequisite: 453 or equivalent for 551, 551 for 552.

CHIN 553 Introduction to Chinese Philology (5) Sp *Boltz* Philological principles and methods in the study of Han and pre-Han texts. Specific texts vary. Prerequisites: five quarters of classical Chinese and ASIAN 401. (Offered alternate years.)

CHIN 554, 555, 556 Readings in Chinese Prose (5,5,5) A,W,Sp *Knechtges* 554: selected readings in the *fu* of the Han, Wei, Jin, and North-South Dynasties period. 555: selected readings in parallel prose (*pianti wen*.) 556: selected readings in *guwen* prose of the Tang and Song periods. Recommended: 551, 552. (Offered alternate years.)

CHIN 560 Proseminar in Chinese (3-5) AWSp *Knechtges* Methods and materials in the study of Chinese texts. Problems in textural analysis and Chinese literary history. Prerequisites: 553 and one of 554, 555, and 556.

CHIN 561, 562, 563 Studies in Chinese Literature (5,5,5) A,W,Sp *Wang* 561: literature of the Chou and Han periods. 562: literature from Wei to T'ang times. 563: literature since the end of T'ang. Prerequisite: permission of instructor.

CHIN 564, 565, 566 History of Chinese Literature (5,5,5) A,W,S *Knechtges* Methods and materials in Chinese literary history: 564: earliest times to Tang; 565: Tang through Song; 566: Yuan to twentieth century. Recommended: 551, 552 for 564; 564 for 565, 565 for 566.

CHIN 573 Seminar in Chinese Poetry (5, max. 15) A *Wang* Directed study of selected works of poetry. Subject emphasis varies each year. Prerequisite: permission of instructor.

CHIN 580 Readings in Vernacular Chinese Fiction (5, max. 15) A *Brandauer* Readings and discussion of traditional vernacular texts. Emphasis on Sung, Yuan, and Ming short stories, such as those found in the *San-yen* collections; and on Ming and Ch'ing full-length novels, such as the *Shui-hu chuan, Hsi-yu chi*, and *Hung-lou meng*. Prerequisite: permission of instructor.

CHIN 582 Seminar in Chinese Fiction (5, max. 15) W *Brandauer* Directed study of selected works of fiction, focusing on the vernacular short story and novel. Prerequisite: permission of instructor.

CHIN 583 Seminar in Modern Chinese Literaure (5) Sp *Brandauer* Directed study of selected works of modern Chinese literature. Primary focus on the novel, short story, and essay. Recommended: 281, 482.

CHIN 591, 592, 593 Studies in the History of Chinese Thought (5,5,5) A,W,Sp *Chan, Knechtges* Directed readings in selected traditional philosophical texts (*Chuang-tzu, Han-fei-tzu, Lun-heng, Shih-shuo hsin-yu*), and documents of political thoughts and institutions. Subject emphasis varies each quarter. Prerequisite: permission of instructor.

Hindi

HINDI 501, 502, 503 Studies in Medieval Hindi Literature (3,3,3) A,W,Sp *Hawley* Representative readings in medieval Hindi literature. Works by varying authors emphasized in different years. Prerequisite: 403 or equivalent.

HINDI 510 Structure of Hindi (3) *Shapiro* Grammatical analysis of Hindi, phonology, syntax, and semantics. Readings from both Western and native grammarians. Prerequisite: 403 or permission of instructor. Recommended: course in linguistics.

Indian

INDN 530 Readings in Pali Literature (3, max. 18) AWSp *Ruegg* Reading and interpretation of intermediate and advanced texts in Pali, dealing with the Theravada countries of South and Southeast Asia (Sri Lanka, Burma, Thailand, etc.). Prerequisite: 402 or equivalent.

Japanese

JAPAN 501 Readings in Bibliographical Materials (5) Sp Intensive reading and discussion of materials from principal bibliographical sources in the social sciences and the humanities pertaining to Asia. Reports on selected topics and problems. Prerequisite: permission of instructor.

JAPAN 505, 506, 507 Readings in Documentary Japanese (5,5,5) A,W,Sp *Hiraga* 505: introduction to Kambun. 506: readings in documents of ancient and medieval periods. 507: readings in documents since the beginning of the Tokugawa period. Prerequisite: permission of instructor. (Offered alternate years.)

JAPAN 531, 532, 533 Advanced Readings in Modern Japanese Literature (5,5,5) A,W,Sp *Treat* Rapid reading of modern literary texts; discussion of style, content, and problems of literary translation. Prerequisite: 433 or equivalent.

JAPAN 540 Seminar on Japanese Linguistics (3, max. 9) *Miller* Problems in the history and structure of the Japanese language. Topics vary each quarter, according to the needs and interests of the students. Prerequisites: 405 and 406, or permission of instructor.

JAPAN 561 Classical Japanese Theatre (5) A *McKinnon* Major Japanese theatrical traditions and related folk theatre traditions. Individual works as literature and as theatre. Study of classical Japanese theatre: Nō, Kyogen. Prerequisite: 473.

JAPAN 562 Popular Japanese Theatre (5) W *McKinnon* Major Japanese theatrical traditions and related folk theatre traditions. Individual works as literature and as theatre. Popular theatre forms: Kabuki, Bunraku, and related folk art forms. Prerequisite: 473.

JAPAN 563 Twentieth-Century Japanese Theatre (5) Sp *McKinnon* Major Japanese theatrical traditions and related folk theatre traditions. Individual works as literature and as theatre. Twentieth-century Japanese theatre and films. Prerequisite: 473.

JAPAN 571, 572, 573 Advanced Readings in Classical Japanese Literature (5,5,5) A,W,Sp Continued readings in classical literary texts. Prerequisite: 473 or permission of instructor.

JAPAN 590 Seminar in Japanese Literature (5, max. 15) AWSp Close examination of selected periods, writers, or genres, including problems of literary criticism in Japanese literature. Prerequisite: permission of instructor.

Korean

KOR 501, 502, 503 Seminar in Korean Linguistics (3-5, 3-5,3-5) A,W,Sp *Lukoff* Topics in Korean linguistics. For majors in Korean language and literature or linguistics. Prerequisites: background in linguistics and permission of instructor.

Sanskrit

SNKRT 550 Seminar on Sanskrit Literature (3, max. 9) *Salomon* Close examination of selected authors, periods, or traditions, within the context of Indian literary history. Prerequisite: 403 or permission of instructor.

SNKRT 555 Seminar on Sanskrit Grammar (3, max. 6) *Salomon* Selected problems relating to the history of the Sanskrit language; reading and critical examination of the methodology of Panini's grammar. Prerequisite: 403 or permission of instructor. (Offered alternate years.)

SNKRT 560 Readings in Philosophical Sanskrit (3, max. 9) AWSp *Potter, Ruegg, Salomon* Intensive reading and analysis of Hindu or Buddhist philosophical texts. Prerequisite: 494 or permission of instructor.

SNKRT 581, 582 Readings in Buddhist Texts (3, max. 9; 3, max. 9) W,Sp *Ruegg* Interpretation of original sources. Texts vary from year to year. Prerequisites: ability to study sources in the original languages and an introduction to Buddhist thought.

Tamil

TAMIL 501, 502, 503 Studies in Tamil Literature (3,3,3) A,W,Sp *Schiffman* Introduction to Tamil literature, beginning with Sangam poetry and culminating in modern post-independence fiction. Prerequisite: 403 or permission of instructor.

Tibetan

TIB 511, 512, 513 Advanced Literary Tibetan (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp *Wylie* Reading of manuscripts and xylographs with emphasis on biographical, historical, and geographical material. Prerequisite: 413 or equivalent.

TIB 531, 532, 533 Buddhist Tibetan (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp *Ruegg* Reading and analysis of Tibetan Buddhist texts and associated literature. Selections vary each quarter and may be taken out of sequence. Prerequisite: 413 or permission of instructor.

Turkic

TKIC 542, 543 Comparative and Historical Grammar of Turkic Languages (3,3) W,Sp *Cirtautas* Classification of the Turkic languages; alphabets used; phonology, morphology, and syntax; lexical composition; structure changing developments. Prerequisites: 303 and 404, or TKISH 103.

TKIC 546 Old Turkic (3) W *Cirtautas* Introduction to Runic script; phonology, morphology, and syntax of the oldest form of Turkic; reading and translation of eighth-century inscriptions of historical and literary importance. Prerequisite: permission of instructor.

TKIC 547 Old Uighur (3) Sp *Cirtautas* Introduction to script systems; phonology, morphology, and syntax. Reading and translation of mainly Buddhist texts in Uighur script, eighth through eleventh centuries. Prerequisite: background in a Turkic language or permission of instructor.

TKIC 561, 562 Middle Turkic (3,3) A,W *Cirtautas* Introduction to the phonology, morphology, and syntax of the Middle Turkic languages; reading and translation of texts in Karakhanid, Khorazmian Turkic, Kipchak, and Chagatai. Prerequisite: permission of instructor.

TKIC 563 Seminar on Turkic Literature (5) Sp *Cirtautas* Topics in oral and written literature. Prerequisite: permission of instructor.

Astronomy

260 Physics

Modern research in astronomy and astrophysics encompasses a large number of disciplines and specialties, and the faculty members of the Department of Astronomy are active in most of these areas. Research areas of the department include planetary astronomy, stellar structure and evolution, interstellar matter, x-ray sources, galactic structure, extragalactic astronomy, quasars and galactic nuclei, and observational cosmology. The department operates a thirty-inch telescope at the Manastash Ridge Observatory near Ellensburg, is a vigorous user of national optical and radio observatories in both northern and southern hemispheres, and is now constructing its own large telescope. In addition, faculty members are frequent users of satellite instruments, such as the *International Ultraviolet Explorer*, and will be closely involved with the *Space Telescope*, scheduled for launch in 1986. Undergraduate majors often assist faculty members in acquisition, reduction, and interpretation of data.

Undergraduate Program

Bachelor of Science Degree

Major Requirements: ASTR 321, 322, 323; 431, 432, 433, or nine units of other astronomy 400- or 500-level courses; PHYS 121, 122, 123; 131, 132, 133; 224, 225, 226; 321, 322, 334, 335; MATH 124, 125, 126, 238; 327, 328; 205 or 302; 9 additional credits in courses at the 300 level or above in physics or related fields, approved by adviser (PHYS 323, 324, 325; 421, 424, 425, 426 recommended for students planning to do graduate work in astronomy); junior year (survey) and senior year (research) papers recommended as ASTR 499 projects, with emphasis on the senior paper for students planning graduate work. For those not planning on graduate study, a program directed toward applied science also is available. No grade lower than 2.0 is acceptable in courses fulfilling the above requirements. Undergraduates interested in advanced work in astronomy may wish to take a double major in astronomy and a related field, such as physics. Undergraduates interested in immediate employment at an observatory or other scientific institution should include computing and electronics courses as part of their program.

Graduate Program

Karl-Heinz Bohm, Graduate Program Coordinator

Master of Science, Doctor of Philosophy Degrees

A series of graduate courses in solar system, stellar, galactic, and extragalactic astrophysics is offered. Because astronomy study depends on the fundamentals of physics, a minimum of 24 credits in physics is required for a doctorate. The student is allowed much flexibility in the planning of a program of study.

The heart of the graduate program is the collaboration of student and faculty members in research at the frontiers of current knowledge in astronomy. At first, the student usually works under the close supervision of a faculty member to develop the techniques and insight necessary for successful research. The student's thesis research may use observational material obtained by using the facilities of either the University of Washington or one of the national observatories, or the thesis preparation may involve analysis and interpretation of existing material. Alternatively, the student may do a purely theoretical thesis. Active research programs are being carried out in the area of stellar interiors, stellar atmospheres, planetary atmospheres and surfaces, theory of convection, x-ray sources, interplanetary dust, extragalactic astronomy, radio astronomy, interstellar matter, cosmology, and relativistic astrophysics.

Special Research Facilities

Research facilities operated by the department include the thirty-inch telescope of the Manastash Ridge Observatory, located near Ellensburg. It is equipped with a photometer, spectrograph, and image-tube camera, and a computer is used for on-line data analysis. Students also have access to a variety of national facilities, such as the Kitt Peak and Cerro Tololo Observatories, the Arecibo Observatory, and the Very Large Array. In collaboration with faculty members, graduate students conduct research using satellite facilities such as the *International Ultraviolet Explorer* and the Einstein Observatory. The department is part of a consortium now constructing a 3.5-meter telescope on Sacramento Peak in New Mexico, and is involved in instrument design for the *Space Telescope*. Available for theoretical research and data analysis are a CDC Cyber computer of the University's Computer Center and a large VAX computer shared between the departments of Physics and Astronomy.

Admission Qualifications

Entering students are not required to have a background in astronomy, although some knowledge of general astronomy is expected of those to whom a teaching assistantship is to be offered. Undergraduates interested in graduate work in astronomy are urged to concentrate primarily on their preparation in physics and mathematics. One foreign language, usually German, French, or Russian, is required for an advanced degree in astronomy.

Assistantships

A number of teaching assistantships, primarily in the elementary astronomy courses, and research assistantships are available.

Correspondence and Information

Graduate Program Coordinator
260 Physics, FM-20

Faculty

Chairperson

Bruce H. Margon

Professors

Balick, Bruce,* Ph.D., 1971, Cornell; radio astronomy, ionized nebulae, peculiar galaxies.

Bohm, Karl-Heinz,* Ph.D., 1954, Kiel (Germany); stellar atmospheres, theory of convection, star formation.

Bohm-Vitense, Erika K.,* Ph.D., 1951, Kiel (Germany); stellar atmospheres, magnetic stars.

Boynton, Paul E.,* (Physics),† Ph.D., 1967, Princeton; high-energy astrophysics, infrared astronomy, x-ray sources.

Brownlee, Donald E.,* Ph.D., 1971, Washington; origin of the solar system, comets, interplanetary dust.

Hodge, Paul W.,* Ph.D., 1960, Harvard; extragalactic astronomy, interplanetary dust.

Jacobsen, Theodor S. (Emeritus), Ph.D., 1926, California (Berkeley); astronomy.

Margon, Bruce H.,* (Physics), Ph.D., 1973, California (Berkeley); galactic and extragalactic x-ray astronomy, optical counterparts of x-ray sources.

Wallerstein, George,* Ph.D., 1958, California Institute of Technology; chemical composition of stars, peculiar stars, interstellar matter.

Associate Professor

Sullivan, Woodruff T.,* Ph.D., 1971, Maryland; radio astronomy, galactic and extragalactic structure, history of astronomy.

Course Descriptions

Courses for Undergraduates

ASTR 101 Astronomy (5) Introductory study of universe and objects in it with emphasis on conceptual, as contrasted with mathematical, comprehension. Modern theories, observations, and ideas concerning nature and evolution of galaxies, quasars, stars, black holes, planets, and solar system. No credit is given students who have taken 102 or 201.

ASTR 102 Introduction to Astronomy (5) Introduction to astronomy for students who have had high school physics or the equivalent introduction to physics at the college level. No credit for students who have taken 101, 201, or 301. Prerequisites: one year of high school physics or PHYS 101-102 or PHYS 110, 111, 112.

ASTR 110 Cosmology: A Cosmic Perspective (3) Historical discussion of man's continuing quest for an understanding of the physical universe. Emphasis on appreciation of modern cosmological ideas in the context of Greek and Renaissance thought, as well as current scientific concepts of the structure and evolution of our expanding universe. No credit for students who have taken 201.

ASTR 150 The Planets (5) For liberal arts and beginning science students. Survey of the planets of the solar system, with emphases on recent space exploration of the planets and on the relationship of man and his earth to the other planets.

ASTR 190 Modern Topics in Astrophysics for Science or Non-Science Majors (3) Topics of current interest, such as origin of chemical elements, novae and supernovae, white dwarfs, neutron stars, black holes, active galaxies, quasars, or interstellar medium and astrochemistry. Choice of topics depends on instructor and class interest. Prerequisite: 5 credits of astronomy courses at the 100 or 200 level or permission of instructor.

ASTR 201 The Universe and the Origin of Life (5) Sequel to 101 or 102, emphasizing modern views of the atomic and molecular evolution of the universe from the initial "big bang" through the formation of the solar system and the emergence of biologic forms on the earth. The latter part of the course considers questions about the existence of, and communication with, extraterrestrial intelligent life, and finally the ultimate fate of the cosmos. Prerequisite: 101 or 102, or PHYS 110 or 114 or 121. No credit for students who have taken 110.

ASTR 301 Astronomy for Scientists and Engineers (3) Introduction to astronomy for students in the physical sciences or engineering. Topics similar to 101, but the approach uses more mathematics and physics. Prerequisite: PHYS 123.

ASTR 321 The Solar System (3) A Solar system; planetary atmospheres, surfaces and interiors, the moon, comets. The solar wind and interplanetary medium. Formation of the solar system. Prerequisites: PHYS 224, 225, 226, or equivalent.

ASTR 322 The Contents of Our Galaxy (3) W Introduction to astronomy. Basic properties of stars, stellar systems, interstellar dust and gas, and the structure of our galaxy. Prerequisites: PHYS 224, 225, 226, or equivalent.

ASTR 323 Extragalactic Astronomy and Cosmology (3) Sp Galaxies, optical and radio morphology and properties. Clusters of galaxies, the red shift controversy, radio sources, and quasars. Observational cosmology. Prerequisites: 101 or 102 or 322, and PHYS 224, 225, 226, or equivalent.

ASTR 431 Stellar Spectra (3) A Basic discussion of the structure of stellar atmospheres and spectroscopic abundance analysis. Prerequisites: 101 or 102 or 322, and PHYS 224, 225, 226.

ASTR 432 Stellar Structure and Evolution (3) W Theory of stellar structure, energy sources, and stellar evolution. Observational tests. Prerequisites: 101 or 102 or 322, and PHYS 224, 225, 226, or equivalent.

ASTR 433 Interstellar Material (3) Sp Interstellar gas, temperature, density, and ionization. Interstellar molecules. Properties of interstellar dust. Active galactic nuclei and quasar spectra and their interpretation. Prerequisites: 101 or 102 or 322, and PHYS 224, 225, 226 and 421.

ASTR 497 Topics in Current Astronomy (1-3) Recent developments in one field of astronomy or astrophysics. Prerequisite varies according to the subject matter.

ASTR 499 Undergraduate Research (*, max. 15) AWSp Special astronomical problems and observational projects, by arrangement with instructor. Prerequisite: permission of instructor.

Courses for Graduates Only

ASTR 500 Seminar in Elementary Astronomy Instruction (1, max. 5) Seminar in the preparation of lecture and workshop materials with emphasis on demonstration and visual aids, and on evaluation of students' progress.

ASTR 507 Physical Foundations of Astrophysics I (3) Thermodynamics from an astronomer's point of view: black body radiation, basic radiative transfer, equation of state, degenerate gases, crystallization of high density, introduction to hydrodynamics and gas dynamics for astronomers: turbulence, convection, shock waves, radiation gas dynamics.

ASTR 508 Physical Foundations of Astrophysics II (3) Introduction to magnetohydrodynamics, basic theorems and application to stellar and interstellar magnetic fields. Introduction to plasma physics, waves in a plasma, kinetic theory and transport phenomena in astrophysics. Prerequisite: PHYS 513 or equivalent.

ASTR 511 Galactic Structure (3) Kinematics, dynamics, and contents of the galaxy. Spiral structure. Structure of other galaxies. Evolution of galaxies.

ASTR 512 Extragalactic Astronomy (3) Types of galaxies. Integrated properties, content, and dynamics. Extragalactic distance scale, groups and clusters. Radio sources. Observational cosmology.

ASTR 513 Cosmology (3) Homogeneous isotropic models. Microwave and x-ray background radiation, radio galaxies, quasars. Nucleosynthesis, galaxy formation.

ASTR 521, 522 Stellar Atmospheres (3,3) Theory of continuous radiation and spectral line formation. Applications to the sun and stars. Prerequisite: PHYS 421 or equivalent.

ASTR 523 Solar Physics (3) Sun as a star, solar photosphere and outer convection zone, granulation and related phenomena, solar chromosphere, and corona, solar activity (especially sunspots and solar flares), sun's radio emission, solar-terrestrial relations. Prerequisite: 521.

ASTR 531 Stellar Interiors (4) Physical laws governing the temperature, pressure, and mass distribution in stars. Equation of state, opacity, nuclear energy generation. Models of main sequence stars. Prerequisite: PHYS 421 or equivalent.

ASTR 532 Stellar Evolution (3) Theoretical and observational approaches to stellar evolution. Structure of red giants and white dwarfs. Prerequisite: 531.

ASTR 541 Interstellar Matter (3) Physical conditions and motions of neutral and ionized gas in interstellar space. Interstellar dust, magnetic fields, formation of grains, clouds, and stars. Prerequisite: modern physics or permission of instructor.

ASTR 555 Planetary Atmospheres (3) A Problems of origin, evolution, and structure of planetary atmospheres, emphasizing elements common to all; roles of radiation, chemistry, and dynamical processes; new results on the atmospheres of Venus, Mars, Jupiter, and other solar system objects in the context of comparative planetology. Offered jointly with ATM S 555 and GPHYS 555.

ASTR 556 Planetary Surfaces (3) Comparison of surface processes and conditions on Mercury, Venus, earth, moon, Mars, asteroids, and satellites of the great planets. Emphasis on understanding how and why planetary surfaces differ from one another and the implied course of solar-system evolution. Analysis of data from earth-based telescopes and manned and unmanned space missions. Offered jointly with GEOL 556 and GPHYS 556.

ASTR 557 Origin of the Solar System (3) Nebular and nonnebular theories of the solar system origin; collapse from the interstellar medium, grain growth in the solar nebula, formation of planetesimals and planets, early evolution of the planets and other possible planetary systems; physical and chemical evidence upon which the ideas concerning the origin of the solar system are based. Offered jointly with GEOL 557 and GPHYS 557.

ASTR 561 High Energy Astrophysics (3) Observed properties of supernovae, x-ray stars, radio sources, quasars. Theories explaining such objects. Origin of cosmic rays.

ASTR 575 Seminar in Astronomy (1-2, max. 20) Discussion of recent research in astronomy and astrophysics. Prerequisite: permission of department.

ASTR 576 Astronomy Colloquium (1, max. 20) Current research topics in astronomy and astrophysics. Prerequisite: permission of department.

ASTR 581 Techniques in Optical Astronomy (3) S Theory and practice of obtaining optical data. Astronomical photoelectric photometers, spectrum scanners, spectrographs, interferometers, image tube, and TV systems. Data-reduction techniques with emphasis on statistical analysis using digital computers. Observations with MRO thirty-inch telescope.

ASTR 582 Techniques in Radio Astronomy (3) Theory and practice in use of radio telescopes and receivers. History, basic definitions, and place of radio astronomy; basics of Fourier transforms; general antenna theory; theory and practice of parabolic reflectors, other filled apertures, interferometers, aperture synthesis arrays, and very long baseline interferometry; microwave receiver systems.

ASTR 597 Topics in Observational Astrophysics (1-5, max. 20)

ASTR 598 Topics in Theoretical Astrophysics (1-5, max. 20)

ASTR 600 Independent Study or Research (*)

ASTR 700 Master's Thesis (*) AWSp

ASTR 800 Doctoral Dissertation (*) AWSp

Atmospheric Sciences

408 Atmospheric Sciences-Geophysics

At the undergraduate level, the department provides a curriculum that covers both theoretical and applied aspects of the field. A student awarded a baccalaureate degree by the department is eligible for the rating of professional meteorologist, given by the United States Civil Service Commission. Courses offered in the graduate programs, leading to the Master of Science and Doctor of Philosophy degrees, emphasize more advanced aspects of the atmospheric sciences, including dynamical meteorology, cloud physics, radiative transfer, turbulence, atmospheric chemistry, weather analysis and prediction, and aeronomy.

The department either owns or has access to aircraft, a wind tunnel, cold rooms, laboratories, radar, glaciological field stations, mobile field stations, a data-processing facility, and an interactive computer system for research and for display of weather data.

Undergraduate Program

Bachelor of Science Degree

Major Requirements: 301, 321, 340, 350, 362, 431, 441 and 450, plus 8 additional credits in atmospheric sciences courses numbered above 400 (excluding 406); ENGR 141; MATH 124, 125, 126, 327; PHYS 117, 118, 121, 122, 123 or equivalents (131 and 132 recommended in place of 117 and 118); CHEM 140; and one course from the following: MATH 328, A A 370, PHYS 224, 225, 226; a grade of 2.0 or better in each of the required courses in atmospheric sciences, mathematics, physics, and chemistry; an overall grade-point average of at least 2.50 in all atmospheric sciences courses used for graduation. Students are encouraged to take a course in oceanography (e.g., OCEAN 203).

Pregraduate Program for Physical Science, Mathematics, and Engineering Majors

The following elective course sequence is suitable preparation for students interested in pursuing graduate study in atmospheric sciences: ATM S 301, 340, 441.

Graduate Program

Dennis L. Hartmann, Graduate Program Coordinator

Admission to the graduate program requires a baccalaureate degree in a physical science, engineering, or mathematics, or its equivalent, as well as the Graduate Record Examination. The program of graduate study varies with each individual.

During the first year of graduate study, most students concentrate on developing a strong background in the fundamentals that underlie the atmospheric sciences and on getting a broad understanding of the wide range of problems encountered in the atmosphere. A qualifying examination is given toward the end of the first year of graduate study as soon as possible after the student has completed 24 credits, including 12 credits in courses numbered 500 and above. All students desiring to proceed toward the Ph.D. degree must take this examination, and students desiring the Master of Science degree may elect to take it. This examination tests understanding of the fundamental aspects of the atmospheric sciences and of the relevant mathematics and physics. Physical reasoning, rather than factual information, is stressed. Those who pass the examination with distinction are encouraged to work toward the Ph.D. degree; those who pass at a lower level may continue toward the Master of Science degree. Alternatively, students whose objective is the Master of Science degree may elect to submit a written thesis proposal in lieu of the qualifying examination.

Research assistantships and a few teaching assistantships are available to full-time students. Applications are made through the department office.

Faculty

Chairperson

John M. Wallace

Professors

Badgley, Franklin I. (Emeritus), Ph.D., 1951, New York; turbulence.

Businger, Joost A. (Emeritus), (Geophysics),† Ph.D., 1954, Utrecht; energy transfer.

Fleagle, Robert G.,* (Marine Studies), Ph.D., 1949, New York; physical and dynamical meteorology.

Hobbs, Peter V.,* Ph.D., 1963, London; cloud physics.

Holton, James R.,* Ph.D., 1964, Massachusetts Institute of Technology; dynamic meteorology, tropics.

Houze, Robert A., Jr.,* Ph.D., 1972, Massachusetts Institute of Technology; cloud physics, mesoscale processes.

LaChapelle, Edward R. (Emeritus), (Geophysics),† D.Sc. (Hon.), 1957, Puget Sound; snow-cover geophysics.

Leovy, Conway B.,* (Geophysics),† Ph.D., 1963, Massachusetts Institute of Technology; upper atmospheric dynamics.

Radke, Lawrence F.* (Research), Ph.D., 1968, Washington; cloud physics.

Reed, Richard J.,* Sc.D., 1949, Massachusetts Institute of Technology; synoptic meteorology, tropics.

Untersteiner, Norbert,* (Geophysics),† Dozent, 1961, Vienna; glaciology, polar geophysics.

Wallace, John M.,* Ph.D., 1966, Massachusetts Institute of Technology; large-scale motions, tropics.

Associate Professors

Baker, Marcia B.,* (Geophysics),† Ph.D., 1971, Washington; cloud physics.

Brown, Robert A.,* Ph.D., 1969, Washington; planetary boundary layers.

Harrison, Halstead,* (Civil Engineering), Ph.D., 1960, Stanford; atmospheric chemistry.

Hartmann, Dennis L.,* Ph.D., 1976, Princeton; climate theory.

Katsaros, Kristina B.,* Ph.D., 1969, Washington; radiation and remote sensing.

Assistant Professors

Hegg, Dean A.,* (Research) Ph.D., 1979, Washington; cloud and aerosol physics.

Mass, Clifford F.,* Ph.D., 1978, Washington; synoptic meteorology.

Thorndike, Alan S., Ph.D., 1978, Washington; glaciology and sea ice.

Warren, Stephen G.,* (Geophysics),† Ph.D., 1973, Harvard; glaciology, radiative transfer.

Course Descriptions

Courses for Undergraduates

ATM S 101 Survey of the Atmosphere (5) AWSpS Conceptual understanding of weather phenomena and climate. Weather analysis and forecasting, including daily weather map discussions. Explanations of highs, lows, fronts, jet streams, clouds, rain, snow, rainbows, mirages, severe storms, terrain effects, air pollution, climate change, and weather modification. Intended for nonmajors.

ATM S 301 Introduction to Atmospheric Sciences (5) A Composition and structure of the atmosphere. Clouds and weather phenomena. Thermodynamic processes. Solar and terrestrial radiation. Air motions. Daily weather discussions and forecasts. For majors and nonmajors. Prerequisites: PHYS 121 and MATH 125, which may be taken concurrently.

ATM S 321 Physical Climatology (3) Sp Evolution and present state of earth's climate. Emphasis on physical processes determining the climate of the earth's atmosphere and surface: radiative transfer, energy balance, hydrologic cycle, atmospheric and oceanic energy transport. Factors controlling climate change. Prerequisite: 301.

ATM S 329 Microclimatology (3) WSp Interaction of biological and meteorological processes with applications to forestry, recreation, wildlife, landscape design, and architecture. Surface energy balances in terms of evaporation, radiation exchange, air and soil temperature, wind speed, and humidity in the lower layer of the atmosphere. Offered jointly with FOR B 329. Prerequisite: 101 or 301, or permission of instructor.

ATM S 340 Introduction to Atmospheric Physics (5) Sp Introduction to thermodynamics and hydrostatics. Introduction to cloud and precipitation processes with emphasis on the microphysics. Prerequisite: MATH 125 or permission of instructor.

ATM S 350 Atmospheric Structure and Analysis (3) W Atmospheric soundings. Thermodynamic diagrams. Diagnosis of circulation systems; general circulation, monsoons, extratropical cyclones and fronts, convective phenomena, tropical systems, mountain waves, and other small-scale phenomena. Scalar and streamline analysis. Applications of radar and satellite data. Prerequisites: 362 or equivalent, MATH 126, PHYS 123.

ATM S 362 Instruments and Observations (3) A Principles of operation of instruments for measuring pressure, temperature, humidity, wind, solar and infrared radiation, precipitation amounts and particle size, ozone and other chemicals, condensation, and ice nuclei. Methods of using these instruments, manipulation of output data to put them in usable format, including analog to digital converters, microprocessors, satellites. Prerequisites: MATH 126, PHYS 123.

ATM S 390 Honors Tutorial in Atmospheric Sciences (*, max. 6) AWSpS Review and discussion of selected problems in atmospheric sciences. Introduction to research methods. Presentation of a research paper. Recommended: MATH 124, PHYS 123.

ATM S 406 Geophysics: The Atmosphere (3) Sp Structure and composition of the atmosphere; atmospheric radiation, use of meteorological data; humidity and cloud processes, structure and dynamics of large-scale weather systems. Offered jointly with GPHYS 406. Prerequisite: GPHYS 404 or permission of instructor.

ATM S 409 Introduction to Atmospheric Electricity (3) W *Holzworth* Electric fields and current systems in atmosphere as generated from thunderstorm and extraterrestrial sources; review of undergraduate electromagnetic theory. Weather and magnetospheric-related electric current generating mechanisms; interactions between systems. AC and DC electromagnetic perturbations. Offered jointly with GPHYS 409. Prerequisites: PHYS 321 sequence or equivalents, or permission of instructor.

ATM S 431 Atmospheric Physics (5) A Energy transfer processes: solar and atmospheric radiation, turbulence and boundary-layer structure, applications. Prerequisite: 340 or PHYS 224.

ATM S 432 Atmospheric Physics (3) Sp Electromagnetic principles and application to the atmosphere, properties of waves, scattering, natural signal phenomena, remote sensing. Prerequisites: 340 or PHYS 224 or equivalent and MATH 327.

ATM S 441 Atmospheric Motions (5) W The basic equations governing atmospheric motions, and their elementary applications; circulation and vorticity; dynamics of midlatitude disturbances. Includes laboratory exercises. Prerequisites: 301, MATH 327.

ATM S 450 Atmospheric Data Analysis (5) W Statistical and other methods employed in atmospheric data analysis. Frequency distributions, sampling theory, linear correlation, elementary time-series analysis, objective map analysis. Prerequisites: 350, ENGR 141, or equivalent.

ATM S 452 Forecasting Laboratory (5) Sp Daily practice in map analysis and forecasting, using current weather data. Severe-storm forecasting. Statistical methods. Prerequisites: 350, 441, and 450.

ATM S 458 Introduction to Air Chemistry (4) A The atmosphere as a chemical system; analytical and physical chemistry of trace atmospheric constituents, both natural and man made. Offered jointly with CEWA 458. Prerequisite: CHEM 140.

ATM S 460 Atmospheric Dispersion of Pollutants (1) A Methods of estimating transport and diffusion of airborne materials introduced near the earth's surface. Emphasis on practical methods used by manufacturing concerns and control agencies rather than on theory. Prerequisites: MATH 124, ENGR 141, concurrent registration in 458 or CEWA 458.

ATM S 462 Sea-Air Transfer Processes (6) S Classroom work and field observations relating to the physical processes occurring at the ocean-atmosphere boundary. Transfer of energy, momentum, and moisture and their effects on small- and large-scale phenomena, including fog formation, convection, modification of air masses. Prerequisite: 441 or permission of instructor.

ATM S 492 Readings in Meteorology or Climatology (*) AWSp Prerequisite: permission of instructor.

ATM S 493 Special Problems in Meteorology or Climatology (*) AWSp Prerequisite: permission of instructor.

ATM S 498 Television Meteorology (1) AWSpS Production and on-air presentation of a weather broadcast on cable TV. Includes seminars with local commercial TV weathercasters.

Courses for Graduates Only

ATM S 501 Fundamentals of Physical and Synoptic Meteorology (6) A *Hobbs, Mass, Wallace* Fundamentals of hydrostatics, thermodynamics, radiative transfer with application to planetary atmospheres. Global energy balance and general circulation. Atmospheric chemistry. Cloud physics. Elementary synoptic analysis. Description and qualitative physical interpretation of atmospheric composition, structure, and motions.

ATM S 510 Physics of Ice (3) A *Raymond* Structure of the water molecule. Crystallographic structures of ice. Electrical, optical, thermal, and mechanical properties of ice. Growth of ice from the vapor and liquid phases. Physical properties of snow. Offered jointly with GPHYS 510. Prerequisite: permission of instructor. (Offered even-numbered years.)

ATM S 511 Formation of Snow and Ice Masses (3) W *Warren* Snow climatology. Transport of snow by wind. Transfer of radiative, sensible, and latent heat at the surface of snow and ice. Freezing of natural water bodies. Heat and mass budget of ice masses. Remote sensing of snow and ice. Theories of ice ages. Offered jointly with GPHYS 511. Prerequisite: permission of instructor. (Offered odd-numbered years.)

ATM S 512 Dynamics of Snow and Ice Masses (3) Sp *Raymond* Rheology of snow and ice. Sliding and processes at glacier beds. Thermal regime and motion of seasonal snow, glaciers, and ice sheets. Avalanches and glacier surges. Deformation and drift of sea ice. Response of natural ice masses to change in climate. Offered jointly with GPHYS 512. Prerequisite: permisson of instructor. (Offered odd-numbered years.)

ATM S 513 Structural Glaciology (3) A *Raymond* Physical and chemical processes of snow and stratigraphy and metamorphism. Interpretation of ice sheet stratigraphy in terms of paleoenvironment. Dynamic metamorphism from ice flow. Structures formed at freezing interfaces. Structure of river, lake, and sea ice. Relationship between structures and bulk physical properties. Offered jointly with GPHYS 513. Prerequisite: permission of instructor. (Offered odd-numbered years.)

ATM S 514 Ice and Climate Modeling (3) W *Warren* Principles of global climate modeling. Modeling seasonal cycles of snow cover and sea ice. Ice-sheet mass balance and flow. Solar radiation anomalies due to changes in earth's orbit. Climate/ice-sheet models of Pleistocene ice ages. Offered jointly with GPHYS 514. Prerequisite: permission of instructor. (Offered even-numbered years.)

ATM S 521 Seminar in Atmospheric Dynamics (*) AWSp *Holton* Directed at current research in the subject. For advanced students. Prerequisite: permission of instructor.

ATM S 523 Seminar in Cloud Physics (*) ASp *Hobbs* See 521 for course description.

ATM S 524 Seminar in Energy Transfer (*) AWSp *Brown, Katsaros* See 521 for course description.

ATM S 525 Seminar in Atmospheric Problems Associated With Air Pollution (2) W *Charlson, Harrison* Seminar for both engineers and atmospheric scientists in the atmospheric problems related to air pollution. A wide variety of topics is covered. Faculty lectures and student participation. Offered jointly with CEWA 525. Prerequisite: 301 or permission of instructor.

ATM S 526 Seminar in Glaciology (*) ASp See 521 for course description.

ATM S 533 Atmospheric Radiation I (3) Sp *Leovy, Warren* Principles of radiative energy exchange in planetary atmospheres with emphasis on emission and absorption of infrared and microwave radiation. Applications to atmospheric and surface energy balance and remote sensing. Prerequisite: PHYS 225 or permission of instructor.

ATM S 534 Atmospheric Radiation II (3) A *Leovy, Warren* Principles of radiative transfer in planetary atmospheres with emphasis on single and multiple scattering of visible and infrared radiation. Applications to atmosphere and surface energy balance and remote sensing. Prerequisite: 533 or permission of instructor.

ATM S 535 Cloud Microphysics and Dynamics (5) W *Hobbs, Houze* Basic concepts of cloud microphysics, water continuity in clouds, cloud dynamics, and cloud models. Prerequisite: 501 or permission of instructor.

ATM S 536 Mesoscale Storm Structure and Dynamics (3) Sp *Houze* Techniques of observing storm structure and dynamics by radar and aircraft, observed structures of precipitating cloud systems, comparison of observed structures with cloud models. Prerequisite: 535.

ATM S 541 Dynamic Meteorology (3) W *Holton, Leovy* Equations of motion, energy equations, vorticity and potential vorticity. Linear wave theory; gravity waves and Rossby waves. Prerequisite: 546, AMATH 401, or equivalents.

ATM S 542 Dynamic Meteorology (3) Sp *Holton, Leovy* Quasi-geostrophic theory, baroclinic instability, planetary waves, wave-mean flow interaction, equatorial flows. Prerequisite: 541, AMATH 402, or equivalents.

ATM S 544 Numerical Modeling and Prediction (3) A *Holton* Numerical methods for initial value and boundary value problems in atmospheric and fluid dynamics. Numerical weather prediction models. Objective analysis and initialization of forecast models. Prerequisite: 542 or permission of instructor.

ATM S 545 The General Circulation of Atmosphere (3) Sp *Wallace* Requirements of the global angular momentum heat, mass, and energy budgets upon atmospheric motions as deduced from observations. A study of the physical processes through which these budgets are satisfied. Prerequisite: 541 or permission of instructor.

ATM S 546 Introduction to Atmospheric Fluid Dynamics (3) A *Brown, Katsaros* Review of derivation of Navier-Stokes equations; turbulent and laminar flow; Reynolds averaging and statistical description of turbulent flow; characteristics of isotropic turbulence; velocity correlations and spectra; turbulent energy equation and scalar variance equation. The closure problem and some examples of how to do it; observational evidence.

ATM S 547, 548 Atmospheric Turbulence (3,3) W,Sp *Brown, Katsaros* 547: turbulent flux of heat, momentum, and moisture in the layer of the atmosphere next to the earth; Richardson's stability criterion; free convection. 548: diffusion of matter in the atmosphere; application of Ficklan and statistical theories of diffusion; use of Lagrangian and Eulerian correlation functions. Prerequisite: 546 for 547.

ATM S 551 Atmospheric Structure and Analysis I: Synoptic Scale Systems (3) A *Mass, Reed* Extratropical cyclones and cyclogenesis. Jet streams. Upper waves in the westerlies. Diagnosis of vertical motions. Fronts and frontogenesis. Prerequisite: 501.

ATM S 552 Objective Analysis (3) W *Wallace* Review of objective analysis techniques commonly applied to atmospheric problems; examples from the meteorological literature and class projects. Superposed epoch analysis, cross-spectrum analysis, filtering, eigenvector analysis, optimum interpolation techniques. Prerequisite: FORTRAN programming. (Offered even-numbered years.)

ATM S 553 Atmospheric Structure and Analysis II: Non-Convective Mesoscale Circulation (3) Thermally forced circulation systems, including sea/land breezes and mountain/valley winds. Topographic deflection, channeling and blocking in mesoscale flows. Analysis and forecasting of local mesoscale phenomena.

ATM S 555 Planetary Atmospheres (3) A *Leovy* Problems of origin, evolution, and structure of planetary atmospheres, emphasizing elements common to all planetary atmospheres; roles of radiation, chemistry, and dynamical processes; new results on the atmospheres of Venus, Mars, Jupiter, and other solar system objects in the context of comparative planetology. For students interested in atmospheric processes or those specifically interested in planets. Offered jointly with ASTR 555 and GPHYS 555.

ATM S 556 Middle Atmospheric Meteorology (3) *Holton, Leovy* Composition and structure. Radiative processes. Extratropical and equatorial circulations. Sudden stratospheric warmings. Transport of trace constituents. Dynamics and chemistry of ozone layer. Prerequisites: 533, 542, and 558 or permission of instructor.

ATM S 558 Atmospheric Chemistry (3) W *Harrison* Photochemistry of urban, rural, and marine tropospheric air, and of the natural and perturbed ozone in the middle atmosphere. Unity of the chemistries in these apparently different regimes. Prerequisite: 458 or 501 or CHEM 457 or permission of instructor.

ATM S 565 Seminar in Atmospheric and Marine Science Policy (1-3) W *Fleagle, Wooster* Decision making and policy determination in major atmospheric and marine programs. Case studies of policy development relating to global observations, air and water quality, climate change. Individual study of selected topics, with emphasis on developing and evaluating alternate policies. Offered jointly with IMS 565 and SMT 565. Prerequisite: permission of instructor.

ATM S 571 Theoretical Climatology (3) W *Hartmann* Physical processes determining the climate and its sensitivity to extrinsic climate controls. Radiative and dynamical feedback processes, climate modeling, past and future climate, orbital parameter theory. Response of the earth's climate to CO_2 increase, volcanic aerosols, and solar variations. Prerequisite: permission of instructor.

ATM S 591 Special Topics (1-4, max. 9) AWSp Lecture series on topics of major importance in the atmospheric sciences. Prerequisite: permission of instructor.

ATM S 600 Independent Study or Research (*)

ATM S 700 Master's Thesis (*)

ATM S 800 Doctoral Dissertation (*)

Biology

318 Biological Sciences

Undergraduate Program

Undergraduate programs leading to a baccalaureate degree are offered by the departments of Botany, Microbiology and Immunology, and Zoology. An interdisciplinary program leading to a baccalaureate degree in biology is described below. Baccalaureate degree programs with a strong biological orientation are also offered by the Department of Psychology and the colleges of Forest Resources and Ocean and Fishery Sciences. In addition to the departments and colleges already noted, courses in the biological sciences are offered by departments in the College of Arts and Sciences (e.g., Anthropology and Genetics) and in the schools of the health sciences (Dentistry, Medicine, Nursing, Pharmacy, and Public Health and Community Medicine). The departments of Botany and Zoology jointly offer a major in biology for students in the College of Education (additional information appears in the College of Education section of this catalog). Interdisciplinary study of biology is supervised by the director of the Office of Biology Education.

Bachelor of Science Degree

Major Requirements: The program leading to a Bachelor of Science degree is in cellular and molecular biology. It is designed for students who wish to obtain undergraduate training that emphasizes the chemical and cellular aspects of biology. The program is particularly well suited to students who wish to pursue graduate work in the

areas of genetics, biochemistry, microbiology, cellular physiology and anatomy, developmental biology, or molecular biology. The following courses are required: MATH 124, 125, and either MATH 126, STAT 311, or Q SCI 381; CHEM 140, 150; 231, 235, 236 or 335, 336, 337; one chemistry laboratory; PHYS 114, 115, 116 or 121, 122, 123; BIOL 210, 211, 212; BIOC 440, 441, and either 442 or GENET 455; GENET 451; and 15 credits of advanced biology course work selected in consultation with the biology adviser. CHEM 350, 351, or 455, 456, 457 are recommended.

Faculty

Professor

Edwards, John S.,* (Zoology),† Ph.D., 1960, Cambridge; zoology, neurobiology, and entomology.

Associate Professor

Pitemick, Leonie K., Ph.D., 1946, California (Berkeley); introductory biology.

Lecturers

Nicotri, M. Elizabeth, Ph.D., 1974, Washington; marine ecology and introductory biology teaching.

Russell, Millie L., (Nursing),† M.S., 1980, Washington; kinesiology.

Course Descriptions

Courses for Undergraduates

The courses in biology listed below are administered by several departments. Other courses in biology are listed under such headings as Biochemistry, Biological Structure, Botany, Microbiology and Immunology, and Zoology.

BIOL 100 Introductory Biology (5) AWSpS Introduction to biological principles and concepts, and the application of biological knowledge to problems of man and society; development of an awareness of science. For nonscience majors only.

BIOL 101-102 General Biology (5-5) A,W Principles of living systems as viewed at levels from the subcellular to the community. Emphasis on structural and functional analysis of biological organization—its adaptedness, its genetic diversity, its energetics—leading to an evolutionary synthesis. The position of man in the biological world. For nonmajors and others desiring a two-quarter introduction to biology.

BIOL 103 Introduction to Biology (5) ASp *Pitemick* Introduction to basic biological concepts within the context of human biology. For students in the Educational Opportunity Program. No credit allowed if 100 has been taken. Prerequisite: permission of instructor.

BIOL 104 Biology for Elementary School Teachers (5) WSp *Pitemick* Basic concepts of biology, with emphasis on background needed for confident use of the new science curriculum materials in the elementary school. Prerequisite: permission of instructor.

BIOL 110. Elementary Biology for Health Professions I (2) A *Russell* Elementary biomedical concepts. For Equal Opportunity Program students only. Prerequisite: permission of instructor.

BIOL 111 Elementary Biology for Health Professions II (2) W *Russell* Elementary human anatomy and physiology, including selected areas in laboratory medicine. For Equal Opportunity Program students only. Prerequisite: 110.

BIOL 112 Elementary Biology for Health Professions III (1-4) Sp *Russell* Field experience in a health profession. For Equal Opportunity Program students only. Prerequisite: 111.

BIOL 113 Biology Tutorial (1-3, max. 6) AWSp Independent study. Topics related to material taken in 103, 110, 111, and 112. For Equal Opportunity Program students only. Prerequisite: permission of instructor.

BIOL 210, 211, 212 Introductory Biology (5,5,5) AWSp, WSp,ASp Introduction to phenomena of life for students intending to take advanced biology courses and preprofessional programs. Emphasis on features common to all living things: molecular and submolecular phenomena; cell structure, metabolism, and energetics; genetic basis of inheritance; structure, function, and development of whole organisms; principles of ecology and evolution. Prerequisites: two quarters of general college chemistry; 210 for 211 or 212, or permission of Biology office.

BIOL 213 Scientific Illustration (3) W *Wood* Practical course designed to acquaint the science student with the techniques of illustrating. Accurate and selective interpretation of shape, texture, and consistency of biological materials, working in black and white and using a variety of illustration techniques. Students may choose objects of special interest to them.

BIOL 214 Scientific Illustration (3) Sp Continuation of 213. Further training techniques: tone, color, and working from the live animal. Exploration of specifications for ultimate use in projection or print.

BIOL 401 Cell Biology (3) ASp *Whiteley* Structure and function of the cell. Prerequisites: 210, 211, 212 or equivalent; one upper-division course in a related area (embryology, histology, physiology, or biochemistry).

BIOL 402 Cell Biology Laboratory (2) *Whiteley* Prerequisites: 401, which must be taken concurrently, and permission of instructor.

BIOL 454 Evolutionary Mechanisms (3) *Kruckeberg, Slatkin* Evolutionary change as determined by mutation, recombination, and selection. Effects of the genetic system, isolating mechanisms, hybridization, and polyploidy on speciation. Examples of microevolutionary and megaevolutionary changes from plant and animal kingdoms. For advanced undergraduate and graduate students in the biological sciences.

BIOL 460 Biology of Eukaryotic Microorganisms (5) *Whisler* Introduction to the comparative biology of the algae, fungi, and protozoa. Emphasis on the life history, physiology, and structure of protists most commonly used in contemporary biological research. Prerequisites: 210, 211, 212 or 101-102 or introductory microbiology.

BIOL 472 Principles of Ecology (3) W *Bliss, Edmondson, Orians, Paine* Population biology, interactions between species in biological communities, relationship of community to environment, physiological ecology, principles of natural selection. Prerequisites: 15 credits in biological sciences and upper-division standing, or permission of instructor.

BIOL 473 Limnology (3) A *Edmondson* Biological, physical, and chemical features of lakes and other inland waters. Prerequisites: 15 credits in biological sciences, 10 credits in college chemistry, and upper-division standing, or permission of instructor.

BIOL 474 Ecology Laboratory (3) Students may be required to share a portion of the transportation costs of field trips. Prerequisites: 472 and permission of instructor.

BIOL 475 Limnology Laboratory (2) A *Edmondson* Examination of biota of fresh waters, survey of limnological methods, and analysis of data. Prerequisites: 473, which may be taken concurrently, and permission of instructor.

BIOL 499 Independent Studies in Biology Instruction (1-5, max. 15) AWSpS *Pitemick* Individual exploration and direct experience with modes of thought and activity in biology instruction. Prerequisite: permission of instructor.

Courses for Graduates Only

BIOL 501 Advanced Cytology (1-5, max. 5) *Laird* Detailed study of the structure and function of the cell. Prerequisite: permission of instructor.

BIOL 508 Cell Biology (3, max. 6) *Whiteley* Four to five topics of current interest in cell biology selected to meet the needs of the enrollees. Prerequisite: permission of instructor.

BIOL 510 Cell Biology Laboratory (2) *Whiteley* Prerequisites: 508, which must be taken concurrently, and permission of instructor.

BIOL 573 Topics in Limnology (2 or 3) *Edmondson* Readings in the literature of limnology, with discussion of modern problems. May be repeated for credit. Prerequisite: permission of instructor.

BIOL 581 Biology of Drosophila Seminar (1, max. 12) Weekly presentation by participants of classical literature, current literature, and research in the molecular biology, developmental biology, neurobiology, and genetics of Drosophila. Prerequisite: permission of instructor.

BIOL 586 Analysis of Development (3, max. 6) A Analysis of structural, physiological, and molecular levels of developmental processes, including gametogenesis, fertilization, cell and tissue movements, induction, and cytodifferentiation. Prerequisites: ZOOL 456 and BIOC 442 or permission of instructor.

BIOL 587 Analysis of Development Laboratory (1-5, max. 5) WSp Series of intensive workshops in developmental biology, each extending over three to five days. Each is based on problems under study in the laboratory of the instructors involved, using materials, methods, and approaches characteristic of that laboratory. Prerequisite: permission of instructor.

BIOL 591 Problems in Biological Instruction (1) Seminar in biological instruction, teaching techniques, course and curricula planning.

BIOL 592 Instructional Skills for Science Teaching Assistants (1) ASp Emphasis on the improvements of each student's basic teaching skills. Videotape analysis of student's presentations.

BIOL 593 Instructional Methods in University Science Teaching (1) W Traditional and innovative methods in university science teaching: lecture method, use of media, discussion-method teaching, individualized instruction and educational technology, inquiry methods, and other innovations. Design of college science courses at different levels.

Botany

430 Biological Sciences

Botany is concerned with the structure, ecology, physiology, classification, and evolution of plants, with emphasis on both organismal and cellular biology. Special courses and programs in botany of the Pacific Northwest are shared with related departments.

Undergraduate Program

Bachelor of Science Degree

Major Requirements: Minimum of 59 credits as follows: BIOL (101-102), and GENET 451 or BIOL 210, 211, 212; CHEM 101, 102 or 140, 150 and 231; BOT 113; 371, 372 or 471, 472; 354 or 444 or 480; and either sequence I (320, and 360 or 441 or 445 or 446) or sequence II (360, 441, and 445 or 446); a minimum of 10 credits of upper-division courses (excluding courses without prerequisites) in botany, zoology, microbiology, genetics, and biology and certain courses in forest resources, oceanography, and fisheries.

A program recommended for students who plan to attend graduate school includes the following: BIOL 210, 211, 212 and GENET 451; CHEM 140, 150, 151; 231, 232 or 231, 235, 236; BOT 113; 471, 472; 360, 441, and 445 or 446; 354 or 444 or 480 and 481; and a minimum of 10 credits of botany courses chosen to provide some depth in one field.

The following are strongly recommended for all students who plan to attend graduate school, but do not count toward the 59 credits: reading knowledge of a foreign language (French, German, or Russian); one year of physics; one year of calculus; Q SCI 381 (statistical methods) and Q SCI 340 (applications using computer).

Graduate Program

The Department of Botany offers programs of graduate study leading to the Master of Science and Doctor of Philosophy degrees. Each program of study is planned individually and takes into consideration the background and interests of the student.

Research Facilities

Special departmental facilities include a greenhouse, growth chambers for both higher plants and algal cultures, and herbarium. The Friday Harbor Laboratories on San Juan Island offer opportunities for the study of marine botany, and the great variety of habitats in the Pacific Northwest provide many opportunities for field investigations.

Special Requirements

A prospective graduate student is expected to have had the equivalent of an undergraduate major in biological science, with training in chemistry (at least through organic chemistry), general botany, plant physiology, and genetics. Calculus is recommended. A doctoral aspirant must demonstrate reading proficiency in at least one foreign language.

Financial Aid

A number of teaching and research assistantships are awarded to selected applicants in March of each year.

Correspondence and Information
Graduate Program Coordinator
Department of Botany, KB-15

Faculty

Chairperson

Lawrence C. Bliss

Professors

Bendich, Arnold J.,* (Genetics), Ph.D., 1969, Washington; nucleic acids as evolutionary indicators, DNA sequence organization in plants, plant cancer.

Bliss, Lawrence C.,* Ph.D., 1956, Duke; physiological plant ecology, arctic, alpine environments.

Cleland, Robert E.,* Ph.D., 1957; California Institute of Technology; physiology, growth substances, cell wall, tissue culture.

del Moral, Roger,* Ph.D., 1968, California (Santa Barbara); ecology, gradient analysis, community structure, phytosociology.

Denton, Melinda F.,* Ph.D., 1971, Michigan; Herbarium curator; systematics of vascular plants; phytogeography.

Haskins, Edward F.,* Ph.D., 1965, Minnesota; cytology, ultrastructure of microorganisms, especially slime molds.

Hitchcock, Charles L. (Emeritus), Ph.D., 1931, Washington (St. Louis); botany, zoology.

Kruckeberg, Arthur R.,* Ph.D., 1950, California (Berkeley); evolution, biosystematics, edaphic ecology.

Leopold, Estella B.,* (Forest Resources),† Ph.D., 1955, Yale; palynology and quaternary environments.

Meeuse, Bastiaan J. D.,* Doctoral, 1943, Delft (Holland); plant physiology, algal physiology, metabolism, plant biochemistry.

Tsukada, Matsuo,* (Geological Sciences), D.Sc., 1961, Osaka City (Japan); interpretation of quaternary events from palynological and kindred data.

Waaland, Robert,* Ph.D., 1969, California (Berkeley); biology of algae, experimental, cytological, and ecological studies of marine algae, gas vacuoles of blue-green algae.

Walker, Richard B.,* Ph.D., 1948, California (Berkeley); plant physiology, mineral nutrition, water relations.

Whisler, Howard C.,* Ph.D., 1960, California (Berkeley); mycology, aquatic fungi, slime-molds and phycomycetes, development.

Associate Professors

Ammirati, Joseph F.,* Ph.D., 1972, Michigan; mycology, taxonomy of the fleshy fungi.

Cattolico, Rose A.,* Ph.D., 1973, State University of New York (Stony Brook); plastid replication, nucleic acid biochemisty in synchronized unicellular algae.

DiMichele, William A.,* Ph.D., 1979, Illinois; morphology, paleobotany.

Halperin, Walter,* Ph.D., 1965, Connecticut; plant physiology, developmental anatomy, plant cancer, tissue culture.

Waaland, Susan D.* (Research), Ph.D., 1969, California (Berkeley); control of development in algae.

Assistant Professor

Spaulding, W. Geoffrey,* Ph.D., 1981, Arizona; paleobotany of North American deserts, late Quaternary phytogeography and climate history of the Southwest and Great Basin, macrofossil paleoecology.

Course Descriptions

Courses for Undergraduates

Students may be required to pay part of the transportation costs of field trips for the following courses: 113, 331, 354, 421, 442, 446, 452, 462, 464, 543, 547, 554.

BOT 110 Plants in the Human Environment (5) AWSpS Basic course on plants, emphasizing diversity, economic importance, and function of plants in vegetation systems and human communities. Some independent fieldwork may be required. For nonmajors.

BOT 113 Elementary Plant Classification (5) SpS *Denton* Plant classification; field study and laboratory identification of the common plant families and the conspicuous flora of western and central Washington. Two full-day field trips.

BOT 301 Plant Propagation (2) AWSp Practical course in methods of plant propagation by seeds, cuttings, budding, layering, bulbs, divisions, and other special structures. Includes consideration of care and handling of plants in the home, garden, and greenhouse. Prerequisites: BIOL 101-102 or equivalent.

BOT 320 The Plant Kingdom (5) A Major groups of the plant kingdom: Structure and reproduction; theories of evolutionary relationships of the phyla. Prerequisites: BIOL 101-102 or equivalent.

BOT 331 Ornamental Plants (3) Sp *Kruckeberg, Tsukada* Identification, recognition, and use of cultivated trees and shrubs. Emphasis on laboratory and field study of woody species used in Pacific Northwest landscapes; plant exploration and origins of ornamentals. For nonmajors, teaching majors in biology, and students in forestry and landscape design. Prerequisite: 113 or 10 credits in biological science.

BOT 350 Introduction to Plant Geography (4) W *Tsukada* Patterns of world vegetation distributions; the relationships between vegetation and climate; introduction to general theories of plant distribution. Emphasis on the affinities between vegetation in different parts of the world.

BOT 354 Introduction to Plant Ecology (5) A *Bliss, del Moral* Basic concepts of plant ecology, including studies of the biotic environment, plant-environment interactions, communities, and ecosystems. Laboratory includes two field trips, laboratory and greenhouse experiments, and an introduction to ecological problem solving. Prerequisite: BIOL 101-102 or BIOL 211.

BOT 356 Washington Plant Communities (4) *del Moral* Lowland plant communities of western Washington, including mature, seral, and ruderal vegetation. Recognition of common species, environmental factors controlling distributions, knowledge of indicator species, and uses of native species in landscape design. Recommended: 113 or 354 or L ARC 463.

BOT 360 General Mycology (5) W *Ammirati, Whisler* General survey of the fungi with emphasis on life cycles, structure, physiology, economic importance. Prerequisite: 10 credits in biological science or permission of instructor.

BOT 371 Elementary Plant Physiology (3) WSp *Bendich, Cleland, Halperin, Meeuse, Walker* Nutrition, assimilation, transport, growth, photosynthesis, and cellular respiration in plants. Prerequisites: BIOL 211 or 101-102, or permission of instructor.

BOT 372 Plant Physiology Laboratory (2) WSp Laboratory experiments on the growth, nutrition, and metabolism of plants. Prerequisite: 371, which may be taken concurrently.

BOT 380 Economic Botany (3) A *Tsukada* Plants useful or harmful to man; their taxonomic and morphological characteristics and chemical constituents; history, distribution, production, usage, and roles in prehistoric and modern cultures and civilization. Prerequisite: 110 or 113 or 10 credits in biological sciences.

BOT 421 Bryology (3) Taxonomy of mosses, with emphasis on the moss flora of the Pacific Northwest. Intensive practice in identification of mosses in laboratory. Field study for collections, recognition, and natural history of mosses. For undergraduate and graduate majors in botany and related fields. (Offered upon demand.)

BOT 431 Topics in Horticultural Botany (3, max. 6) A *Kruckeberg* Topics include selected families or genera of ornamental importance, urban stress, hardiness, propagation, plant breeding, plant introduction, and diseases of ornamentals. Prerequisite: 331 or equivalent. (Offered alternate years; offered 1984–85.)

BOT 433 Advanced Systematics (5) A *Denton, Kruckeberg* Study of taxonomic principles, emphasizing the bases for classification and the analysis of characters used in taxonomic studies. Major plant families studied. Prerequisites: 113 and permission of instructor. (Offered alternate years; offered 1985-86.)

BOT 434 Advanced Systematics (5) W *Denton* Taxonomic theory and practice; nomenclature; classification systems, historical and modern; individual project required. Prerequisites: 433 and permission of instructor.

BOT 435 Biology of Grasses and Allies (5) A Biology, taxonomy, and evolutionary relationships of graminoid plants (Gramineae, Cyperaceae, and Juncaceae). Keying and recognition of families and genera in field situations. Prerequisite: 113 or equivalent. (Offered alternate years; offered 1984-85.)

BOT 439 Forest History (4) Sp *Leopold* Development, composition, and structure of the present woody vegetation in the Pacific Northwest. Environmental restrictions in modern species and implications for ecological management based on historic biogeographic distributions of woody plants, edaphic features, and climatic changes. Offered jointly with FOB B 460. Prerequisite: 354 or equivalent.

BOT 441 Comparative Morphology of Vascular Plants (5) A *DiMichele, Halperin* Detailed study of the morphology (structures and life cycles) of the angiosperms, gymnosperms, ferns, and other nonseed vascular plants. The history of each group is reviewed to trace the derivation of modern structures and processes and to reveal the major evolutionary trends. Prerequisite: BIOL 211 or 101-102, or equivalents.

BOT 442 Paleobotany of Terrestrial Plants (5) Sp *DiMichele* Morphology, evolution, and ecology of terrestrial plants and ecosystems, including plant-animal interactions, from a paleontological perspective. Prerequisite: 320 or 441. (Offered alternate years; offered 1984-85.)

BOT 443 Origins of Our Modern Floras (4) W *Leopold* Evolution and biogeographic development of our modern forest taxa and their associations. Late Cenozoic forests (last 60 million years) of western North America and their environments. Geologic and climatic shifts that have shaped temperate forest types from tropical vegetation during early Cenozoic Era. Prerequisite: 113 or equivalent. (Offered alternate years; offered 1985-86.)

BOT 444 Plant Anatomy (5) W *DiMichele* Study of the origin and differentiation of tissue systems; practice in interpretation of histology of plant materials. Prerequisite: BIOL 101-102 or 211. (Offered alternate years; offered 1984-85.)

BOT 445 Marine Botany (8) ASp Survey of plants represented in marine environments; natural history; ecology, distribution, habitat, adaptation, and trophic interrelationships. Offered at Friday Harbor Laboratories. Prerequisites: appropriate credits in biological sciences, concurrent registration in ZOOL 430, and permission of the Director of Friday Harbor Laboratories.

BOT 446 Algology (5) Sp *Cattolico, J. R. Waaland* Examination of algal phyla from the viewpoint of morphological and physiological characteristics important to their systematics. Emphasis on phylogeny of various lines of evolution in algae, relationships between algae and other parts of plant and animal kingdoms, algal geography and species of economic importance. Prerequisite: 320 or BIOL 211 or permission of instructor.

BOT 448 Marine Algal Ecology (3) W *Waaland* Marine environment in relation to requirements for algal life. Intertidal, subtidal, geographical, and seasonal distribution of marine algae. Functional aspects of algal form, structure, productivity, and energy economy of marine algal communities. Algal utilization and aquaculture. Prerequisite: 445 or 446, or permission of instructor. (Offered alternate years; offered 1985-86.)

BOT 453 Concepts and Methods in Paleoecology (4) A *Brubaker, Leopold, Tsukada* Conceptual framework and methods of study for interpretation of fossils in sediments; tree rings, sedimentary/geochemical evidence. Past dynamic changes in plant communities and species history evaluated in context of modern ecological theory. Offered jointly with QUAT 453 and FOR B 453. Prerequisite: 354 or FOR B 320. (Offered alternate years; offered 1984-85.)

BOT 456 Plant Community Ecology (5) Sp *del Moral* Development of plant community theory; theory of vegetation structure and typal identification; numerical methods for vegetation description and pattern analysis; gradient analysis; competition and allelopathy in complex systems; vegetation dynamics; niche theory. Laboratory emphasizes sampling design and field and computer methods. Two weekend field trips required. Prerequisite: 354 or permission of instructor. (Offered alternate years; offered 1985-86.)

BOT 460 Slime Molds (5) *Haskins* Life history, development, genetics, physiology, and taxonomy of slime molds. Prerequisites: 360 or MICRO 400, or permission of instructor.

BOT 462 Agarics and Gasteromycetes (5) A *Ammirati* Structure, classification, and biology of mushrooms, puffballs, and their relatives. Emphasis on fungi from the Pacific Northwest. Prerequisite: 360 or permission of instructor. (Offered alternate years; offered 1985-86.)

BOT 463 Phycomycetes and Related Fungi (5) Sp *Whisler* Life history, development, taxonomy, and physiology of slime molds and phycomycetes. Prerequisites: 360, MICRO 400, or permission of instructor. (Offered alternate years.)

BOT 464 Ascomycetes (5) Structure and classification of the ascomycetes. Prerequisite: 360 or permission of instructor.

BOT 465 Lichenology (5) A *Ammirati* Structure, classification, and general biology of lichens. Emphasis on families and genera; local lichens collected and identified as to species. Prerequisite: 320, 360, or permission of instructor. (Offered alternate years; offered 1984-85.)

BOT 466 Rusts, Smuts, and Fungi Imperfecti (5) Structure, classification, and biology of rusts, smuts, and imperfect fungi, with particular emphasis on the role of these fungi in plant pathology. Prerequisite: 360 or permission of instructor.

BOT 467 Aphyllophorales (5) *Ammirati* Structure and classification of major groups of the Aphyllophorales (Basidiomycetes), with emphasis on their economic and ecological importance and on the most recent developments in their taxonomy. Prerequisite: 360 or permission of instructor.

BOT 468 Fungi Imperfecti (5) Structure and modern bases for classification of the imperfect fungi (Deuteromycetes). Considers economically important species and plant pathogens. Prerequisite: 360 or permission of instructor.

BOT 471 Plant Physiology (3) Covers the same material as 371, but stresses biochemical approaches. Recommended for biology majors. Not open to students who have taken 371. Lectures only. Prerequisites: BIOL 101-102 or 211, and completion of, or concurrent registration in, organic chemistry.

BOT 472 Plant Physiology Laboratory (2) Laboratory experiments on the growth, nutrition, and metabolism of plants, with an emphasis on biochemical and quantitative techniques. Not open to students who have taken 372. Prerequisite: 471, which should be taken concurrently.

BOT 475 Reproductive Biology of the Flowering Plants (5) Sp *Meeuse* Strategies and tactics of plant dispersal and pollination; morphological, physiological, and behavioral adaptations of animal pollinators and dispersers; physiology of seed dormancy and germination in an ecological context; biochemistry and physiology of plant fertilization; practical and theoretical (evolutionary) implications of all the above. Prerequisites: 113 and BIOL 211 or BOT 371 or 472, or permission of instructor.

BOT 476 Mineral Nutrition (3) A *Walker* Absorption, translocation, and utilization of essential mineral elements. Soil culture and solutions as nutrient media for the growth of plants considered in theory and practice. Prerequisite: 371 or 472, or equivalent. (Offered alternate years; offered 1985-86.)

BOT 478 Plant Morphogenesis (3) *Halperin* From subcellular machinery controlling development (information storage, macromolecular assembly, metabolic regulation, cell cycle, etc.), as studied in microorganisms, animals, and plants, to a study of development at the cell, tissue, and organ level in multicellular plants. Reading based on primary sources. Prerequisite: BIOL 211 or BOT 371 or equivalents.

BOT 480 Plant Cell Biology (3) W *Cattolico, Haskins* Analysis of structure and function of plant cells. Emphasis on the ultrastructure of plant cells and cell components. Prerequisites: 15 credits in biological science.

BOT 481 Plant Cell Biology Laboratory (2) W *Cattolico, Haskins* Bright-field and phase-contrast microscopy; cytochemical methods; demonstration of optical equipment; individual projects may be required. Prerequisite: 480.

BOT 490 Undergraduate Seminar (1) Presentation and discussion of special topics in botany.

BOT 498 Special Problems in Botany (1-15) AWSp Students with suitable background in botany may enroll for special study in algology, anatomy, bryology, cytology, mycology, morphology, paleobotany, physiology, or taxonomy. Prerequisite: permission of instructor.

Courses for Graduates Only

BOT 501 Tutorial in Botany (1-5, max. 10) AWSp Small-group study and discussion of a specified topic in the plant sciences, largely in fields not covered by courses and existing special area seminars. Impetus for registration would come from two or more graduate students finding a faculty member who shares with them an interest in the topic. Prerequisite: permission of instructor.

BOT 502 Teaching Assistant Orientation (3) A Laboratory and lecture preparation, organization, and presentation for incoming botany graduate students. Two student presentations required; to be self-, instructor, and peer evaluated.

BOT 520 Seminar (1) AWSp Prerequisite: permission of instructor.

BOT 521 Topics in Plant Physiology (2, max. 10) AWSp *Bendich, Cleland, Halperin, Meeuse, Walker* Modern trends and methods in plant physiology. Prerequisite: permission of instructor.

BOT 522 Seminar in Morphology and Taxonomy (2, max. 10) AWSp *Denton, DiMichele, Kruckeberg* Current research and trends in morphology and taxonomy of higher plants. Prerequisite: permission of instructor.

BOT 523 Selected Topics in Mycology (2, max. 10) AWSp *Ammirati, Whisler* Selected topics from all phases of mycology. Prerequisite: permission of instructor.

BOT 524 Topics in Algology (2, max. 10) AWSp *Cattolico, J. R. Waaland, S. Waaland* Selected topics from all phases of algology. Prerequisite: permission of instructor.

BOT 525 Topics in Plant Ecology (2, max. 10) AWSp *Bliss, del Moral, Leopold, Tsukada* Selected topics from various phases of plant ecology. Prerequisite: permission of instructor.

BOT 526 Topics in Palynology (2, max. 6) AWSp *Leopold, Tsukada* Discussion and review of literature in pollen structure, disposition in sediments, and paleoecology. Prerequisite: permission of instructor.

BOT 528 Plant Molecular Biology (3) A *Bendich, Cattolico* Current research and trends in plant nucleic acids, including such topics as plastid and nuclear genomes, regulation of organelle biogenesis, the cell cycle, and evolution. (Offered alternate years; offered 1985-86.)

BOT 543 Freshwater Algae (5) Morphology, life histories, systematics, and ecology of freshwater algae, with emphasis on the local flora. Studies made on algae collected in the field and on specimens grown in laboratory culture. Not open to students who have taken 443. Prerequisite: 320 or permission of instructor.

BOT 545 Marine Algology (9) S *J. R. Waaland* Morphology, life histories, systematics, and ecology of marine algae, with emphasis on the local flora. Prerequisite: 320 or permission of the Director of Friday Harbor Laboratories. (Consult Friday Harbor Laboratories bulletin for the year offered.)

BOT 547 Phytoplankton Morphology and Taxonomy (5) Advanced discussion of phytoplankton morphology with emphasis on characteristics important to their taxonomy. Emphasis on cytology of the organisms, their life histories, adaptive morphological characteristics, and isolation and culture of phytoplankton organisms. Prerequisite: 445 or 446, or permission of instructor.

BOT 549 Advanced Algology (9) S *J. R. Waaland* Varied marine algal flora of the San Juan region. Topic changes from year to year. Individual research projects. Prerequisites: 545 or equivalent and permission of the Director of Friday Harbor Laboratories. (Consult Friday Harbor Laboratories bulletin for the year offered.)

BOT 552 Vegetation of North America (5) W *Bliss* Detailed analysis of the biomes of America north of Columbia, including principles of plant geography, floristics, climate, soils, ecophysiology, paleobotany, vegetation structure, and community patterns. Prerequisite: 350. (Offered alternate years; offered 1984-85.)

BOT 554 Palynology and Quaternary Phytogeography (5) A *Tsukada* Study of former vegetation and environments by relating the fossil pollen record to ecological principles; fundamentals and applications of pollen-spore morphology and pollen analysis. Two full-day (Friday and Saturday) field trips required. Prerequisites: 113; BIOL 472, or permission of instructor. (Offered alternate years; offered 1985-86.)

BOT 565 Marine Mycology (9) *Whisler* Taxonomy and morphology of aquatic fungi with emphasis on marine forms. Prerequisites: 320 or 360 or 20 credits in biology and permission of the Director of Friday Harbor Laboratories. (Consult Friday Harbor Laboratories bulletin for the year offered.)

BOT 569 Development in Lower Plants (5) *S. Waaland* Survey of developmental systems in algae and fungi. Comparative study of control of development with an emphasis on photoregulation, cell wall interactions, and hormonal control. Prerequisite: 320 or permission of instructor.

BOT 570 Plant Metabolism (3) A *Meeuse* Metabolism of organic compounds, with emphasis on photosynthesis and cellular respiration. Prerequisites: 472, and CHEM 232 or equivalent, and permission of instructor.

BOT 571 Plant Metabolism Laboratory (2) A *Meeuse* Prerequisite: concurrent registration in 570.

BOT 572 Water Relations (3) A *Walker* Permeability and water relationships, with special emphasis on influences affecting behavior of plants in the field. (Offered alternate years; offered 1984-85.)

BOT 573 Water Relations Laboratory (2) A *Walker* Prerequisite: concurrent registration in 572. (Offered alternate years; offered 1984-85.)

BOT 574 Physiological Plant Ecology (5) Sp *Bliss, Walker* Theory and practice of the measurement of important environmental variables in plant ecology (radiation, temperature, light, wind, humidity) and the basic responses of the plants. Some aspects of plant interactions, especially allelopathy; primary emphasis on reactions of the individual plant, with some implications to ecosystems included. Prerequisites: introductory courses in plant physiology and plant ecology. (Offered alternate years; offered 1984-85.)

BOT 577 Plant Growth and Development (3) A *Cleland* Control of growth, development, and differentiation in higher plants by hormones. Prerequisite: 472 or permission of instructor. (Offered alternate years.)

BOT 579 Environmental Control of Plant Growth and Development (3) A *Cleland* Effects of light, temperature, and water stress on the growth, development, and metabolism of higher plants. Prerequisite: 371 or 472 or permission of instructor. (Offered alternate years.)

BOT 580 Methods in Subcellular and Macromolecular Analysis (3) A *Bendich, Cattolico* Introduces the theory underlying basic laboratory techniques used in the isolation and quantitation of subcellular and macromolecular components. Discusses the practical problems in applying techniques such as radioisotope methodology, chromatography, electrophoresis, and cell fractionation.

BOT 581 Laboratory Techniques in Plant Molecular Biology (5) *Bendich, Cattolico* Procedures for the use of radioisotopes, with emphasis on the problem of microbial contamination during radiolabeling of plant materials. Extraction of proteins and nucleic acids, as well as their fractionation by gel electrophoresis, column chromatography, and density gradient centrifugation. *In vitro* translation of RNA. Prerequisite: permission of instructor.

BOT 600 Independent Study or Research (*) AWSp

BOT 700 Master's Thesis (*) AWSp

BOT 800 Doctoral Dissertation (*)

Chemistry

109 Bagley

Chemistry is a branch of natural science that deals principally with the properties of substances, the changes they undergo, and the natural laws that describe these changes.

Undergraduate Program

Special options: Within the traditional degree programs below, elective study options are available in biological chemistry, chemistry and business, chemistry and public policy, environmental chemistry, and polymer chemistry. Consult the Chemistry advising office for more information.

Bachelor of Science Degree

Admission Requirements: Suggested high school curriculum to include three units of German; at least three units of mathematics, including 1½ units of algebra and ½ unit of trigonometry; one unit of physics; and one unit of chemistry.

Major Requirements: CHEM 145 (or 140), 155 (or 150), and 160 (or 164), (students with inadequate backgrounds in laboratory work should include CHEM 151 in their freshman program; CHEM 157 and 167 may replace 151 and 321); CHEM 321; 335, 336, 337, 346, 347 (or 231, 235, 236, 241, 242, and a passing score on the standard American Chemical Society examination in organic chemistry, if necessary); CHEM 455, 456, 457, 460 or 464; a minimum of 5 credits from 426, 429, 461, 462, or 463; 414 (or 416); 5 credits in English composition; one year of physics, including one credit of laboratory (PHYS 121, 122, 123, 132 recommended); MATH 124, 125, 126, and two additional courses numbered 200 or above (MATH 238 and 205 recommended); one year of German, French, or Russian or placement into second year on the language examination; 19 credits of approved upper-division science electives (or ENGR 141). Grade-point average of 2.80 in chemistry courses, with 1.7 or better in all required chemistry courses and a graduation grade-point average of 2.80 or better. Required science courses may not be taken on a satisfactory/not satisfactory basis.

Bachelor of Arts Degree

Admission Requirements: Same as for the Bachelor of Science degree.

Major Requirements: Chemistry requirements through 321 are the same as those listed for the Bachelor of Science degree: CHEM 231, 235, 236, 241, 242 (or 335, 336, 337, 346, 347); 350, 351, 455 (or 455, 456, 457); 460 or 464; 426, 429, 461, 462, or 463; 414 (or 416) recommended; 5 credits in English composition; one year of physics, including one credit of laboratory; MATH 124, 125, 126. Grade-point average of 2.00 in chemistry courses, with 1.7 or better in all required chemistry courses. Required science courses may not be taken on a satisfactory/not satisfactory basis.

Graduate Program

The Master of Science and Doctor of Philosophy programs are designed to lead to positions of leadership and independent investigation with research institutes, industrial laboratories, and government agencies, and as teachers, researchers, or administrators in colleges and universities in chemistry or in fields having substantial chemical content. The Doctor of Arts program is primarily designed for students planning careers in college teaching.

Qualifying examinations to assess knowledge and understanding of undergraduate material in four areas (analytical, inorganic, organic, physical with substitution of one of these by biochemistry, mathematics, or physics possible with permission) are given to entering students as an aid to planning course programs.

Thesis research for the Master of Science degree and dissertation research for the Doctor of Philosophy degree should constitute an original contribution to knowledge worthy of report in the scientific literature. The Doctor of Arts dissertation normally will constitute a critical review of an important body of chemical research.

Master of Science Degree

Admission Requirements: Baccalaureate degree with major in chemistry. Placement (qualifying) examinations.

Graduation Requirements: With Thesis—36 approved credits with 18 in courses at the 500 level or above; 18 in courses at the 400 level or above taken for numerical grade; 9 credits in thesis research. *Without Thesis*—Same as with thesis, except that additional graded course work may be substituted for a part of the required research. Grade-point average of 3.00 required for both degrees.

Doctor of Philosophy Degree

Admission Requirements: Same as for the Master of Science degree.

Graduation Requirements: 18-27 credits of approved courses at the 400 or 500 level, with a total grade-point average of 3.00; cumulative examinations covering area of specialization; reading proficiency in German or alternate approved foreign language; dissertation; experience as a teaching assistant or predoctoral teaching associate.

Doctor of Arts Degree

Admission Requirements: Completion of requirements for Master of Science degree with thesis.

Graduation Requirements: 33 credits (2.7 or higher grades), including CHEM 414 or 416, 418, 427, 508, 530, 531, 550, and 552 and selections from 410, 414 or 416, 415, 426, 435 or 436, 450, 460, 470 or 471, 532, 533, 551, 553, and 559; 9 credits (may be *S* grade) selected from 510, 520, 540, and 560 series with maximum of 6 in one area; 12 credits in approved electives outside chemistry; cumulative examinations in one or more areas of specialization; teaching internship; dissertation.

Faculty

Chairperson

Alvin L. Kwiram

Professors

Andersen, Niels H.,* Ph.D., 1967, Northwestern; structure, synthesis and biogenesis of sesquiterpenes and other natural products.

Anderson, Arthur G., Jr.,* Ph.D., 1944, Michigan; chemistry of nonclassical aromatic compounds and novel heterocycles, new synthetic reactions.

Borden, Weston T.,* Ph.D., 1968, Harvard; molecular orbital theory of organic molecules, hydrocarbon synthesis, mechanisms of fundamental reactions.

Cady, George H. (Emeritus), Ph.D., 1930, California; chemistry.

Callis, James B.* (Research), Ph.D., 1970, Washington; fluorescence spectroscopy, ultra-trace analysis of environmental pollutants, instrumentation development.

Christian, Gary D.,* Ph.D., 1964, Maryland; atomic absorption, clinical analysis, biological and environmental analytical problems, electroanalysis.

Eggers, David F., Jr.,* Ph.D., 1950, Minnesota; Raman and infrared spectra, spectra of pure substances and dilute solid solutions at low temperatures.

Eichinger, Bruce E.,* Ph.D., 1967, Stanford; physical chemistry of macromolecules.

Engel, Thomas,* (Physics), Ph.D., 1969, Chicago; surface chemistry and catalysis.

Epiotis, Nicolaos D.,* Ph.D., 1972, Princeton; quantum mechanics in organic and biochemistry.

Fairhall, Arthur W. (Emeritus), Ph.D., 1952, Massachusetts Institute of Technology; nuclear geochemistry.

Gouterman, Martin P.,* Ph.D., 1958, Chicago; electronic structure and spectra of porphyrins, vibrational-electronic interactions, radiationless transitions.

Gregory, Norman W.,* Ph.D., 1943, Ohio State; structure and thermodynamic properties of inorganic substances, vaporization reactions.

Halsey, George D.,* Ph.D., 1948, Princeton; absorption and interaction of rare gases with surfaces, solid solutions of rare gases, catalysis, colloids.

Jensen, Lyle H.,*‡ (Biological Structure, Biochemistry), Ph.D., 1943, Washington; molecular structure, x-ray diffraction.

Kowalski, Bruce, R.,* Ph.D., 1969, Washington; ultra-trace metal analysis by mass spectrometry, artificial intelligence and computers in chemistry.

Kwiram, Alvin L.,* Ph.D., 1963, California Institute of Technology; molecular structure and dynamics with emphasis on excited states: magnetic resonance (ESR, NMR, ENDOR, and optical detection methods).

Lingafelter, Edward C. (Emeritus), Ph.D., 1939, California (Berkeley); crystal and molecular structure of coordination compounds.

Meyer, Carl B.,* Ph.D., 1960, Zurich; indoor air pollutants, molecular spectroscopy (diatomics), sulfur chemistry.

Norman, Josephus G., Jr.,* Ph.D., 1972, Massachusetts Institute of Technology; synthesis and structures of transition metal complexes, theoretical calculations on large molecules.

Pocker, Yeshayau,* Ph.D., 1953, D.Sc., 1960, London (England); organic reaction mechanisms, chemical and enzymatic catalysis, metalloenzymes.

Rabinovitch, B. Seymour,* Ph.D., 1942, McGill; high-temperature gas kinetics, nonequilibrium systems, chemical activation, energy transfer

Reid, Brian R.,* (Biochemistry),† Ph.D., 1965, California (Berkeley); biophysical chemistry.

Ritter, David M. (Emeritus), Ph.D., 1937, Chicago; chemistry.

Robinson, Rex J. (Emeritus), Ph.D., 1929, Wisconsin; chemistry.

Rose, Norman, J.,* Ph.D., 1960, Illinois; design, synthesis, and study of coordination compounds of transition metals, including the lanthanides.

Schomaker, Verner (Emeritus), Ph.D., 1938, California Institute of Technology; crystal structures by x-ray diffraction, molecular-sieve catalysts.

Schubert, Wolfgang M.,* Ph.D., 1947, Minnesota; mechanism and steric course of organic reactions; substituent and solvent effects, acid-base catalysis.

Schurr, John M.,* Ph.D., 1964, California (Berkeley); thermal transitions in biopolymers, inelastic light scattering, time-dependent quantum theory.

Slutsky, Leon J.,* Ph.D., 1957, Massachusetts Institute of Technology; lattice dynamics, kinetics of conformational change, physical absorption.

Trager, William F.,* (Medicinal Chemistry), Ph.D., 1965, Washington; medicinal chemistry.

Vandenbosch, Robert,* (Physics), Ph.D., 1957, California (Berkeley); nuclear studies, particularly fission and nuclear reaction mechanisms, nuclear spectroscopy.

Zoller, William H.,* Ph.D., 1969, Massachusetts Institute of Technology; analytical, environmental, and nuclear chemistry

Associate Professors

Crittenden, Alden L.,* Ph.D., 1946, Illinois; mass spectra, solid electrode polarography.

Raucher, Stanley,* Ph.D., 1973, Minnesota; organic chemistry, development of new methods in synthetic organic chemistry and their application to the total synthesis of biologically active natural products.

Sivertz, Victorian (Emeritus), Ph.D., 1926, McGill; chemistry.

Woodman, Darrell J.,* Ph.D., 1965, Harvard; peptide synthesis, heterocyclic compounds, chemistry of ketoketenimines.

Assistant Professors

Hopkins, Paul B.,* Ph.D., 1982, Harvard; organic synthesis, bioorganic chemistry.

Macklin, John W.,* Ph.D., 1968, Cornell; spectroscopic studies of inorganic compounds and solution complexes, and empirical studies of Raman intensities.

McAlister, Donald R.,* Ph.D., 1978, California Institute of Technology; inorganic mechanisms in transition metal organic chemistry, synthesis and manipulation of air-sensitive compounds, mechanism and design of catalytic processes.

Robinson, Bruce H.,* Ph.D., 1975, Vanderbilt; magnetic resonance, molecular dynamics, polymer dynamics, nonlinear response theory.

Course Descriptions

Courses for Undergraduates

CHEM 100 Chemical Science (5) Sp Terminal survey course for nonscience majors. Not to be considered as preparation for other chemistry courses. No credit given to those who have taken one unit or more of high school chemistry.

CHEM 101 General Chemistry (5) AWSpS For nonscience and nonengineering majors who plan to terminate their study of chemistry with 101 or 102. Molecular theory, quantitative relationships in chemical processes, solutions, ionic equilibria, acids, bases, and salts. Chemistry of common metals and nonmetals. Students with strong high school background in chemistry are urged to take an exemption examination. For students with one year of high school chemistry, not more than 5 credits allowed from among 101, 105, and 140 or 145.

CHEM 102 General and Organic Chemistry (5) AWSpS Organic compounds; hydrocarbons, alcohols, aldehydes, ketones, ethers, acids, aromatics, fats and oils, proteins, and carbohydrates. Students who plan to take 231 should not take 102. Prerequisite: 101 or 101 exemption examination.

CHEM 105 Introduction to General Chemistry (3) AWSpS For students without a full year of high school chemistry who plan to take 140 or 145. (When 105 is not available, 101 may be helpful.) Basic introduction to chemistry for physical science, biological science, premedical, engineering majors who intend to take a year or more of college chemistry. Emphasis on quantitative reasoning. For students with one year of high school chemistry, not more than 5 credits allowed from among 101, 105, and 140 or 145.

CHEM 140 General Chemistry (4) AWSpS For science, engineering, and other majors who plan to take a year or more of chemistry courses. Chemical reactions, basic principles, equilibrium systems, structure and bonding, properties of matter. Prerequisites: high school chemistry or physics (both recommended), or 101 or 105; and qualification for MATH 124 or placement on basis of Washington Precollege Testing quantitative composite score.

CHEM 145 General Chemistry (4) A Parallels 140. For science, engineering, and other majors who plan to continue their study of chemistry through physical chemistry. Assumes strong high school background in chemistry, or 105 and good aptitude for study of science. Prerequisite: qualification for MATH 124 or placement on basis of Washington Precollege Testing quantitative composite score.

CHEM 150 General Chemistry (4) AWSpS Continuation of 140. Concurrent registration in 151 recommended. Prerequisite: 140 or 145.

CHEM 151 General Chemistry Laboratory (2) AWSpS Experiments illustrating quantitative relationships in chemistry. Prerequisite: concurrent registration in, or prior completion of, 150 or 155.

CHEM 155 General Chemistry (4) W To follow 145. Parallels 150. Prerequisite: 145.

CHEM 157 General Chemistry Honors Laboratory (3) W Introduction to quantitative chemistry. Prerequisites: 150 or 155 concurrently, and permission of adviser.

CHEM 160 General Chemistry (4) AWSpS Chemistry of representative elements, metals, and nonmetals. Introduction to organic and nuclear chemistry. Prerequisite: 150 or 155.

CHEM 164 General and Introductory Environmental Chemistry (5) Sp Parallels 160. Beyond the coverage of descriptive general chemistry of 160, additional material emphasizes environmental applications of basic chemistry. Prerequisite: 150 or 155.

CHEM 167 General Chemistry Honors Laboratory (3) Sp To follow 157. Prerequisite: 157.

CHEM 199 Special Problems (1, max. 6) AWSpS Problems relating to experimental chemistry. For chemistry majors only. Prerequisites: permission of chemistry adviser and a chemistry grade-point average above 3.00.

CHEM 231 Organic Chemistry (3) AWSpS For students planning two or three quarters of organic chemistry. Structure, nomenclature, reactions, and synthesis of the main types of organic compounds. Prerequisite: 150 or 155.

CHEM 232 Organic Chemistry (3) AWSpS Continuation of 231 for students planning only two quarters of organic chemistry. Consideration of polyfunctional compounds and natural products. Study of sugars, amino acids, and heterocycles. Prerequisite: 231.

CHEM 235 Organic Chemistry (3) AWSpS Continuation of 231 for those desiring three quarters of organic chemistry. Further discussion of transformations of organic molecules, especially aromatic systems. Prerequisite: 231.

CHEM 236 Organic Chemistry (3) AWSpS Continuation of 235 for those desiring three quarters of organic chemistry. Consideration of polyfunctional compounds and natural products. Study of sugars, amino acids, and heterocycles. Prerequisite: 235.

CHEM 241 Organic Chemistry Laboratory (3) AWSpS Usually to accompany 231. Preparation of representative compounds. Prerequisites: 231, which may be taken concurrently, and one laboratory course in chemistry.

CHEM 242 Organic Chemistry Laboratory (3) AWSpS Usually to accompany 232 or 236. Preparations and qualitative organic analysis. Prerequisites: 232 or 235, either of which may be taken concurrently, and 241.

CHEM 321 Quantitative Analysis (5) AWSpS Introduction to chemical analysis, including gravimetric, volumetric, spectrophotometric, and potentiometric analyses. Laboratory computer use included. Not intended for students who have completed 167. Prerequisites: 150 or 155, and 151 or strong high school laboratory preparation.

CHEM 335, 336, 337 Honors—Organic Chemistry (4,4,4) A,W,Sp For chemistry majors and other qualified students planning three or more quarters of organic chemistry. Structure, nomenclature, reactions, and synthesis of organic compounds. Theory and mechanism of organic reactions. Prerequisites: 160 or 155 for 335; 335 for 336; 336 for 337.

CHEM 346 Organic Chemistry Honors Laboratory (3) W Usually to accompany 336. Prerequisite: 336, which may be taken concurrently.

CHEM 347 Organic and Qualitative Organic Honors Laboratory (3) Sp Continuation of 346. Usually to accompany 337. Prerequisites: 337, which may be taken concurrently, and 346.

CHEM 350, 351 Elementary Physical Chemistry (3,3) W,Sp Survey of some major topics in physical chemistry. Prerequisites: two quarters of general chemistry, PHYS 116, and MATH 125 (126 recommended) or 157 for 350; 350 for 351.

CHEM 410 Radiochemical Techniques and Radioactivity Measurements (3) Sp Introductory general service course for students planning further work in nuclear or tracer applications. Safety procedures, detection and measurement of nuclear radiations, radiochemical and tracer techniques. Prerequisites: 150 or 155, MATH 124 and PHYS 116.

CHEM 414 Chemistry of the Main Group Elements (3) W The elements and their compounds in relation to the periodic system. Prerequisites: senior standing and 457, or 351 and 455.

CHEM 415 The Chemical Bond (3) W The nature of the chemical bond. Emphasis on simple bonding theories, molecular orbital methods, symmetry, and group theory. Includes some experience in carrying out molecular orbital calculations on the computer. Prerequisite: 455.

CHEM 416 Chemistry of the Transition Metal Elements (3) A Prerequisite: senior standing. Recommended: 351 or 457.

CHEM 418 Nuclear Chemistry (3) W Natural radioactivity, nuclear systematics and reactions, radioactive decay processes, decay laws, statistical considerations, applications of radioactivity. Prerequisite: 455.

CHEM 426 Instrumental Analysis (3) Sp Introduction to instrumental methods of chemical analysis, including atomic and molecular emission and absorption spectrometry and electrochemistry. Prerequisite: 167 or 321.

CHEM 427 Advanced Quantitative Theory (3) A Principles of analytical chemistry. Prerequisites: 321 or 167, 232 or 236 or 337, and 457.

CHEM 429 Chemical Separation Techniques (4) Sp Introduction to modern separation techniques such as gas chromatography, high-performance liquid chromatography, electrophoresis, and field flow fractionation. Prerequisite: one year of organic chemistry.

CHEM 435 Introductory Biophysical Chemistry (3) W Survey of the statics and dynamics of biophysical biochemical processes. Prerequisites: organic and physical chemistry. (Offered alternate years.)

CHEM 436 Introductory Bio-organic Chemistry (3) W Topics in biosynthetic chemistry. Emphasis on primary metabolic products (α-amino acids, carbohydrates, fatty acids, Krebs cycle intermediates, mevalonic acid) and secondary natural products (acetogenins, alkaloids, flavonoids, steroids). Prerequisite: 236 or 337. (Offered alternate years.)

CHEM 450 Applied Physical Chemistry (3) Sp Chemistry in environmental, biological, and material science. Methods rather than theory. Includes heterogeneous equilibrium in multicomponent systems, ionic solutions, nonideal solutions and gases, surface chemistry and catalysis, and thermodynamic calculations using tabulated data. Primarily for undergraduates and graduates in related fields, but acceptable for chemistry majors. Prerequisite: 350 or 456. Recommended: 351 or 457.

CHEM 455 Physical Chemistry (3) ASpS Introduction to quantum chemistry and spectroscopy. Theory of quantum mechanics presented at an elementary level and applied to the electronic structure of molecules and to molecular spectra. Honors section available Winter Quarter. Prerequisites: 150 or 155, MATH 126 (238 recommended), and college physics.

CHEM 456 Physical Chemistry (3) WS Chemical thermodynamics. Laws of thermodynamics presented with applications to phase equilibria, chemical equilibria, and solutions. Honors section available Autumn Quarter. Prerequisites: 150 or 155, MATH 126 (238 recommended), and college physics. May be taken without 455.

CHEM 457 Physical Chemistry (3) ASp Introduction to statistical mechanics, kinetic theory, chemical kinetics, and statistical thermodynamics. Other topics of physical chemistry not in 455 or 456 may be covered. Honors section available Spring Quarter. Prerequisites: 455 and 456.

CHEM 460 Spectroscopic Molecular Identification (3) Observation and interpretation of infrared, ultraviolet, NMR, and mass spectra with emphasis on the determination of structure of polyatomic molecules.

CHEM 461 Physical Chemistry Laboratory (2-3) AWSp Physical measurements in chemistry. Vacuum and high-temperature techniques, calorimetry, spectroscopic methods, electrical measurements. Prerequisites: 455, 457 or 351. Recommended: 464.

CHEM 462 Techniques of Synthetic Chemistry (2-3) ASp Techniques of synthetic chemistry with examples from organic, inorganic, and biological chemistry. Vacuum line synthesis, low- and high-temperature techniques, high-pressure syntheses, photochemical reactions, radiochemical synthesis, gas phase reactions, etc. Chromatography and separation techniques. Prerequisite: 347 or 242; 460, which may be taken concurrently.

CHEM 463 Spectroscopic Techniques for Structural Identification (2) AWSp Techniques of spectroscopic analysis for structural determination using UV, IR, NMR, mass spectroscopy. Prerequisite: 460, which may be taken concurrently.

CHEM 464 Principles of Spectroscopic Instrumentation and Data Analysis (3) Introduction to error analysis, modern spectroscopic techniques, and applications of computers in chemical science. Prerequisites: 455 and ENGR 141, or equivalent programming background.

CHEM 470 Physical Chemistry of Macromolecules (3) A Solution thermodynamics, chain dimensions, rubber elasticity, solid-state morphology, and viscoelastic behavior of high polymers. Prerequisites: 457 or 351 or equivalent, and FOR P 488 or CH E 570. (Offered alternate years.)

CHEM 471 Physical Chemistry of Macromolecules (3) W Classical hydrodynamic methods, and modern optical correlation and pulse techniques for studying dynamical motions and conformations of macromolecules, especially biopolymers, in solution. Cooperative thermal transitions, optical properties, and polyelectrolyte effects. Prerequisites: 457 or 351 and 455. Recommended: 470. (Offered alternate years.)

CHEM 490 Topics in Applied Chemistry (1, max. 3) A Applications of pure chemistry, as practiced in industrial and academic settings. Seminar topics vary and may include pulp and paper, petroleum, medicinal, environmental, and cosmetic chemistry, and biochemistry.

CHEM 498 Teaching Experience in Chemistry (1, max. 6) AWSpS Students are trained as assistants in laboratories and quiz sections. For chemistry majors, especially those planning graduate work. Prerequisites: permission of instructor, grade-point average above 3.00, and upper-division standing.

CHEM 499 Undergraduate Research (*, max. 12) AWSpS For qualified chemistry majors in the bachelor of science curriculum, especially those planning graduate work. Prerequisites: permission of adviser and grade-point average above 3.00 in chemistry courses.

Courses for Graduates Only

CHEM 508 Advanced Inorganic Chemistry (3, max. 9) Sp Discussion of selected applications of nuclear magnetic resonance spectrometry, electronic, infrared, and Raman spectroscopy, magnetic susceptibility measurements, Mossbauer spectrometry and isotope replacement studies in the understanding of structure and bonding in inorganic compounds.

CHEM 510 Current Problems in Inorganic and Nuclear Chemistry (3, max. 12) Sp For doctoral candidates in inorganic chemistry. Current topics (e.g., acid-base theory; halogens; hydrides; groups III and IV; interstitial, chelate, and high-temperature chemistry; inorganic free radicals.)

CHEM 520 Current Problems in Analytical Chemistry (2, max. 12) AWSp For doctoral candidates in analytical chemistry. Current topics (e.g., electrochemistry, trace analysis, methods of data treatment, analytical instrumentation theory).

CHEM 526 Advanced Analytical Analysis (3, max. 9) W Modern topics in analytical chemistry; emphasis on chemometrics and mass spectrometry. See instructor for topics covered during any particular quarter. Prerequisite: graduate standing. (Offered alternate years.)

CHEM 530 Advanced Organic Chemistry (3) A Fundamental aspects of organic structures and transformations. Structure and basicity of carbanions, substitution reactions, elimination reactions, nucleophilic addition and addition/elimination reactions, condensation reactions, structure and rearrangements of carbocations, electrophilic addition, electrophilic substitutions, neighboring group effects. Prerequisite: 337.

CHEM 531 Advanced Organic Chemistry (3) W Structure, mechanism, acidity and basicity, stereochemistry, kinetics and equilibria, reactive intermediates, and catalysis. Prerequisite: 530.

CHEM 532 Advanced Organic Chemistry (3) Sp Synthetic organic chemistry. Discussion of practical methods for the synthesis of complex organic molecules with an emphasis on synthetic strategy and the control of stereochemistry. Prerequisite: 531.

CHEM 533 Advanced Organic Chemistry (3) Sp Molecular orbital theory in organic chemistry. Woodward-Hoffman rules, aromaticity, concerted reactions, photochemical transformations, and reactions of electron-deficient species. Prerequisite: 530.

CHEM 540 Current Problems in Organic Chemistry (3, max. 18) AWSp For doctoral candidates in organic chemistry. Discussions of topics of current interest and importance. See the department for instructor and topic during any particular quarter.

CHEM 550 Introduction to Quantum Chemistry (3) A Origins and basic postulates of quantum mechanics; solutions to single particle problems; angular momentum and hydrogenic wave functions; matrix methods; perturbation theory; variational methods. Prerequisite: 455.

CHEM 551 Introduction to Quantum Chemistry (3) Sp Electronic structure of many-electron atoms and molecules; vibration and rotation levels of molecules; effects of particle exchange; angular momentum and group theory; spectroscopic selection rules. Prerequisite: 550.

CHEM 552, 553 Statistical Mechanics (3,3) A,W General theorems of statistical mechanics; relation of the equilibrium theory to classical thermodynamics; quantum statistics; theory of imperfect gases; lattice statistics and simple cooperative phenomena; lattice dynamics and theory of solids; liquids, solutions, and polymers; time-dependent phenomena and mechanisms of interaction. Prerequisites: 455 and 456 (concurrent registration permitted) or equivalent for 552; 552 for 553.

CHEM 559 Chemical Kinetics (3) Sp Modern experimental methods and fundamental theories of reaction rates. Role of vibrational excitation in unimolecular and bimolecular reactions. Energy transfer. Nonequilibrium systems and microscopic rate parameters. Prerequisite: 457 or 552.

CHEM 560 Current Problems in Physical Chemistry (3, max. 9) ASp For doctoral candidates in physical chemistry. A discussion of topics selected from active research fields. See the department for instructor and the topic during any particular quarter.

CHEM 561 Macromolecules (3, max. 9) Physical chemistry of macromolecules and biopolymers. Topics include solution thermodynamics, hydrodynamic properties, molecular weight distributions, optical and electro-optic techniques, chain configuration statistics, cooperative phenomena, theory of rubber elasticity, polyelectrolytes.

CHEM 562 Surface and Membrane Chemistry (3, max. 9) Advanced treatment of multiphase equilibrium; chemisorption and contact catalysis; micelles, theory of membrane formation, potentials, and action; physical adsorption and surface-area measurement. Prerequisites: 456 or other courses in basic thermodynamics and MATH 238; recommended: 552.

CHEM 563 Magnetic Resonance Methods in Chemistry (3, max. 9) Magnetic resonance phenomena in molecular systems. Topics include the chemical shift and spin-spin splitting in proton and 13C NMR, quadrupole interactions in NQR, hyperfine interaction and zero field splittings in ESR. Applications of magnetic resonance to the study of molecular structures and dynamics, including electronic properties of excited states as revealed by optical detection of magnetic resonance.

CHEM 581 Topics in Inorganic Chemistry (3, max. 18) AWSp Open only to students accepted for doctoral work in chemistry.

CHEM 582 Topics in Analytical Chemistry (3, max. 18) AWSp Open only to students accepted for doctoral work in chemistry.

CHEM 583 Topics in Organic Chemistry (3, max. 18) AWSp Open only to students accepted for doctoral work in chemistry.

CHEM 585 Topics in Physical Chemistry (3, max. 18) AWSp Open only to students accepted for doctoral work in chemistry.

CHEM 590 Seminar in General Chemistry (1, max. 18) AWSpS

CHEM 591 Seminar in Inorganic Chemistry (1, max. 18) AWSpS

CHEM 592 Seminar in Analytical Chemistry (1, max. 18) AWSpS

CHEM 593 Seminar in Organic Chemistry (1, max. 18) AWSpS

CHEM 594 Seminar in X-Ray Crystallography (1, max. 18) AWSpS

CHEM 595 Seminar in Physical Chemistry (1, max. 18) AWSpS

CHEM 600 Independent Study or Research (*) AWSpS Prerequisite: permission of coordinator.

CHEM 700 Master's Thesis (*) AWSpS Prerequisite: permission of coordinator.

CHEM 800 Doctoral Dissertation (*) Prerequisite: permission of coordinator.

Chicano Studies

B523 Padelford

An undergraduate degree in Chicano Studies is not offered. However, a General Studies degree is available to students interested in following a program in this area. Additional information is available from a General Studies adviser, B10 Padelford.

Course Descriptions

Courses for Undergraduates

CHSTU 102 Introduction to Chicano Studies (5) *Gamboa* Selected themes in Chicano experience; studies in Chicano politics and Chicano socioeconomic concerns. Not open to students who have taken GIS 302.

CHSTU 110 Beginning Mexican Folk Dance (3) A *Gonzalez-Radke* Fundamental technique course to increase appreciation and awareness of Mexican people and their culture through acquaintance with folk customs, historical backgrounds, costumes, and music. Expressive interpretation characteristic of regional dance forms. Regions include Oaxaca, Michoacan, Norte, and Jalisco. Not open to students who have taken GIS 110.

CHSTU 202 Intermediate Chicano Studies (3) AW *Gamboa* Follows 102. Further understanding of selected themes in Chicano experience; studies in Chicano politics and Chicano socioeconomic concerns.

CHSTU 204 History of Chicanos in Washington State (5) Sp *Gamboa* Causes, extent, and results of the Chicano presence from earliest Spanish explorations to the present; contemporary problems of Chicanos in a broader national context. Not open to students who have taken GIS 201.

CHSTU 207 Chicano Consumer: Past and Present (3) AW *Aguirre* Coordinates Chicano economic history with contemporary economic problems of Chicanos, emphasizing social, psychological, and financial aspects that deprive the Chicanos of their economic freedom. Not open to students who have taken GIS 207 or 208.

CHSTU 210 Beginning/Intermediate Mexican Dance (3) W *Gonzalez-Radke* Regional Mexican folk dancing: dance, costumes, music, and customs, concentrating on the regions of Oaxaca, Michoacan, and Jalisco. Not open to students who have taken GIS 111.

CHSTU 305 Advanced Chicano Studies (3) S *Gamboa* Chicano culture as related to current values and health practices, Mexican labor and immigration in both historical and contemporary setting. Chicano politics 1848 to present. Recurrent problems of Chicanos in society; social movement for acceptance and for self-determination.

CHSTU 310 Intermediate Mexican Folk Dance (3) Sp *Gonzalez-Radke* Expands the knowledge of Mexican folklore through research, dance, and music, enables students to create folk dance through the development of their own choreography. Prerequisite: 110 or 210 or equivalent.

CHSTU 391 Independent Study (1-6, max. 10) AWSpS *Flores, Gamboa* Students work individually or in teams. Prerequisite: permission of instructor.

CHSTU 491 Special Topics in Chicano Studies (3-5, max. 10) A Interdisciplinary course concentrating on one aspect of the Chicano Experience.

Chinese Regional Studies

See International Studies.

Classics

218 Denny

Classics embraces the ancient Greek and Roman civilizations from prehistoric times to the Middle Ages. The department is concerned with both the Greek and Latin languages and their literatures, including poetry, drama, history, philosophy, rhetoric, and political theory, as well as with classical art and archaeology.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: Classical Studies: Greek or Latin through 307 and 312 or the equivalent; 36 additional credits chosen with department approval from courses in Greek and Latin at the 300 or 400 level (excluding LAT 300, 301, or GRK 300, 301), classics in English, classical art and archaeology, ancient history, the history of ancient philosophy, and the history of ancient science. Classical studies is especially suited to students not preparing for graduate study in classics but wishing to explore the literature, history, art, archaeology, and philosophy of classical antiquity primarily through English translations.

Classics: 18 approved credits in Greek at the 400 level and 18 approved credits in Latin at the 400 level.

Greek: 27 approved credits in Greek at the 400 level plus 9 credits chosen with department approval from courses in Latin, Greek at the 400 level, classics in English, classical art and archaeology, ancient history, the history of ancient philosophy, and the history of ancient science.

Latin: 27 approved credits in Latin at the 400 level plus 9 credits chosen with department approval from courses in Greek, Latin at the 400 level, classics in English, classical art and archaeology, ancient history, the history of ancient philosophy, and the history of ancient science.

CLAS 101, 205, and HST 111 may not be offered in fulfillment of major requirements for baccalaureate degrees in the Department of Classics.

Graduate Program

Lawrence J. Bliquez, Graduate Program Coordinator

The Department of Classics offers programs of graduate study leading to the Master of Arts and Doctor of Philosophy degrees. The M.A. degree may be in Greek, Latin, or Classics (a combination of Greek and Latin). The Ph.D. degree requires both Greek and Latin.

The program of formal instruction has been designed to ensure comprehensive and thorough training in the basic disciplines needed for teaching and research. The department offers courses in the major writers and periods of literature, philosophy, and history, in classical art and archaeology, and in Greek and Latin linguistics. The courses in Greek and Latin literature include most works on the Ph.D. degree reading list. Seminars introduce research techniques through the study of more specialized topics, which vary from quarter to quarter. Students may include in their programs courses and seminars given by other departments in such subjects as ancient philosophy, ancient and medieval history, comparative literature, and linguistics. A brochure, *The Graduate Program in Classics*, available from the department gives additional information.

The Suzzallo Library has an extensive classics collection. The department's seminar room in Denny Hall, which is available to graduate students for their study and research, contains an excellent non-circulating library with such reference works as Pauly-Wissowa, *L'Année philologique*, the *Thesaurus Linguae Latinae*, the *Müller Handbuch* series, the Teubner and Oxford texts, commentaries on the classical authors, standard collections of inscriptions and fragments, and a number of important serials.

Applicants for admission to the M.A. program should present an undergraduate major or its equivalent in Greek, Latin, or Classics. Prospective aspirants for the Ph.D. degree should have had two years of upper-division study in both languages, but may be admitted with less preparation in one language if their preparation in the other language is exceptionally strong. Admission to the Ph.D. program may be granted after completion of the requirements for the M.A. degree.

M.A. degree requirements are a minimum of 27 credits in courses or seminars in Greek or Latin or both, and in related subjects approved by the department; a reading knowledge of French or German; either an acceptable thesis or 9 additional credits in approved graduate courses and seminars and a research paper.

Ph.D. degree requirements are a minimum of 72 credits in courses or seminars in Greek, Latin, and related subjects approved by the department; a reading knowledge of French and German; Greek and Latin prose composition; translation examinations on the Greek and Latin reading list; three research papers; an oral General Examination. Graduate students must have teaching experience before completing requirements for their terminal degree.

A number of teaching assistantships are available. Assistants teach sections of an elementary course in Latin and Greek derivatives, hold discussion sections in classical literature in translation, or assist faculty members with other courses. The teaching load is four to five hours a week throughout the academic year.

Correspondence and Information

Graduate Program Coordinator
218 Denny, DH-10

Faculty

Chairperson

Daniel P. Harmon

Professors

Grummel, William C. (Emeritus), Ph.D., 1949, New York; Latin literature and philosophy, Roman historians.

Harmon, Daniel P.,* (Comparative Literature),† Ph.D., 1968, Northwestern; Latin and Greek poetry, Greek and Roman religion, classical linguistics.

MacKay, Pierre A.,* (Near Eastern Languages and Civilization, Comparative Literature),† Ph.D., 1964, California (Berkeley); Greek literature, postclassical and Byzantine Greek literature, numismatics, computer typesetting and document preparation.

McDiarmid, John B. (Emeritus), Ph.D., 1940, Johns Hopkins; Greek literature and philosophy.

Pascal, Paul,* (Art History), Ph.D., 1953, North Carolina; Latin literature and paleography, medieval Latin.

Associate Professors

Bliquez, Lawrence J.,* (Art History),† Ph.D., 1968, Stanford; Greek oratory, Greek historiography and historians, Greek and Roman medicine.

Langdon, Merle K.,* (Art History),† Ph.D., 1972, Pennsylvania; Greek archaeology, epigraphy, topography, and history.

Assistant Professors

Clauss, James J., Ph.D., 1983, California (Berkeley); Latin poetry, Hellenistic literature.

Dunn, William R., A.M., 1980, Harvard; Roman drama, Latin prose.

Halleran, Michael R.,* Ph.D., 1981, Harvard; Greek tragedy, Greek epic, late republican and Augustan poetry.

Rissman, Leah,* Ph.D., 1980, Michigan; ancient epic, archaic Greek poetry, Roman satire.

Course Descriptions

Courses for Undergraduates

Classics Courses in English

Upper-division classics courses in English (300 and 400 level) in the Department of Classics do not generally have prerequisites. Most 400-level courses deal with a single genre of literature or with a limited area of classical studies. The 300-level courses deal with broader subjects at a relatively advanced level. Both are primarily for juniors and seniors, but they are open to freshmen and sophomores with an interest or background in the subject of the course.

CLAS 101 Latin and Greek in Current Use (2) AWSpS Designed to improve and increase English vocabulary through a study of the Latin and Greek elements in English, with emphasis on words in current literary and scientific use. No auditors. Knowledge of Latin or Greek is not required.

CLAS 205 Bioscientific Vocabulary Building From Latin and Greek (3) AWSpS Designed to help the student master the scientific vocabulary of his particular field by a study of the Latin and Greek roots that are used to create the majority of scientific terms. No auditors. Knowledge of Latin or Greek is not required.

CLAS 210 Greek and Roman Classics in English (5) AWSp *Bliquez, Halleran, Harmon, Langdon, MacKay, Pascal, Rissman* Introduction to classical literature through a study of the major Greek and Latin authors in modern translation.

CLAS 320 Greek and Roman Private and Public Life (3) A or Sp *Bliquez* Study of the civic and social practices and institutions of everyday Greek and Roman private and public life, including the family, social classes, the courts and legal systems, military service and war, technology and the trades, money and banking, agriculture and rural life. Many lectures illustrated by slides.

CLAS 322 Intellectual History of Classical Greece (5) Sp *Halleran* Development of Greek thought from mythic and poetic formulations to description, analysis, and systematic abstraction; based on the study of a variety of poetic, historical, and philosophical texts, from Homer to the Hellenistic age.

CLAS 420 Roman Politics: The Rise and Fall of Political Freedom (3) The political theory of the Romans, the realities of republican power politics, and the tensions and conflicts that brought about the loss of political freedom. Special attention is given to contrasts and comparisons with our own political institutions as they were conceived by the framers of the Constitution and as they function today.

CLAS 422 Greek Historians and Philosophers in English (3) Readings, lectures, and discussion of select historical and philosophic texts in English translation.

CLAS 424 The Epic Tradition (5) A *MacKay, Rissman* Ancient and medieval epic and heroic poetry of Europe in English: the *Iliad, Odyssey,* and *Aeneid;* the *Roland* or a comparable work from the medieval oral tradition; pre-Greek forerunners, other Greco-Roman literary epics, and later medieval and Renaissance developments and adaptations of the genre. Choice of reading material varies according to instructor's preference. Offered jointly with C LIT 424.

CLAS 427 Greek and Roman Tragedy in English (3) W *Halleran* Study of the development of Greek and Roman tragedy, with extensive readings in representative plays of Aeschylus, Sophocles, Euripides, and Seneca.

CLAS 428 Greek and Roman Comedy in English (3) A or Sp *Pascal* Readings from the comedies of Aristophanes, Plautus, and Terence.

CLAS 430 Greek and Roman Mythology (3) AWSp *Halleran, Pascal, Rissman* Principal myths found in classical and later literature.

CLAS 435 The Ancient Novel (3) W *Pascal* Study of the origins and growth of fiction and the novel in the Latin tradition.

CLAS 440 Greek and Roman Critics in English (3) Literary theories of the Greeks and the Romans as seen in the writings of Plato, Aristotle, Longinus, and other major classical authors. Attention is given to their influence on modern literary critics.

CLAS 445 Greek and Roman Religion (3) A *Harmon, Langdon* Religion in the social life of the Greeks and Romans, with emphasis placed on their public rituals and festivals. Attention is given to the priesthoods, personal piety, rituals of purification and healing, and the conflict of religions in the early Roman Empire. Many lectures illustrated by slides. Offered jointly with RELIG 445. Prerequisite: one course in ancient history, or classics, or religious studies; RELIG 201 preferred.

Classical Archaeology

CL AR 340 Pre-Classical Art and Archaeology (3) A *Langdon* Survey of the art and the other material remains of the civilizations in the Aegean from the Neolithic Age to the end of the Bronze Age, with special emphasis on Minoan Crete and the Mycenaean kingdoms of mainland Greece, illustrated by slides. The history, techniques, and results of significant excavations are examined. Offered jointly with ART H 340.

CL AR 341 Greek Art and Archaeology (3) W *Bliquez, Langdon* Survey of the material remains and the developing styles in sculpture, vase painting, architecture, and the minor arts from the geometric to the Hellenistic periods, illustrated by slides. Principal sites and monuments, as well as techniques and methods of excavation, are examined in an attempt to reconstruct the material culture of antiquity. Offered jointly with ART H 341.

CL AR 342 Roman Art and Archaeology (3) Sp *Pascal* Roman architecture and art, with emphasis on the innovations of the Romans; illustrated by slides. Offered jointly with ART H 342.

CL AR 343 Hellenistic Art and Archaeology (3) Sp *Langdon* Survey of the art of Greece and the eastern Mediterranean from the time of Alexander the Great to the Roman conquest. Principal sites with their sculpture, painting, mosaics, and minor arts examined in lectures illustrated with slides. Offered jointly with ART H 343.

CL AR 442 Greek and Roman Painting (3) A *Langdon* Study of painted decoration on Greek vases, and Roman wall painting, with emphasis on the historical and stylistic development of each. Offered jointly with ART H 442. (Offered alternate years; offered 1984-85.)

CL AR 444 Greek and Roman Sculpture (3) W *Langdon* History and development of Greek sculpture and sculptors, their Roman copyists, and Roman portraits and sarcophagi. Emphasis on Greek sculpture of the fifth century B.C. Offered jointly with ART H 444. (Offered alternate years; offered 1984-85.)

CL AR 446 Greek Architecture (3) Sp *Langdon* Detailed study of Greek architecture from its beginnings, with special emphasis on the Periclean building program in fifth-century Athens. Offered jointly with ARCH 454 and ART H 446. (Offered alternate years; offered 1984-85.)

Greek

GRK 101, 102, 103 Elementary Greek (5,5,5) A,W,Sp 101, 102: an intensive study of grammar, with reading and writing of simple Attic prose; 103: reading of selections from classical Greek literature. Prerequisites: 101 for 102, 102 for 103.

GRK 300, 301 Greek Language, Accelerated (5,5) W,Sp Intensive introduction to Attic Greek. Not accepted as upper-division credit toward a major in Greek or classics. Prerequisites: for 300, some previous experience in, or study of, a foreign language; 300 for 301.

GRK 305, 306 Attic Prose (3,3) A,W Selections from Attic prose, including Plato's *Republic,* Book I, Plato's *Apology,* and the orations of Lysias. To be taken concurrently with 310, 311. Prerequisites: 103 for 305; 305 for 306.

GRK 307 Homer (3) Sp Selections from the *Iliad* or *Odyssey.* To be taken concurrently with 312. Prerequisite: 306.

GRK 308 Introduction to Koine Greek Texts (3) Sp *Williams* Reading and discussion of selected religious and philosophical texts from Koine Greek. Prerequisite: 306.

GRK 310, 311, 312 Grammar and Composition (2,2,2) A,W,Sp To be taken concurrently with 305, 306, 307. Prerequisite: 103.

GRK 401, 402 ,403 Elementary Modern Greek (5,5,5) Introduction to spoken modern Greek, with emphasis on conversational skills. Reading of contemporary writers of demotic Greek. The artificial literary language (Katharevousa) is introduced but not explored in depth. Some experience in language study desirable.

Prerequisite for the following 400-level Greek courses: four years of high school Greek or 307 or permission of undergraduate adviser.

GRK 413 The Pre-Socratic Philosophers (3) A *Rissman* See above. (Offered alternate years; offered 1984-85.)

GRK 414 Plato (3) W See above. (Offered alternate years; offered 1984-85.)

GRK 415 Aristotle (3) Sp *MacKay* See above. (Offered alternate years; offered 1984-85.)

GRK 422 Herodotus and the Persian Wars (3) A *Bliquez* See above. (Offered alternate years; offered 1985-86.)

GRK 424 Thucydides and the Peloponnesian War (3) W *Bliquez, Langdon* See above. (Offered alternate years; offered 1985-86.)

GRK 426 Attic Orators (3) Sp *Bliquez, Langdon, MacKay* See above. (Offered alternate years; offered 1985-86.)

GRK 442, 443, 444 Greek Drama (3,3,3) A,W,Sp *Halleran* See above. (Offered alternate years; offered 1985-86.)

GRK 449 Greek Epic (3) A *Rissman* See above. (Offered alternate years; offered 1984-85.)

GRK 451 Lyric Poetry (3) W *Rissman* See above. (Offered alternate years; offered 1984-85.)

GRK 453 Pindar: The Epinician Odes (3) Sp *Halleran* See above. (Offered alternate years; offered 1984-85.)

GRK 461 Early Greek Literature (3-5, max. 15) S Readings and discussion of selected authors of the early Greek period.

GRK 462 Literature of Classical Athens (3-5, max. 15) S Readings and discussion of selected authors of classical Athens.

GRK 463 Hellenistic Greek Literature (3-5, max. 15) S Readings and discussion of selected authors of the Hellenistic Age.

GRK 490 Supervised Study (*, max. 18) AWSp Special work in literary and philosophical texts for graduates and undergraduates. Prerequisite: permission of undergraduate adviser.

GRK 499 Undergraduate Research (*, max. 18) AWSp Prerequisite: permission of undergraduate adviser.

Latin

LAT 101, 102, 103 Elementary Latin (5,5,5) A,W,Sp 101, 102: an intensive study of grammar, with reading and writing of simple Latin prose; 103: reading of selections from classical Latin literature. Prerequisites: 101 for 102, 102 for 103.

LAT 300, 301 Latin Language, Accelerated (5,5) W,Sp Intensive introduction to classical Latin. Not accepted as upper-division credit toward a major in Latin or classics. Prerequisites: for 300, some previous experience in, or study of, a foreign language; 300 for 301.

LAT 305 Introduction to Latin Literature (3) A Readings in prose and poetry from various Latin authors. To be taken concurrently with 310. Prerequisite: two years of high school Latin or 103.

LAT 306 Cicero and Ovid (3) W Readings from the orations of Cicero and the elegiac verse of Ovid. To be taken concurrently with 311. Prerequisite: 305.

LAT 307 Vergil (3) Sp Selections from the first six books of the *Aeneid.* To be taken concurrently with 312. Prerequisite: 306.

LAT 310, 311, 312 Grammar and Composition (2,2,2) A,W,Sp To be taken concurrently with 305, 306, 307. Prerequisite: 103.

LAT 401 Medieval Latin (3) Sp *Pascal* Prerequisite: permission of instructor.

Prerequisite for the following 400-level Latin courses: four years of high school Latin, or 307, or permission of undergraduate adviser.

LAT 412 Lucretius (3) A See above. (Offered alternate years; offered 1985-86.)

LAT 413 Cicero's Philosophical Works (3) W *Harmon* See above. (Offered alternate years; offered 1985-86.)

LAT 414 Seneca (3) Sp See above. (Offered alternate years; offered 1985-86.)

LAT 422 Livy (3) A *Harmon* See above. (Offered alternate years; offered 1984-85.)

LAT 423 Cicero and Sallust (3) W See above. (Offered alternate years; offered 1984-85.)

LAT 424 Tacitus (3) Sp *Harmon* See above. (Offered alternate years; offered 1984-85.)

LAT 447 Roman Lyric (3) A *Harmon* See above. (Offered alternate years; offered 1985-86.)

LAT 449 Roman Elegy (3) W *Harmon* See above. (Offered alternate years; offered 1985-86.)

LAT 451 Roman Satire (3) Sp *Rissman* See above. (Offered alternate years; offered 1985-86.)

LAT 457 Roman Drama (3) A *Pascal* See above. (Offered alternate years; offered 1984-85.)

LAT 458 Roman Epic (3) W *Halleran* See above. (Offered alternate years; offered 1984-85.)

LAT 459 Roman Pastoral (3) Sp *Halleran* See above. (Offered alternate years; offered 1984-85.)

LAT 461 Latin Literature of the Republic (3-5, max. 15) S Readings and discussion of selected authors from the era of the Roman Republic.

LAT 462 Latin Literature of the Augustan Age (3-5, max. 15) S Readings and discussion of selected authors from the Augustan era.

LAT 463 Latin Literature of the Empire (3-5, max. 15) S Readings and discussion of selected authors from the Roman Empire.

LAT 475 Improvement of Teaching: Latin (3) S *Pascal* Examination and evaluation of the various methods of teaching Latin; audiovisual aids; testing materials; textbooks; relation of Latin to other languages; Latin derivatives in English vocabulary. Offered jointly with EDC&I 438. (Offered Summer Quarter only.)

LAT 476 Caesar and Vergil for High School Teachers (3) S *Pascal* Interpretation of the works of Caesar and Vergil, with special reference to the problems of high school teaching. Offered jointly with EDC&I 439.

LAT 490 Supervised Study (*, max. 18) AWSp Special work in literary and philosophical texts for graduates and undergraduates. Prerequisite: permission of undergraduate adviser.

LAT 499 Undergraduate Research (*, max. 18) AWSp Prerequisite: permission of undergraduate adviser.

Courses for Graduates Only

Classics

CLAS 700 Master's Thesis (*)

CLAS 800 Doctoral Dissertation (*)

Greek

GRK 520 Seminar (3, max. 27) AWSp *Bliquez, Halleran, Harmon, MacKay, Rissman*

In the courses numbered 580 through 589, graduate students read extensively in texts appearing on the Ph.D. Greek reading list.

GRK 580 Greek Tragedy (3) A *Halleran* (Offered alternate years; offered 1984-85.)

GRK 582 Herodotus and Thucydides (3) W *Bliquez* (Offered alternate years; offered 1984-85.)

GRK 584 Plutarch, Xenophon, Demosthenes (3) Sp *Bliquez, MacKay* (Offered alternate years; offered 1984-85.)

GRK 585 Plato, *Republic* (3) A *MacKay* (Offered alternate years; offered 1985-86.)

GRK 587 Aristotle, *Politics or Ethics* (3) W *MacKay* (Offered alternate years; offered 1985-86.)

GRK 589 Aristophanes (3) Sp *Bliquez* (Offered alternate years; offered 1985-86.)

GRK 590 Supervised Study (*, max. 18) AWSp Prerequisite: permission of graduate program coordinator.

GRK 600 Independent Study or Research (*) AWSp

Latin

LAT 520 Seminar (3, max. 27) AWSp *Halleran, Harmon, Pascal, Rissman*

In the courses numbered 580 through 589, graduate students read extensively in texts appearing on the Ph.D. Latin reading list.

LAT 580 Roman Rhetoric (3) A (Offered alternate years; offered 1984-85.)

LAT 582 Augustan Poetry (3) W *Halleran, Harmon* (Offered alternate years; offered 1984-85.)

LAT 584 Survey of Latin Poetry (3) Sp *Harmon*

LAT 585 The Civil War: Caesar, Cicero, Lucan (3) A (Offered alternate years; offered 1985-86.)

LAT 587 Roman Comedy, Menander, and Petronius (3) W *Pascal* (Offered alternate years; offered 1985-86.)

LAT 589 Prose of the Roman Empire (3) Sp *Harmon* (Offered alternate years; offered 1985-86.)

LAT 590 Supervised Study (*, max. 18) AWSp Prerequisite: permission of graduate program coordinator.

LAT 600 Independent Study or Research (*) AWSP

Classical Archaeology

CL AR 511 Mycenaean Archaeology (3) The art, architecture, and culture of Greece in the late Bronze Age, with emphasis on recent archaeological and linguistic discoveries.

CL AR 513 Athenian Topography (3) *Langdon* Detailed consideration of the topography and monuments of ancient Athens from the beginning through the Roman period.

CL AR 515 Attic Epigraphy (3) *Langdon* Study of Athenian inscriptions with emphasis on their historical value. The classification and editing of inscriptions, epigraphical techniques, and special problems are treated in detail.

CL AR 541 Seminar in Greek and Roman Art (3) *Langdon* In-depth study of selected topics and problems of the art of ancient Greece and Rome. Offered jointly with ART H 541.

Classical Linguistics

CL LI 501 Comparative Phonology of Greek and Latin (3) *Harmon* Phonological developments of Greek and Latin from Indo-European to the classical periods of both languages.

CL LI 503 History of the Greek Language (3) W Morphological and syntactical development of the Greek language from Homer through the New Testament; the development of prose and poetic style.

CL LI 505 History of the Latin Language (3) Sp *Harmon* Morphological and syntactical development of the Latin language; the development of Latin as a literary language.

CL LI 506 Italic Dialects (3) *Harmon* Principal remains of the non-Latin languages and dialects of ancient Italy.

CL LI 508 Greek Dialects (3) Non-Attic dialects of ancient Greek, based on a study of inscriptions and the literary remains.

CL LI 510 Mycenaean Greek (3) *Langdon* Study of the Linear-B tablets found in Crete and on the Greek mainland.

Communications

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Undergraduate Program

The School of Communications offers undergraduate professional preparation in editorial journalism, advertising, broadcast journalism, and communications. Undergraduate majors are given training in communication skills and opportunities for practical experience in their fields. The undergraduate program is interdisciplinary, with emphasis on the social sciences and humanities.

Bachelor of Arts Degree

Admission Requirements: 75 credits completed with no more than 20 credits in School of Communications courses; 201, 202, 203 (or equivalents); at least one full quarter of work at the University of Washington prior to application; a grade-point average in the past three quarters (or 45 credits), either at the University of Washington or any other collegiate institution, at least .20 of a point above the preceding Spring Quarter all-University grade-point average; letters as required by the faculty. Satisfaction of these minimum requirements ensures consideration; it does not guarantee acceptance.

Major Requirements: 10 credits from courses in literature; 35 credits in related social sciences (courses to be selected from anthropology, economics, geography, history, philosophy, political science, psychology, and sociology), including at least 20 credits in upper-division courses and 20 credits in one department; core requirements of at least 50 credits within the school, to include the following: CMU 201, 202, 203, 315, 320; and three additional communications courses at the 400 level, one in each of these areas—theoretical, methodological, substantive (see adviser for specific listing for each category), with the exclusion of CMU 415, 449, 498; and one of the following sequences of study: Editorial Journalism—CMU 322, and 4 to 12 credits from among CMU 323, 324, 325, 327. Broadcast Journalism—CMU 350, 354, 356, 358. Advertising—CMU 341, 344, 345. Communications—Students are expected to plan and complete a coherent program of study, which also should satisfy the requirement that a minimum of 50 credits be completed within the School of Communications, including core requirements, must be approved by the faculty. Suggested programs in communication research, public communication, etc., are available for examination.

To continue as a major in the school, a student must maintain an acceptable grade-point average for all courses in the school and an average no more than .30 of a point below the all-University average for all course work outside the school.

Internship Programs: Internship credit does not fulfill any specific course requirements, nor does it apply to the 50 communications credits that must be earned for graduation. The internship is designed to augment, not replace, the formal course offerings.

Graduate Program

Gerald J. Baldasty, Graduate Program Coordinator

The School of Communications offers programs leading to the degrees of Master of Arts, Master of Communications, and Doctor of Philosophy. For admittance to a master's degree program, the student is expected to have a baccalaureate degree in journalism or communication or, before being admitted to the program, to complete any preparatory course work specified by the Graduate Admissions Committee. Basic communication skills courses (e.g., writing, editing, broadcast production) are offered only at the undergraduate level.

The Master in Communications program offers the practicing professional journalist an opportunity to develop a substantive reporting specialty in conjunction with the academic study of communication.

The Master of Arts program can be either preparation for doctoral study or a terminal degree. The student selects a major and a minor from sets of courses prescribed in three areas: (1) behavioral studies (communication dynamics, audience analysis, etc.); (2) institutional studies (history, law, media structure, etc.), and (3) international studies (communication systems, propaganda, etc.). A thesis is required.

The Doctor of Philosophy program is designed to develop conceptual and methodological capabilities in a substantive area of communication. (Substantive scholarly interests represented in the school may be found in the faculty listing below.) Doctoral students are expected to apply these capabilities as apprentice scholars in the teaching and research functions of the school.

A foreign language, if appropriate to the student's program of study, may be required in the M.A. and Ph.D. programs.

Special Requirements

Students are admitted to programs in the Autumn Quarter. February 15 is the deadline for all applicants who wish to be considered for financial support. The deadline for initiating applications for Autumn Quarter admission is April 1.

An applicant for a program must submit: transcripts of all previous study; results of required tests (the Graduate Record Examination for all programs, plus the Miller Analogies Test for the M.A. and Ph.D. programs); a letter of intent linking the applicant's vocational objectives to an available graduate program; three letters of recommendation and, where applicable, evidence of fluency in English.

Financial Aid

Applications for teaching and research assistantships should be submitted to the department by February 15. Notices of financial aid are sent in most cases on or about April 1.

Research Facilities

The International Communications Center facilitates research abroad, issues publications, and organizes international conferences.

The school maintains a reference center for current publications and general reference works. The editorial laboratory offers word-processing, text-editing, and computing capabilities to facilitate research and computer-assisted instruction. A remote station links the school to the University's three mainframe computers for statistical analysis, data-base management, and document preparation. The school has its own closed-circuit television laboratory. Access also is available to the University's radio (KCMU-FM and KUOW-FM) and television (KCTS-TV) stations.

Correspondence and Information

Graduate Program Coordinator
343 Communications, DS-40

Faculty

Director

William E. Ames

Professors

Ames, William E.,* Ph.D., 1962, Minnesota; communication history; early American history, historiography.

Carter, Richard F.,* Ph.D., 1957, Wisconsin, conceptual analysis, communication theory, new methods for communication research, scientific perspectives on behavioral analysis.

Edelstein, Alex S.,* Ph.D., 1958, Minnesota; comparative communication research, public opinion, propaganda, international communication.

Pember, Don R.,* Ph.D., 1969, Wisconsin; contemporary law and mass communication, First Amendment history, regulation of mass communication, press-government relations, contemporary media performance.

Ryan, Milo A. (Emeritus), M.A., 1934, Michigan; broadcasting.

Shadel, Willard F. (Emeritus), M.A., 1935, Michigan; broadcasting.

Smith, Henry Ladd (Emeritus), Ph.D., 1946, Wisconsin; history/editorial journalism.

Yenna, Fendall W.,* A.B., 1936, Hamilton; journalism.

Associate Professors

Baldasty, Gerald J.,* Ph.D., 1978, Washington; communications history and law; government-press relations, First Amendment philosophy and theory.

Bowen, Lawrence,* Ph.D., 1973, Wisconsin; advertising, media research, consumer information-seeking and -processing behaviors.

Bowes, John E.,* Ph.D., 1971, Michigan; man-machine communication (informatics), public opinion, international communication.

Cranston, Pat, M.J.,* 1954, Texas; broadcast journalism; history, writing, and production of docudramas.

Dervin, Brenda J.,* Ph.D., 1971, Michigan State; applied communication theory, survey research, content analysis, information-needs assessment, image assessment, communication training and system design.

Giffard, C. Anthony,* Ph.D., 1968, Washington; international communication systems, media systems in southern Africa, antecedents of the periodical press.

Jackson, Kenneth M.,* Ph.D., 1970, Washington; institutional communications, media research, mass media and public policy.

Johnston, William F., B.A., 1941, Idaho; editorial journalism.

Rotler, J. Reid (Emeritus), M.B.A., 1940, Ohio; advertising.

Samuelson, Merrill,* Ph.D., 1960, Stanford; research methods, processes of reading, patterns in reader selection of news stories.

Simpson, Roger A.,* Ph.D., 1973, Washington; communication history, law of communication, media economics, editorial journalism.

Stamm, Keith R.,* Ph.D., 1968, Wisconsin; communities and newspapers, new media technology, dynamic models of communication behavior.

Course Descriptions

Courses for Undergraduates

CMU 201 History and Development of Communication and Journalism (5) History and development of communication from prehistoric times: social and technical inventions; political and economic contexts. Not open for credit to students who have taken 214.

CMU 202 The Phenomena of Communicating (5) Types of communicating behaviors in progressively more complex situations, from individual cognition through interpersonal interactions to mass communicating. Not open for credit to students who have taken 200.

CMU 203 Mass Communications and Society (5) Structure and functions of mass media communication systems; audiences and content; alternative structures; implications of new technologies. Not open for credit to students who have taken 150.

CMU 300 Fundamentals of Applied Communication (5) Practice in communicating in variety of social relationships: intimate; employer-employee; instructor-student; client-helper; public organization. Problem areas include: cooperation, competition, instruction, and invention. Prerequisite: 202 or permission of instructor.

Journalism

CMU 304 The Press and Politics in the United States (3) Journalist's role in elections and public policy. Relationship between news coverage and political campaigns. Study and analysis of local political newswriting, reporting, and response by local and state political figures. Extensive off-campus experience included. Offered jointly with POL S 304.

CMU 315 Information Processing for Mass Media (5) Training in gathering information through interviews and observation, and from written records and other public sources. Practice in organizing and writing this information for presentation in a mass medium such as a newspaper or radio or television broadcast. Open only to majors. Prerequisite: ability to type.

CMU 320 Legal Aspects of Communications (5) Regulations governing publication and broadcast in the mass media. Open to nonmajors.

CMU 321 News Writing (4) Journalistic forms, diction, and conventions. News values. Prerequisites: major standing, typewriting.

CMU 322 Reporting (4) News gathering and writing. Open only to majors. Prerequisite: 315.

CMU 323 Special Reporting Topics (4, max. 12) Topics vary with instructor. Open only to majors. Prerequisite: 322.

CMU 324 Critical Writing for the Mass Media (4) Editorials, commentaries, reviews. Prerequisite: 315.

CMU 325 Copy Editing (4) Open only to majors. Prerequisites: 315 and permission of departmental adviser.

CMU 326 Magazine Article Writing (3) Prerequisite: permission of departmental adviser.

CMU 327 Legislative Reporting (12) W Full-time coverage of Washington legislature for a daily newspaper. Selected students live in Olympia, interview legislative delegations, report committee and floor sessions, gubernatorial and other press conferences. Open only to majors. Prerequisites: 315, 322, POL S 382, and permission of instructor.

CMU 391 Photography (3) Basic photojournalism, black-and-white processing and 35-mm. camera techniques, picture editing and layout, field assignments.

CMU 392 Advanced Still Photography (3) Photojournalism, introduction to color for publication, extensive field assignments for news and documentary, advertising, and free-lance photography.

CMU 399 Editorial Practicum Seminar (2-6, max. 6) Supervised academic work done in connection with editorial internship. Designed to extend the student's knowledge of professional perspectives. Does not apply to required 50 credits in communications. Open only to majors. Prerequisites: 315, 320, 322, and permission of instructor.

CMU 415 Production Editing (4) Editorial role in preparation of text and visual materials for production (typesetting, layout, printing, binding, distribution). Editor's responsibilities and prerogatives as they relate to those of other professionals in the production phase of the publications field. Offered jointly with STC 415. Prerequisite: STC 402 or permission of instructor.

Public Relations

CMU 339 Problems in Public Relations (3) Group practice in applying techniques to problems of local businesses and agencies.

Advertising

CMU 341 Beginning Advertising Copy and Layout (3) Writing effective copy; developing creative approaches. Specific approaches and strategies. Open only to majors. Prerequisite: 315.

CMU 342 Advanced Advertising Copy and Layout (3) Multimedia creative and writing experience. Open to majors only. Prerequisite: 341.

CMU 344 Advertising Media Planning (3) Characteristics of the media. Demographic, geographic, and psychographic factors in developing a target audience. Writing of local and national media plans. Open only to majors. Prerequisite: 315.

CMU 345 Advertising Campaigns (5) Preparation of an advertising plan for a product or service. Open only to majors. Prerequisites: 341 and 344.

CMU 347 Advertising Internship (2-5, max. 6) Internships are assigned to qualified students through the cooperation of the industry working with the school. Open only to majors. Does not apply to required 50 credits in communications. Prerequisites: 341 or 344, depending on nature of internship; 120 credits completed.

CMU 348 Advertising Research (3) Problems relevant to advertisers, agencies, media, and syndicated services. Conceptualization in mass communication context. Review of literature. Open only to majors. Prerequisite: 315.

CMU 449 Advertising Seminar (3) Presentations by industry professionals of current practice. Prerequisite: senior standing in advertising sequence.

Broadcast Journalism

CMU 350 Writing and Reporting Broadcast News (5) Writing and producing news stories and newscasts for broadcasting. Open to majors only. Prerequisite: 315.

CMU 354 Basic Visual Communication (3) Basics common to all visual media, plus motion. Use of electronic and film materials in news and public affairs programming; emphasis on visual continuity and editorial judgment. Open only to majors.

CMU 356 News Broadcasting (3) Preparation and presentation of news broadcasts; editing radio news program; use of visuals; television newscast performance. Open only to majors. Prerequisite: 315, 350.

CMU 358 TV News Reporting and Editing (5) Preparation and presentation of news broadcasts, including reporting, scripting, and use of visuals. Prerequisites: 315, 350, 354.

CMU 367 Broadcast Internship (2-5, max. 6) Experience in the day-to-day operation of a broadcast station. Internship credit may not be applied to fulfill specific course requirements or to 50-credit requirement for a communications major. For majors only. Prerequisites: 315, 320, 350, and courses determined by faculty coordinator.

CMU 373 Television Writing (3) Practice in writing programs; camera, direction, and production problems.

CMU 377 The Documentary (3) History, background, aims, creative aspects. Function in mass media. Open to nonmajors.

Courses for Undergraduate and Graduate Students

CMU 400 Communications Theory (3) Applicability of theory. Important communication phenomena and principles of communicating. Nature of communicating. Useful perspectives on communicating. Analysis of communicating and its effects. Prerequisite: 202 or permission of instructor.

CMU 407 Content Analysis (3) Techniques used in the systematic study of messages.

CMU 408 Survey Research Methods in Communication (3) Practical exercises, readings, and discussion of survey research applications, including sampling theory, survey designs, measurement and questionnaire design; data collection and processing, data presentation and interpretation. Prerequisite: 411 or equivalent.

CMU 409 Experimentation in Communication (3) Techniques of experimentation in the study of communicating. Prerequisite: elementary statistics.

CMU 411 Mass Communications Research (5) Sample surveys, content analysis, or experimental techniques, depending upon interests of class and instructor. Recommended: relevant courses in the social sciences.

CMU 417 History and Communications (3 or 2) Development of mass communication in the United States. Journalism and its response to change in social, political, and ethical patterns. Individual research project. Prerequisite: 201.

CMU 419 Government and Mass Communications (3 or 2) The Anglo-American concept of freedom of communication; its evolution under federal and state constitutions. Tension areas, judicial decisions, statutes, and administrative regulations affecting publishing, broadcasting, etc. Individual research project.

CMU 421 Structure and Process of the Mass Media (3 or 2) Organization for information and enforcement. Consequences of public policy. Place in American political economy. Individual research project. Prerequisite: 201 or 203 or permission of instructor.

CMU 447 Communication and Consumer Behavior (3) Consumer information processing and buying behavior. Review of research. Prerequisite: 202 or permission of instructor.

CMU 463 Television Production Workshop for Teachers (5) Presentation of instruction through television. Offered jointly with EDC&I 489. Open only to nonmajors.

CMU 470 Theory and Criticism of Broadcasting (3) Application of critical standards to the sociological functions and esthetic elements of broadcast media. Recommended: relevant courses in the social sciences or humanities.

CMU 471 National Systems of Broadcasting (3) Each quarter the course focuses on a broadcast system of a different country, comparing origins, development, and present operation with the U.S. system. Consult advising office for schedule of topical offerings each quarter. Open to nonmajors. Prerequisites: 201 and 203 or permission of instructor.

CMU 476 Noncommercial R-TV (3) History of educational radio and television as it relates to the current public and instructional systems of broadcasting. Emphasis on political/financial relationships. Prerequisite: nonmajors by permission of instructor only.

CMU 479 Propaganda (3 or 2) Analysis of selective information techniques and involuntary exposure of audience. Role of propaganda in countries other than the United States. Individual research project.

CMU 481 Public Opinion and Communication (3 or 2) Collective behavior and its methodology. Polls evaluated as referendums on government policies, as manipulative instruments, and as expressions of the commonality of thought. Role of the mass media. Individual research project. Recommended: relevant courses in political science, sociology, psychology, or communications.

CMU 483 International Communication Systems (5) Patterns, institutions, cultural influences, functions of the media in particular foreign areas. Problems of cultural compatibility and structural linkage.

CMU 484 Comparative Communication Research (3 or 2) Point of view and conceptual and methodological approaches to comparative communication research. Analyzes a large body of substantive research as a means of assessing its generality and utility for theory and practice.

CMU 486 Telecommunications Policy and Research (3) Considers new telecommunications technologies as they influence, and are influenced by, behavioral, social, economic, and policy matters. Discussion in lay terms of technologies *per se*. Prerequisite: major standing or permisson of instructor.

CMU 498 Problems of Communications (1-5, max. 10) Research and individual study. Prerequisite: permission of instructor.

Courses for Graduates Only

CMU 500, 501 Seminar in Theory of Communication (5,5) Procedures for analyzing concepts and theoretical material to provide basis for one's research. How to make productive use of the literature. Procedures for theorizing about empirical findings and generalizations. Typologies, models, theories, laws, and working hypotheses. Prerequisite: permission of instructor.

CMU 505 Communication and Politics (3) Primary literature dealing with communication and American political behavior. Prerequisite: 421.

CMU 507 Computer Applications in Communication Research (3) Potential of the computer for use in behavioral science. Prerequisites: elementary programming, elementary statistics.

CMU 508, 509 Communication Research (5,5) Basic methodological questions in communication research. Foundations in history and philosophy of science. Prerequisite: permission of instructor.

CMU 511 Seminar in Communication Research (3, max. 15) Individual research projects undertaken collectively within a given area of study, under direction of faculty member. Prerequisite: permission of instructor.

CMU 515 Field Seminar in Communication Historiography (5) Readings in communications history.

CMU 516 Communications History Research Methods (5) Development of the historical approach to communications research. Study of historical methods, bibliography, and criticism.

CMU 517 Seminar in Communications History (5) Topical research seminar in communications history.

CMU 519 Seminar in Government and Mass Communications (5) Legal problems of mass communication, institutions, and media operations.

CMU 521 Seminar in Media Structure (5) Directed independent research into structural aspects of American mass communications. Prerequisite: graduate standing.

CMU 543 Seminar in Advertising in Society (3) Interacting historical, social, economic, and legal influences shaping institutional character. Prerequisite: permission of instructor.

CMU 547 Seminar in Communication and Consumer Behavior (3) Directed reading and research in communication and consumer behavior. Emphasis on conceptualization and original research. Prerequisite: permission of instructor.

CMU 550 Advanced Communication Methods (1-3, max. 3) Directed individual projects at a level acceptable by print or broadcast media. Advanced techniques of research and production analyzed and applied. Open only to students seeking the Master in Communications degree.

CMU 570 Seminar in the Theory and Criticism of Broadcasting (3) Criticism of the function and performance of broadcasting. Use of primary sources, including systematic data gathering and analysis. Prerequisite: 470.

CMU 580 Seminar in Propaganda (5) Analysis of propaganda as historical and behavioral phenomena. United States and international perspectives. Interdisciplinary focus.

CMU 581 Seminar in Public Opinion and Communication (5) Conceptual and methodological approaches to public opinion and communication as historical and behavioral phenomena. United States and international perspectives. Recommended: appropriate background in the social sciences.

CMU 583 Seminar in International Communication Systems (3) International communications and contemporary issues that affect the functioning of global communication systems. Interdisciplinary focus.

CMU 584 Seminar in Regional Communication Systems (3, max. 6) Communication as a factor in economic, sociocultural, and political relations among nations of a region. Focus varies with specialization of instructor. Consult graduate secretary for details. Interdisciplinary focus.

CMU 585 Seminar in Comparative Methodologies (3) Conceptual and methodological approaches to comparative studies of international communication systems. Recommended: appropriate background in the social sciences.

CMU 586 Telecommunications Structure and Policies (3) Structures and policies governing the functioning of communication technologies and data flow: U.S. and international perspectives. Interdisciplinary approach.

CMU 590, 591, 592 Proseminar in Communication (1,1,1) Behavioral, institutional, and international approaches to the study of communication.

CMU 597 Practicum in Communication Research (1-3, max. 6) Student participation in faculty-directed research projects.

CMU 598 Selected Readings (1-5, max. 10) Prerequisite: permission of supervisory committee chairperson.

CMU 600 Independent Study or Research (*) Prerequisite: permission of supervisory committee chairperson.

CMU 700 Master's Thesis (*)

CMU 800 Doctoral Dissertation (*)

Comparative History of Ideas

B531 Padelford

Comparative History of Ideas provides for the interdisciplinary study of intellectual history by bringing together thematically related courses from such fields as literature, history, anthropology, philosophy, the arts, and religious studies. Courses within the program have been chosen and designed to explore the history of specific ideas or themes, to examine the history of particular intellectual cultures (Western and non-Western), or to study comparatively the underlying assumptions and attitudes of different intellectual worlds. As a unique approach to liberal humanistic studies, the program provides a solid basis for postgraduate study in, for example, law, administration, medicine, education, journalism, or area studies.

Undergraduate Program

A Bachelor of Arts degree in the Comparative History of Ideas is offered through the Comparative Literature major.

Major Requirements: 55 credits with a 2.50 grade-point average, including colloquium in the history of ideas, six core courses distributed in three areas, and the remaining credits chosen among approved electives. At least half the credits presented for the major must be at the upper-division level. An optional senior thesis requiring an additional 15 credits is available.

Faculty Executive Committee

Chairperson

John E. Toews

Behler, Ernst H.,* Ph.D., 1951, Munich, romanticism, literary theory, history of criticism.

Boler, John F.,* Ph.D., 1960, Harvard; medieval philosophy.

Collins, Douglas P.,* Ph.D., 1978, Missouri; nineteenth- and twentieth-century literature.

Hankins, Thomas, L.,* Ph.D., 1964, Cornell; history of science.

Opperman, Hal N.,* Ph.D., 1972, Chicago; history of art.

Searle, Leroy F.,* Ph.D., 1970, Iowa; twentieth-century literature, critical theory, American studies.

Toews, John E.,* Ph.D., 1973, Harvard; modern intellectual history.

Webb, Eugene,* Ph.D., 1965, Columbia, modern English, French, and German literature, comparative religion.

Course Descriptions

Courses for Undergraduates

CHID 390 Colloquium in the History of Ideas (5) Basic theoretical issues in the comparative history of ideas as a disciplined mode of inquiry; examination of representative historical figures and problems. Primarily for majors; open to nonmajors by permission of program adviser.

CHID 491-492-493 Senior Thesis (5-5-5) 491: critical and methodological issues. 492-493: research and writing of thesis under supervision of a faculty member. Required of candidates for an honors degree; available to others with permission of program adviser. Prerequisite: 390.

CHID 499 Undergraduate Independent Study of Research (1-5, max. 10) AWSP Supervised independent study for students who wish to pursue topics not available in regular course offerings. Prerequisite: permission of program adviser.

Comparative Literature

B531 Padelford

The Comparative Literature program transcends the confines of a national literature and explores the relationships existing among several literatures. In addition, the program is concerned with the relationship of literature to the arts and to such fields of knowledge as philosophy, religion, and political thought. Typical areas of inquiry include literary traditions and periods, motifs, genres; patterns of influence and reception of literary works among national cultures; and the general principles of literary theory and criticism.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: 50 credits, including the following courses: CLAS 210 or any upper-division literature course in classics; C LIT 300, 301, 302, and two additional courses in comparative literature at the 300 or 400 level; and at least one course in a literature, studied in the original tongue, other than the student's native literature. Remaining credits are to be earned, with few exceptions, in 300- and 400-level courses from among the offerings of Comparative Literature and the eight participating departments: Asian Languages and Literature, Classics, English, Germanics, Near Eastern Languages and Civilization, Romance Languages and Literature, Scandinavian Languages and Literature, and, Slavic Languages and Literature. Departmental courses in foreign literature in translation are listed under the respective departments.

Graduate Program

Jean M. Dombush, Graduate Program Coordinator

The Department of Comparative Literature offers a program of study with faculty drawn from the following participating departments: Asian Languages and Literature, Classics, English, Germanics, Near Eastern Languages and Civilization, Romance Languages and Literature, Scandinavian Languages and Literature, and Slavic Languages and Literature. Study in this program leads to a Master of Arts or Doctor of Philosophy degree. Students concentrate on graduate courses in comparative literature and specialize in two or more national literatures of major interest to them, studied in the original language. With permission, a Ph.D. aspirant may choose as a third area of study a field outside of literature (e.g., philosophy, religion, art, political thought). On receiving the advanced degree, the student is qualified for teaching and research in comparative and general literature, as well as the language and literature of his or her specialization.

Special Requirements

Applicants for the M.A. program are required to have a B.A. degree in comparative literature, English, or any foreign literature, or an equivalent background; applicants for the Ph.D. program are required to have an M.A. in one of the above. M.A. students are required to demonstrate advanced competence in one foreign language and a basic reading knowledge of a second. Ph.D. students are required to demonstrate advanced competence in two foreign languages and a basic reading knowledge of a third. Advanced competence usually must be demonstrated upon admission to the program, and the reading knowledge is required before M.A. or Ph.D. examinations are administered. Language competence is evaluated by Comparative Literature faculty through departmental examinations or by evidence of completion of satisfactory advanced (400- or 500-level) course work in the language.

Financial Aid

Students working for advanced degrees in comparative literature are eligible to apply for teaching assistantships in the department(s) of language and literature relevant to their specialization. Comparative Literature has a very limited number of teaching assistantships available and they are usually awarded to advanced students.

Correspondence and Information

Graduate Program Coordinator
B531 Padelford, GN-32

Faculty

Chairperson

Ernst H. Behler

Professors

Adams, Hazard S.,* (English),† Ph.D., 1953, Washington; literary theory, history of criticism.

Altieri, Charles F.,* (English),† Ph.D., 1969, North Carolina; nineteenth- and twentieth-century literature, literary theory.

Behler, Diana I.,* (Germanics),† Ph.D., 1970, Washington; romanticism, the novel, nineteenth century.

Behler, Ernst H.,* (Germanics),† Ph.D., 1951, Munich (Germany); romanticism, literary theory, history of criticism.

Christofides, Constantine G.,* (Art History, Romance Languages and Literature),† Ph.D., 1956, Michigan; seventeenth-century French literature, literature and art.

Harmon, Daniel P.,* (Classics),† Ph.D., 1968, Northwestern; Greek and Roman religion, Latin poetry, Greek tragedy.

Hruby, Antonin,* (Germanics),† Ph.D., 1946, Prague; medieval European literature.

Jones, Frank W. (Emeritus), Ph.D., 1955, Oxford (England); translation, twentieth-century theatre, poetry.

Leiner, Jacqueline (Emeritus), (Romance Languages and Literature),† Dr. es Lettres, 1969, Strasbourg (Germany); nineteenth- and twentieth-century French, African literature.

Leiner, Wolfgang (Emeritus), D.Phil., 1955, University de la Sarre; seventeenth- and twentieth-century French and Italian literature.

Mackay, Pierre A.,* (Classics, Near Eastern Languages and Civilization),† Ph.D., 1964, California (Berkeley); Greek and Arabic literature.

McKinnon, Richard N.,* (Asian Languages and Literature, East Asian Studies),† Ph.D., 1951, Harvard; Japanese literature.

Reinert, Otto,* (English),† Ph.D., 1952, Yale; modern European drama.

Rossel, Sven H.,* (Scandinavian Languages and Literature),† Magister, 1968, Copenhagen; medieval literature, European preromanticism and romanticism, European symbolism, Danish.

Steene, Birgitta K.,* (Scandinavian Languages and Literature),† Ph.D., 1960, Washington; modern Scandinavian drama, Scandinavian film, comparative literature.

Wang, Ching-Hsien,* (Asian Languages and Literature),† Ph.D., 1971, California (Berkeley); Chinese poetry, East-West literary relations.

Webb, Eugene,* (International Studies),† Ph.D., 1965, Columbia; modern English and French, and German literature, comparative religion.

Ziadeh, Farhat, J.,* (Near Eastern Languages and Civilization),† LL.B., 1940, London; Arabic language and literature, Islamic law, Islamic institutions.

Associate Professors

Ammerlahn, Hellmut H.,* (Germanics),† Ph.D., 1965, Texas; the age of Goethe, literary symbolism and psychology, West European literature and culture from seventeenth century to twentieth century.

Andrews, Walter G.,* (Near Eastern Languages and Civilization),† Ph.D., 1970, Michigan; Near Eastern literature.

Ellrich, Robert J.,* (Romance Languages and Literature),† Ph.D., 1960, Harvard; eighteenth-century European literature.

Kogoj-Kapetanic, Breda,* Litt.D., 1966, Zagreb (Yugoslavia); theories of comparative literature, theory of the novel, nineteenth- and twentieth-century European literature.

Konick, Willis A.,* (Slavic Languages and Literature, International Studies),† Ph.D., 1964, Washington; Russian literature, nineteenth-century European literature.

Kramer, Karl D.,* (Slavic Languages and Literature),† Ph.D., 1964, Washington; late nineteenth-century Russian, American, and French literature, short story.

Loraine, Michael B.,* (Near Eastern Languages and Civilization),† Ph.D., 1968, Cambridge; Persian language and literature.

McLean, Sammy K.,* (Germanics),† Ph.D., 1963, Michigan; Western drama, twentieth-century poetry, psychoanalysis and literature, translation.

Modiano, Raimonda,* (English),† Ph.D., 1973, California (San Diego); romanticism.

Sehmsdorf, Henning K.,* (Scandinavian Languages and Literature),† Ph.D., 1968, Chicago; mythology and folklore, European romanticism.

Vaughan, Micael F.,* (English),† Ph.D., 1973, Cornell; medieval English literature.

Willeford, William O.,* (English),† Ph.D., 1966, Zurich (Switzerland); Renaissance and modern English literature, literature and psychology and mythology.

Yarbro-Bejarano, Yvonne M.,* (Romance Languages and Literature),† Ph.D., 1976, Harvard; sixteenth- and seventeenth-century literature of Spain, Chicano theater.

Assistant Professor

Peck, Jeffrey M., (Germanics),† Ph.D., 1979, California (Berkeley); literary criticism and history, nineteenth- and twentieth-century literature.

Lecturer

Dornbush, Jean M.,* Ph.D., 1976, Princeton; medieval period, symbolist poetry, modern literary theory.

Course Descriptions

All Comparative Literature courses are taught in English unless otherwise indicated. It is recommended that students enrolling in 300- or 400-level courses have taken 10-15 credits in literature or general humanities courses. Content of many courses varies from quarter to quarter.

Courses for Undergraduates

C LIT 200 Introduction to Comparative Literature (5) Reading, understanding, and enjoying literature from various countries, in different forms of expression (e.g., dramatic, lyric, narrative, rhetorical) and of representative periods. Emphasis on the comparative study of themes and motifs common to many literatures of the world.

C LIT 240 Writing in Comparative Literature (5) Comparative approach to literature and a workshop in writing comparative papers. Emphasis on cross-cultural comparison of literary masterpieces. Readings in English with an option to read selected texts in the original languages (French, German, Italian, Russian, Spanish, or a Scandinavian language—varies each quarter). Writing in English. Basic reading knowledge of one of the above languages recommended.

C LIT 250 Themes in World Literature: Parents and Children (5) World literature, from the Renaissance to modern times, based upon the theme of "parents and children." Selections drawn from European, English, and American literature, not limited to period and genre. Focus upon the motive of generational conflict.

C LIT 251 Themes in World Literature: Love, Sex, and Murder (5) World literature, from the Renaissance to modern times, based upon the theme of "love, sex, and murder." Selections drawn from European, English, and American literature, not limited to period and genre. Focus upon the human potential for both great violence and extraordinary compassion.

C LIT 252 Themes in World Literature: Death and Transfiguration (5) Theme of death, transfiguration, and new life in world literature. Selections from Tolstoy, D. H. Lawrence, Celine, E. M. Forster, and other major writers.

C LIT 300 Comparative Literature: Genres (5) A Major genres of world literature: poetry, fiction, drama. Readings, in English, from a wide selection of national literatures.

C LIT 301 Comparative Literature: Periods (5) W Major periods of world literature. Readings, in English, from a wide selection of national literatures.

C LIT 302 Comparative Literature: Themes (5) Sp Major themes of world literature. Readings, in English, from a wide selection of national literatures.

C LIT 310 The Concept of Revolution in Modern Literature and Thought (5) The idea of revolution, as it evolved in the wake of the American and French revolutions, in major works of Western literature and thought from the Enlightenment and the period of romanticism to contemporary treatments of the revolutionary theme.

C LIT 315 Literature of Absurdity (5) French, German, British, and American absurd novels and plays, 1940-65, including Sartre, Camus, Ionesco, Beckett, Albee, Pinter, and others. Background lectures in philosophy and literature.

C LIT 357 Literature and Film (3-5, max. 10) The film as an art form, with particular reference to the literary dimension of film and to the interaction of literature with the other artistic media employed in the form. Films are shown as an integral part of the course. Content varies.

C LIT 398 Special Studies in Comparative Literature (3-5, max. 10) Offered by visitors or resident faculty. Content varies.

C LIT 401 Modern European Drama (5) Selected plays, read in English, by Ibsen, Strindberg, Chekhov, Pirandello, Brecht, Camus, Durrenmatt, the absurdists, and others, representing naturalism, expressionism, theatricalism, and other movements that have shaped the modern European theater.

C LIT 405 Romanticism (5) Literature, philosophy, esthetics, and culture of Western romanticism. Emphasis on literature and criticism and on historical and philosophical aspects of the romantic movement in Europe and the United States.

C LIT 407 Literary Impressionism (5) Selected novels, stories, poems, and plays by Fet, Garshin, Chekhov, Crane, Conrad, James, Bunin, and Proust, which are frequently identified with the impressionist trend in Western literature from 1850 to 1920.

C LIT 410 Literary Motifs (3-5, max. 10) Important fictional figures, situations, and plots that, through their repeated recurrence in world literature, appear to have a profound and universal significance for the human imagination. Content varies.

C LIT 415 The Comic in Literature (5) Masterpieces of comic literature emphasizing various modes and uses of the comic.

C LIT 424 The Epic Tradition (5) A Ancient and medieval epic and heroic poetry of Europe in English: the *Iliad, Odyssey,* and *Aeneid;* the *Roland* or a comparable work from the medieval oral tradition; pre-Greek forerunners, other Greco-Roman literary epics, and later medieval and Renaissance developments and adaptations of the genre. Choice of reading material varies. Offered jointly with CLAS 424. Literary background recommended.

C LIT 440 The Novel (3-5, max. 10) The novel as a genre. Material varies with individual faculty members who offer it, but, normally, the larger technical, social, and philosophical questions are illustrated through intensive study of novels by two or more writers from different national cultures.

C LIT 472 Studies in Narrative (3-5, max. 10) Narrative styles and developments from antiquity to the present. Content varies.

C LIT 476 Comparative Approaches to Chinese Poetry and Poetics (5) W Chinese poetry and poetics in context of world literature; emphasis on lyrical tradition. Investigation of essence, modes, conventions, imagery, and symbolism defined in three thousand years of continued, prolific developments. Relevant Western works are compared with Chinese subjects. All readings in English.

C LIT 480 Modern European Poetry (5) Selected works read, in English, by French, German, Italian, and Spanish poets from the romantic period to the present.

C LIT 490 Directed Study or Research (1-5, max. 10) AWSpS Individual study of topics in comparative literature by arrangement with the instructor and the Comparative Literature office.

C LIT 493 Comparative Literature Honors Seminar (5) Special topics in comparative literature. Required of honors students in comparative literature. Prerequisite: permission of honors adviser.

C LIT 495 Honors Thesis (4) Preparation of an honors thesis under the direction and supervision of a faculty member. Prerequisites: 493 and permission of honors adviser.

C LIT 498 Special Studies in Comparative Literature (3-5, max. 15) Offered occasionally by visitors or resident faculty.

Courses for Graduates Only

Consult the Comparative Literature office for information on the quarter and year the courses below will be offered. Graduate-level course numbers merely distinguish courses and do not indicate ascending level of knowledge required to take the course. Reading knowledge of at least one foreign language recommended.

C LIT 510 Theories and Methods of Comparative Literary History (5) Lectures on comparative theory and practice from Vico to the present; seminar papers on comparative topics relevant to the student's fields of concentration.

C LIT 511 Literary Translation (5) Lectures on principles of translating literary works into readable English. Students present and comment on translations made by them and write seminar papers on problems of translation in theory and practice.

C LIT 513, 514 History of European Literary Theory and Criticism I, II (5,5) Main concepts of literary theory and literary criticism in the Western world as they have developed from the Middle Ages to the present. Emphasis on the philosophical background from which the literary ideas emerged.

C LIT 515 Recent Trends in Literary Criticism (3-5) Structural and philosophical approaches emphasized.

C LIT 516 Colloquium in Criticism (5) Recent trends in literary criticism, taught by representatives from various literature departments, covering critical trends such as structuralism, poststructuralism, hermeneutics, reception theory, and sociological approaches to literature.

C LIT 517 Colloquium in Folklore (5) Recent trends in folklore studies, taught by representatives from various literature departments and disciplines in the social sciences.

C LIT 519 Lectura Dantis (3-5) Selected aspects of Dante's *Divina Commedia* (in English), conducted as a faculty-graduate student colloquium with representatives from various literature departments.

C LIT 522 Twentieth-Century Literature (3-5) Selected movements, schools, and trends of significance in twentieth-century literature of Europe and the Americas. Symbolism, surrealism, dada, expressionism, neorealism, existentialism, the *nouveau roman*, and the absurd may be considered. Texts in English, French, and German figure most prominently, but Spanish, Italian, Russian, and other materials may also be dealt with. Content and emphasis vary.

C LIT 525 The Baroque in Criticism and Literature (3-5, max. 15) Origins and history of the term as used in literary criticism, accompanied by a study of representative Baroque literature in various countries. Included are such works as *Don Quixote*, *Phedre*, and French, Spanish, Italian, and German poetry available in translation, but preferably to be read in the original.

C LIT 546 Studies in the Renaissance (3-5, max. 10) Aspects of Western European literature during the Renaissance. Course content varies.

C LIT 547 Classical Tradition in Medieval and Renaissance Europe (3-5, max. 15) Intensive study of a single topic or genre. Course content varies.

C LIT 548 The Romantic Movement (3-5, max. 10) Chief authors, works, and/or themes of the romantic movement in Europe and America. Course content may vary.

C LIT 550 European Realism (3-5) European realism (Balzac, Flaubert, Turgenev, Dostoevsky, Tolstoy, the representative Victorians, and the writers of "poetic realism") in connection with various esthetic doctrines and subsequent critical appraisals.

C LIT 551 The Symbolist Movement (3-5, max. 10) The symbolist movement from its beginnings in nineteenth-century French poetry through later developments in European poetry, fiction, and drama. Related developments in philosophy, critical theory, and the other arts. Reading knowledge of French required.

C LIT 560 Classical Rhetoric and Literature (3-5) Influence and importance of classical rhetoric in European literary works of the seventeenth and eighteenth centuries. Texts and examples chosen in English, French, Italian, and German literatures.

C LIT 570 The Novel: Theory and Practice (3-5, max. 15) Study of the novel as a genre, examining two or more novels of varying national literatures. Course content varies.

C LIT 571 The Lyric: Theory and Practice (3-5, max. 15) Examination of central questions in the study of the lyric genre as approached from an international point of view. Course content varies.

C LIT 572 The Epic: Theory and Practice (3-5, max. 15) Examination of epic literature as exemplified by selected works chosen from various cultures and periods (e.g., French and German medieval courtly epic, the epic in Renaissance and baroque Europe, traditions of the mock epic). Course content varies.

C LIT 573 The Drama: Theory and Practice (3-5, max. 15) Examination of various aspects of the drama as a major literary genre, as approached from international and multilingual points of view. Course content varies.

C LIT 574 Literary Motifs (3-5, max. 10) Examination of important fictional figures, situations, and plots that, through their repeated recurrence in world literature, appear to have a profound and universal significance for the human imagination. Course content varies.

C LIT 576 Seminar in East-West Literary Relations (3-5, max. 15) Comparative investigation of literary topics requiring the study of both Eastern and Western documents. Explores parallels and contradictions between the two, in concepts, ideas, and specific topics. A comparative paper on a chosen topic with qualified conclusions is required. Emphasis varies. Prerequisite: at least one East Asian language. (Offered alternate years.)

C LIT 580 Literature and Other Disciplines (3-5, max. 15) Seminar examining relationships or parallels between literature and other disciplines such as philosophy, psychology, sociology, anthropology, or political science. Course content varies.

C LIT 598 Special Studies in Comparative Literature (3-5, max. 15) Offered occasionally by visiting or resident faculty. Course content varies.

C LIT 600 Independent Study or Research (*) AWSpS

C LIT 700 Master's Thesis (*) AWSpS

C LIT 800 Doctoral Dissertation (*) AWSpS

Comparative Religion

See International Studies.

Computer Science

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Computer science is the study of information and algorithms in the context of real and abstract computing devices. Computer scientists study: the representation and storage of information; algorithms to access, examine, and transform information; programming and mathematical languages to express algorithms; and hardware and software processors to execute algorithms. These concerns lead both to theoretical investigations and to practical developments in computer technology and applications.

The objective of computer science undergraduate education is to develop broadly educated and competent computer scientists for professional careers or graduate studies. Especially important is a foundation that will endure as technology advances and changes.

The computer field has a broad base of industrial and governmental jobs suitable for the Bachelor of Science graduate: systems analyst, systems programmer, technical salesperson, and hardware or software specialist. In addition, there are jobs for which graduate education may be appropriate: producers and developers of computer systems, and teachers and researchers.

Undergraduate Program

Bachelor of Science Degree

Admission Requirements: 45 credits completed, including MATH 124, 125, 126, PHYS 121, 122, 123, C SCI 210; minimum 3.00 grade-point average for all courses at this University (3.00 guarantees consideration, but not acceptance).

Major Requirements: (1) Preparatory Component (39 credits): MATH 124, 125, 126; PHYS 121, 122, 123; three of MATH 205, 238, 239, 301, 302, 303, 305, any mathematics course in the elective component (below), or STAT 311; and one from PHYS 334, E E 306, 310, or 335. (2) Inner Core Component (29 credits): 201, 241 (or 210, 211), 321, 322, 326, 341, 378. (3) Outer Core Component (minimum of 12 credits): 401, 421, 431, 451, 470, 473. (4) Elective Component (minimum of 10 credits): computer science courses from the Outer Core not used to satisfy the Outer Core, or up to 6 credits of 498, or any other 400-level computer science course that may be introduced, or other courses chosen from a senior electives list available in the department. (5) Recommended: 10 credits of natural science, business, or engineering beyond the requirements in (1) through (4), above.

Graduate Program

Steven Tanimoto, Graduate Program Coordinator

The Department of Computer Science offers programs of study leading to the degrees of Master of Science (with a thesis or a nonthesis option) and Doctor of Philosophy. Individual programs can be designed to provide considerable breadth of knowledge, as well as depth in an area of specialization. An M.S. degree can usually be completed in one to two years, and a Ph.D. degree can be completed in four to five years (it is not necessary to complete an M.S. program before entering the Ph.D. program). Degree requirements are outlined in the *Computer Science Graduate Program Brochure*, which is included in the application packet available from the department.

The department has twenty-one faculty members with appointments in Computer Science and eight affiliated faculty members from other disciplines. Research opportunities exist for graduate students in the following ongoing projects and in other areas: local networks and distributed processing, VLSI design tools, computer architecture, operating systems, programming languages, compilers, program semantics, design and analysis of algorithms, computational complexity, performance evaluation, analytic modeling, simulation, artificial intelligence, computer graphics, document preparation systems, data bases, and biomedical computing.

Special Research Facilities

The Computer Science Laboratory provides powerful, state-of-the-art facilities for graduate student and faculty research and instruction including a DEC System-2060, several VAX 11/780s and 11/750s, and work stations with graphic capabilities. These machines are connected to the Arpanet. Other facilities are available on campus.

Application Requirements

Four items are required for a complete application: (1) The Application for Admission to the Graduate School. (2) The Application for Admission to the Graduate Program in Computer Science showing background that includes: (a) a knowledge of computer organization and computer programming, (b) advanced undergraduate preparation (though not necessarily a major) in the mathematical, natural, or engineering sciences. (3) Three letters of recommendation that should be sent by the recommenders to the department. (4) Two copies of official transcripts sent from the schools to the Graduate Admissions Office.

The Graduate Record Examination is not required, but may be helpful to the applicant in competing for available openings in the program. Complete applications must be received by the department by these deadlines: July 1 for Autumn Quarter, November 1 for Winter Quarter, February 1 for Spring Quarter, May 15 for Summer Quarter.

Assistantships

Some research assistantships are available in the Computer Science Laboratory and through faculty research grants. Teaching assistantships are also available. In general, this support is allocated on the basis of scholastic excellence and potential. Students who are applying for assistantships to start in Autumn Quarter should have all applications to the Graduate School and the department *completed by February 1.*

The application packet contains all the necessary forms for applying to the Graduate School and to the Graduate Program in Computer Science and for consideration for assistantships.

Correspondence and Information

Graduate Program Coordinator
Department of Computer Science, FR-35

Faculty

Chairperson

Paul Young

Professors

Baer, Jean-Loup,* Ph.D., 1968, California (Los Angeles); parallel processing, systems architecture, data structures.

Golde, Hellmut,* (Electrical Engineering), Ph.D., 1959, Stanford; programming languages, programming systems, compilers.

Holden, Allstair D. C.,*‡ (Electrical Engineering), Ph.D., 1964, Washington; artificial intelligence and applications to speech understanding, vision and computer-aided design.

Johnson, David L.,*‡ (Electrical Engineering), Ph.D., 1955, Purdue; switching theory and logical design, models of learning, concept formation, man-machine interaction.

Kehl, Theodore H.,* (Physiology and Biophysics),† Ph.D., 1961, Wisconsin; real-time hardware and software systems, computer design, VLSI.

Klee, Victor,*‡ (Mathematics), Ph.D., 1949, Virginia; linear programming, network optimization, combinatorics, convexity, functional analysis.

Ladner, Richard E.,* Ph.D., 1971, California (Berkeley); theory of computation, computational complexity, design and analysis of algorithms, computer communication theory, computers to aid the handicapped.

MacKay, Pierre A.,*‡ (Classics, Comparative Literature, Near Eastern Languages and Literature), Ph.D., 1964, California (Berkeley); multilingual text editing and typesetting (especially Arabic script), graphics, peripheral design.

Meditch, James S.,*‡ (Electrical Engineering), Ph.D., 1961, Purdue; computer communications networks, telecommunications, optimization theory.

Noe, Jerre D.,* (Electrical Engineering), Ph.D., 1948, Stanford; distributed computer systems, operating systems, simulation and performance evaluation.

Shaw, Alan C.,* Ph.D., 1968, Stanford; computer graphics, document preparation systems, operating systems, software specifications.

Snyder, Lawrence,* Ph.D., 1973, Carnegie-Mellon; parallel computation, VLSI.

Young, Paul,* Ph.D., 1963, Massachusetts Institute of Technology; computational complexity, computatability, and connnections with mathematical logic.

Zick, Gregory L.,*‡ (Electrical Engineering), Ph.D., 1974, Michigan; computer engineering, sorting, I/O subsystems.

Associate Professors

Dekker, David B. (Emeritus), Ph.D., 1948, California (Berkeley); numerical analysis, curve fitting, numerical solution of differential equations.

Lazowska, Edward D.,* Ph.D., 1977, Toronto; computer systems: modeling and analysis, design and implementation, distributed systems.

Ruzzo, Walter L.,* Ph.D., 1978, California (Berkeley); design and analysis of algorithms, computational complexity, parallel computation, theoretical issues in VLSI systems.

Sobolewski, John S.* (Research), Ph.D., 1970, Washington State; data communication, data-base management systems, management of computing, medical applications of computing.

Tanimoto, Steven L.,* (Electrical Engineering), Ph.D., 1975, Princeton; image analysis, computer graphics, artificial intelligence.

Assistant Professors

Almes, Guy T.,* Ph.D., 1980, Carnegie-Mellon; design of operating systems and computer systems.

Black, Andrew P. (Research), Ph.D., 1982, Oxford; programming methodology, programming languages, formal semantics, specification.

Boehm, Hans-J., Ph.D., 1983, Cornell; programming languages and their implementation, formal semantics.

Borning, Alan H.,* Ph.D., 1979, Stanford; artificial intelligence, programming languages and environments.

Fich, Faith E., Ph.D., 1982, California (Berkeley); computational complexity, design and analysis of algorithms, formal language theory.

Levy, Henry M.,* (Research), M.S., 1981, Washington; computer system architecture, operating systems, software engineering.

Tompa, Martin P.,* Ph.D., 1978, Toronto; computational complexity.

Zahorjan, John,* Ph.D., 1980, Toronto; computer system performance analysis, analytic models of computer systems, control policies for distributed systems.

Course Descriptions

Courses for Undergraduates

C SCI 210, 211 Computer Science I, II (5;5) AWSpS, AWSpS Integrated two-quarter introduction to computer science. Emphasis on four areas: (1) introductory programming as a serious discipline; (2) elementary data structures and algorithms; (3) reasoning about the correctness and efficiency of programs; and (4) the structure of computer systems. Pascal language introduced and used. Prerequisites: MATH 124 for 210, 210 for 211.

All 300-level courses, except as noted, are primarily for majors. Nonmajors must petition for entry cards, must satisfy all prerequisites for entry into the major program, and must apply to the major program during the current quarter.

C SCI 321 Discrete Structures (3) AW Fundamentals of set theory, graph theory, enumeration, and algebraic structures, with applications in computing. Prerequisites: 211 and MATH 126.

C SCI 322 Introduction to Formal Models in Computer Science (3) W Finite automata and regular expressions; context-free grammars and pushdown automata; nondeterminism; Turing machines and the halting problem. Emphasis on understanding models and their applications and on rigorous use of basic techniques of analysis. Induction proofs, simulation, diagonalization, and reduction arguments. Prerequisite: 321.

C SCI 326 Data Structures (5) ASp Data types, abstract data types, and data structures. Efficiency of algorithms. Sequential and linked implementation of lists. Binary tree representations and traversals. Searching: dictionaries, priority queues, hashing. Directed graphs, depth-first algorithms. Garbage collection. Dynamic storage allocation. Internal and external sorting. No credit if 373 or E E 374 have been taken. Prerequisite: 321.

C SCI 341 Programming Languages (5) ASp Designed to make the student reasonably fluent in several radically different languages, such as LISP, APL, SIMULA, and others. Prerequisite: 211.

C SCI 373 Data Structures and Algorithms (3) A Fundamental algorithms, and data structures for implementation. Techniques for solving problems by programming. Linked lists, stacks, queues, directed graphs. Trees: representations, traversals. Searching (hashing, binary search trees, multiway trees). Garbage collection, memory management. Internal and external sorting. No credit if 326 or E E 374 taken. Prerequisite: 211, nonmajor.

C SCI 378 Machine Organization and Assembly Language (5) A Differences and similarities in machine organization; central processors; fundamentals of machine language and addressing; assembly language programming, including macros; operating system interfaces. No credit if E E 371 has been taken. Prerequisite: 211.

All 400-level courses, except as noted, are primarily for majors. Nonmajors must petition for entry cards and must satisfy all prerequisites for entry into the major program. Also, the course must be an approved elective for the student's current department, or the student must be a fifth-year or graduate student.

C SCI 401 Introduction to Compiler Construction (3) W Fundamentals of compilers and interpreters. Symbol tables, lexical analysis, syntax analysis, semantic analysis, code generation and optimization for general-purpose programming languages. Offered jointly with E E 401. Prerequisites: 326 and 378.

C SCI 421 Introduction to the Analysis of Algorithms (3) Techniques for design and analysis of efficient algorithms. Methods for showing lower bounds on computational complexity. Particular algorithms for sorting, searching, set manipulation, arithmetic, graph problems, pattern matching, etc. Prerequisites: 322, 326.

C SCI 431 Introduction to Theory of Computation (3) Sp Models of computation, computable and noncomputable functions, space and time complexity, tractable and intractable functions. Prerequisite: 322.

C SCI 440 Computer Based Simulation (4) Sp Monte Carlo, continuous time, and discrete-event simulations. Design of appropriate simulation experiments and interpretation of their results. Students implement simulations using Pascal, DYNAMO, and GPSS. Prerequisites: 211, 373 or equivalent, and major standing or permission of instructor.

C SCI 451 Introduction to Operating Systems (3) W Principles of operating systems. Process management, memory management, auxiliary storage management, resource allocation. No credit if E E 474 already taken. Prerequisites: 326, 378.

C SCI 470 Computer Design (4) AW Fundamental gating circuits are developed into large-logic gating structures. The use of these structures in the design of central processing units, memories, and peripheral equipment is illustrated. Prerequisite: 378.

C SCI 473 Introduction to Artificial Intelligence (3) Sp Principal ideas and developments in artificial intelligence: theorem proving, problem-solving methods, representation of knowledge, natural language analysis and synthesis, programming languages for artificial intelligence. Prerequisite: 326.

C SCI 498- Senior Project (1-9-, max. 9) AWSp A report (and perhaps demonstration) describing a development, survey, or small research project completed by the student in an area in computer science or an application to another field. Objectives are: (1) integrating material from several courses, (2) introducing the professional literature, (3) gaining experience in writing a technical document, and (4) showing evidence of independent work. The work normally extends over more than one quarter, for a maximum of 6 credits for 498- and a maximum of 9 credits for 498H-. Prerequisite: senior standing in computer science major.

C SCI 499 Reading and Research (1-24, max. 24) Available for special cases for advanced computer science majors to do reading and research in the field. Offered on credit/no credit basis only. Usable as a free elective, but not in place of a core course or computer science elective. Prerequisites: senior standing and permission of instructor.

Courses for Graduates Only

All graduate courses are primarily for Computer Science graduate students. Others must petition for entry cards.

C SCI 500 Computers and Society (2) W Study of the impact of computer technology on present and future society, including political, economic, cultural, social, and moral issues. Seminar. Includes frequent guest lecturers and discussion leaders. Each student is required to complete a term project. Offered on credit/no credit basis only. Prerequisite: graduate standing in computer science or permission of instructor. (Offered alternate years.)

C SCI 501 Compiler Construction (3) Sp Design of compilers for block-structured general-purpose programming languages. Automatic generation of lexical analyzers and parsers. Error detection and correction. Code optimization. Prerequisites: 401 and 531.

C SCI 505 Concepts of Programming Languages (3) Sp Basic concepts in programming languages: data structures, types, patterns, environments, control, evaluation, application, matching, relation to high-level machines. Prerequisites: 401 and a working knowledge of Pascal and LISP.

C SCI 506 Formal Semantics (3) W Techniques for defining semantics of programming languages. Topics may include denotational semantics (Lambda calculus, fixed points, and domain theory); relationship between denotational and axiomatic semantics (i.e., Hoare rules and wp); abstract data types (methods of data type definition, total and partial algebras, and completeness). Prerequisite: familiarity with axiomatic semantics.

C SCI 508 Representation and Handling of Data Structures (3) A Sequential and linked allocation of linear lists, trees, and multidimensional lists (stacks, queues, deques, tree traversals, priority queues and heaps, sparse matrices). Searching: data structures, algorithms and their analysis (balanced and B-trees, hashing, weighted trees). List-marking and garbage collection (compaction, copying). Dynamic storage allocation, String representation.

C SCI 518 Digital Signal Processing (4) Sp Digital representation of analog signals. Frequency domain and Z-transforms of digital signals and systems. Design of digital systems; IIR and FIR filter design techniques, fast Fourier transform algorithms. Sources of error in digital systems. Analysis of noise in digital systems. Offered jointly with E E 518. Prerequisite: knowledge of Fourier analysis techniques or permission of instructor.

C SCI 519 Computer Science Research Seminar (1, max. 3) A Weekly presentations on current research activities by members of the department. Only computer science graduate students may register, although others are encouraged to attend. Offered on credit/no credit basis only.

C SCI 520 Computer Science Colloquium (1, max. 9) AWSp Weekly public presentations on topics of current interest by visiting computer scientists. Offered on credit/no credit basis only.

C SCI 521 Design and Analysis of Algorithms I (3) Sp Principles of design of efficient algorithms: recursion, divide and conquer, balancing, dynamic programming, greedy method, data structure selection. Correctness and analysis of algorithms. Examples drawn from problems in sorting, searching, set manipulation, pattern-matching, graphs, matrices, polynomials, and integers. Prerequisite: 508.

C SCI 522 Design and Analysis of Algorithms II (3) Sp Analysis of algorithms more sophisticated than those treated in 521. Content varies and may include such topics as algebraic algorithms, combinational algorithms, techniques for proving lower bounds on complexity, and algorithms for special computing devices such as networks, formulas, or list-processing machines. Prerequisite: 521.

C SCI 531 Formal Languages and Automata (3) A Formal models in computer science, including finite automata, regular expressions, context free grammars, pushdown automata, Turing machines, and techniques for analyzing them. Nondeterminism, undecidability, syntax, and semantics.

C SCI 532 Complexity Theory (3) W Models of computation, such as Turing machines and random access machines; nondeterminism and alternation. Computable and noncomputable functions. Time and space complexity, complexity hierarchies, NP-completeness, and provably difficult problems. Proof techniques, such as simulation, diagonalization, and reducibility.

C SCI 533 Advanced Topics in Complexity Theory (3) Sp Topics in computational complexity more sophisticated than those treated in 532. Topics are expected to vary from year to year, but might typically focus on such areas as parallel complexity, probabilistic complexity, circuit- or automaton-based complexity, or logic. (Offered alternate years.)

C SCI 540 Discrete System Simulation (3) A Principles of simulation of discrete, event-oriented systems. Model construction, simulation and validation; relationship to other techniques for system analysis and design. Use of SIMULA, a programming language with special features for simulation. Prior familiarity with some statistical tools desirable.

C SCI 542 Central Processor Architecture (3) Sp Several central processing units are examined at the gate level. Included are the logic structures of: I/O bus, memory bus, ALU, address modification, control logic, combinatorial and multiphase instructions, access priority, cycle stealing, etc. Prerequisite: 470. (Offered alternate years.)

C SCI 543 Computer System Performance Modeling (3) Sp Use of queueing network models as tools to evaluate the performance of centralized and distributed computer systems. Prerequisite: 451.

C SCI 544 Fundamentals of Stochastic Models of Computer Systems (3) Mathematical and computational properties of analytic performance models of computer systems. Markov stochastic processes, single congestion point queueing theory, separable and nonseparable networks, and formal and heuristic approaches to the analysis of these models. Prerequisites: 453 and some familiarity with concepts from basic probability theory.

C SCI 548 Computer Systems Architecture (3) W Notations for computer systems. Processor design (single chip, look-ahead, pipelined, data flow.) Memory hierarchy organization and management (virtual memory and caches). Microprogramming. I/O processing. Multiprocessors (SIMD and MIMD). Prerequisites: 451 and 470, which may be taken concurrently.

C SCI 551 Operating Systems (3) Sp Operating systems design and construction techniques. Concurrent programming, correctness, deadlock, protection, transaction processing, design methodologies, and other topics. Structure of different kinds of operating systems. Prerequisite: 451.

C SCI 557 Computer Graphics (3) A Generation and interpretation of pictures by computer with or without human interaction. Graphics hardware. Display programming. Picture transformation. Representations of pictures and their attributes. Curve and surface design and generation. Input methods. Graphics programming languages and systems. Laboratory project required. Prerequisite: 508.

C SCI 561 Computer Communications and Networks (3) A Fundamentals of data transmission: coding, message formats, and protocols; organization of computer networks. Examples of existing network implementations. Term paper or laboratory project required.

C SCI 573 Artificial Intelligence I (3) A Introduction to the use of the computer in nonnumerical problem solving. Survey of theorem-proving, symbol manipulating, pattern recognition, and inductive problem-solving techniques. Computer models of human thought. Prerequisites: 508 and knowledge of LISP or permission of instructor.

C SCI 574 Artificial Intelligence II (3) W Continuation of studies of artificial intelligence systems,emphasizing theorem proving, symbolic problem solving, pattern recognition, and natural language data processing. Students are required to do projects. Prerequisite: 573. (Offered alternate years.)

C SCI 590 Special Topics in Computer Science (*) AWSp Several offerings each quarter, on topics of current interest. Prerequisite: permission of instructor.

C SCI 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

C SCI 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

C SCI 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Dance

255 Meany

The dance program provides a foundation for future advanced work in the areas of choreography, historical research and writing, movement analysis, performing, and teaching.

Students have an opportunity to perform and/or choreograph in quarterly performances.

Undergraduate Program

Bachelor of Arts Degree

Admission Requirement: Students must complete a minimum of one quarter of basic dance technique at the University before acceptance into the major program. Transfer applicants may audition or submit videotape for consideration.

Major Requirements: Minimum of 70 credits in dance and 9 credits in related courses. 207, 208, 209, 242, 254, 304, 305, 306, 344, 345, 351, 360, 361, 365, 390, 420, 493; 3 credits of ballet technique; 1 credit of ethnic dance; 4 credits from 322, 371, 470, 471; 6 credits of music; 3 credits of theatre production.

An overall grade-point average of 3.00 in dance courses is required to maintain major status.

Faculty

Associate Professors

Green, Evelyn H. (Emeritus), B.A., 1940, Barnard; ballet technique.

Skinner, Joan,* M.A., 1963, Illinois; dance composition, improvisation, and kinesthetic training.

Lecturer

Hackney, Peggy J., M.F.A., 1971, Sarah Lawrence; contemporary dance technique, Laban movement analysis, notation composition, improvisation, and repertory.

Part-time faculty drawn from professionals in the community.

Course Descriptions

Courses for Undergraduates

DANCE 107, 108, 109 Introduction to Dance (4, max. 8; 4, max. 8; 4, max. 8) Contemporary dance technique, ballet, and new approaches to movement training.

DANCE 201, 202, 203 Ballet Technique II (1,1,1) Continued development of all beginning areas. Expansion of ballet vocabulary. Prerequisites: permission of instructor for 201; 201 or permission of instructor for 202; 202 or permission of instructor for 203.

DANCE 207, 208, 209 Dance Synthesis (6,6,6) Orientation to a broad experience of dance. Integration of the study of technique with improvisation and composition. Prerequisite: dance major or permission of instructor.

DANCE 231 Folk/Ethnic Dances of Western Cultures (1, max. 6) Folk dances of Western cultures (i.e., Irish, American square, Spanish, Scandinavian, or Scottish). See quarterly *Time Schedule* for specific offering. Prerequisites: 103, 106, or 109, or permission of instructor.

DANCE 232 Folk/Ethnic Dances of Eastern Europe and Middle East (1) Folk dances of Eastern Europe and the Middle East (i.e., Greek, Balkan, Russian, African). See quarterly *Time Schedule* for specific offering. Prerequisites: 103, 106, or 109, or permission of instructor.

DANCE 233 Folk/Ethnic Dances of Eastern Cultures (1, max. 6) Folk dances of Eastern cultures (i.e., Korean, Japanese, East Indian, Cambodian). See quarterly *Time Schedule* for specific offering. Prerequisites: 103, 106, or 109, or permission of instructor.

DANCE 242 Music in Relation to Dance (3) Practicum in percussion techniques. Relationship of music to dance in major dance works. Splicing tapes and creating sound scores.

DANCE 250 Exploring the Articulate Body I (3) *Hackney* Basic body connections and joint articulations. Principles of dynamic body alignment, patterning efficient lines of muscular use, weight initiation, connections from lower-body support to upper-body freedom. Based on the Bartenieff fundamentals as developed by the Laban Institute of Movement. Prerequisites: permission of instructor and concurrent registration in a basic dance technique course.

DANCE 254 Laban Movement Analysis I (3) *Hackney* Laban's effort/shape concepts. What makes movement expressive, how to see movement textures clearly, how to broaden the dynamic range of one's movements. Prerequisite: permission of instructor.

DANCE 301, 302, 303 Ballet Technique III (2,2,2) Advanced-intermediate level: continued development and expansion in all areas of technique. Prerequisites: permission of instructor for 301; 301 or permission of instructor for 302; 302 or permission of instructor for 303.

DANCE 304, 305, 306 Contemporary Dance Technique III (4; max. 8; 4, max. 8; 4, max. 8) Intermediate-advanced. Dance sequences of greater complexity. Prerequisites: 209 or permission of instructor for 304; 304 or permission of instructor for 305; 305 or permission of instructor for 306.

DANCE 322 Repertory (2, max. 8) Learning and performing pieces from professional dance repertoire, including reconstructions from notated scores. Prerequisites: permission of instructor and concurrent registration in a dance technique course.

DANCE 330 Kinesthetic Training I (3) Knowledge gained through direct perceptual experience. Uses imagery to facilitate efficient functioning of the mind/body complex in an artistic task. Prerequisite: permission of instructor.

DANCE 344 Dance History (3) Study of the evolution of dance from ritual to a theatre art form.

DANCE 345 History of Dance (3) Roots of contemporary dance as an art form and its relationship to developments in ballet since the turn of the century.

DANCE 346 Twentieth-Century Dance History Through Style Analysis (3) Historical trends of dance in the twentieth century. A perspective for looking at movement concerns of choreographers through style analysis. Prerequisite: 254 or permission of instructor.

DANCE 351 Dance/Movement Notation (3) Analyzing and recording the structural elements of movement as developed by Rudolph Laban. Prerequisite: permission of instructor.

DANCE 360, 361, 362 Improvisation (2,2,2) Spontaneous composition as an art and skill. Prerequisite: permission of instructor.

DANCE 365, 366, 367 Dance Composition (3,3,3) Study of dynamic forms that arise out of juxtaposition of movement elements in time and space; counterpoint. Prerequisite: permission of instructor.

DANCE 371 Choreographic Workshop (2) Performing experience for students in pieces choreographed by faculty members. Prerequisite: permission of instructor.

DANCE 390 Dance Teaching Methodologies (3) Introduction to dance pedagogy. Practical teaching experience. Prerequisite: dance major status or permission of instructor.

DANCE 404, 405, 406 Contemporary Dance Technique IV (4, max. 8; 4, max. 8; 4, max. 8) Advanced technical skills applied to longer dance sequences. Prerequisites: 306 or permission of instructor for 404; 404 or permission of instructor for 405; 405 or permission of instructor for 406.

DANCE 407, 408, 409 Advanced Dance Synthesis (2,2,2) Assessment of training and development in skills, kinesthetic perception, creative process, and performance. Prerequisite: senior dance major.

DANCE 420 Dance Esthetics (3) Reading and discussion of writings pertaining to the esthetics of dance. Prerequisite: permission of instructor.

DANCE 430 Kinesthetic Training II (3) Continuation of 330. Language of imagery developed to a more sophisticated level. Designed to enable the student to experience integration of the mind/body complex in the creative process. Prerequisite: 330 or permission of instructor.

DANCE 450 Exploring the Articulate Body II (3) *Hackney* Movement fundamentals; further development of 250 course work. Prerequisites: 250 and permission of instructor.

DANCE 451 Advanced Dance/Movement Notation (3) Further development of 351 course work. Prerequisites: 351 and permission of instructor.

DANCE 454 Laban Movement Analysis II (3) *Hackney* Includes in-depth work in combinations of effort qualities (states and drives), space harmony, and phrasing of effort, shape, space, and body. Prerequisites: 254 and permission of instructor.

DANCE 455 Movement Observation (3) *Hackney* Practical techniques for developing skill in the use of Laban movement analysis for observing and describing movement. Overview of work of observers in various fields of research. Extensive work on location and in the studio observing movement, live and on film/video. Focuses on particular applications for diverse research needs. Prerequisites: 254 and permission of instructor.

DANCE 456 Seminar in LMA Applications (3) *Hackney* Theory, movement, and observation experiences integrated with an understanding of the history and applications of Laban movement analysis. Prerequisites: 454, 455, and permission of instructor.

DANCE 460 Advanced Improvisation (3) Improvisation as a performance form. Spontaneous composition of movement ideas and phrases shaped into a coherent whole by group ensemble work. Prerequisites: 360, 361, 362, or permission of instructor.

DANCE 466 Advanced Dance Composition (3) Explores a variety of approaches to personal creative process in dance composition. Prerequisites: 365, 366, 367, or permission of instructor.

DANCE 470 Dance Production Activities (1-3, max. 12) Participation in dance productions, either studio showings or public performances, conducted under faculty direction or supervision. Prerequisite: permission of instructor.

DANCE 472 Choreographic Workshop (2) Further development of 371 course work. Prerequisite: permission of instructor.

DANCE 490 Special Studies in Dance (1-3, max. 10) AWSpS Special studies designed to address contemporary and historical concerns in the field of dance. Prerequisite: permission of instructor.

DANCE 493 Anatomy for Dance (4) Anatomy of the musculoskeletal system and its applications in dance movement. Prerequisite: permission of instructor.

DANCE 499 Undergraduate Independent Study (*, max. 6) AWSp

Drama

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The School of Drama is concerned with the whole continuum of acting, directing, designing, theatre history, and dramatic forms through which the human, dramatic imagination finds expression.

The school operates three theatres: the Glenn Hughes Playhouse, with a thrust stage; the Penthouse Theatre, first theatre-in-the-round built in America; and the Showboat Theatre, fashioned after a turn-of-the-century floating showboat with a proscenium stage. Faculty- and student-directed plays drawn from the full range of world dramatic literature are presented throughout the year. Additional productions are mounted in the two theatres of Meany Hall. Technical and design support is provided for opera productions at the School of Music and for programs of the dance division.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: A minimum of 61 credits in drama courses. Three quarters of acting: DRAMA 251, 252, 253 or 351, 352, 353 or 451, 452, 453 (with 350 and 450 series, 3 credits of DRAMA 298 or 498 also required). One quarter of child drama: DRAMA 230. Three quarters of technical theatre: DRAMA 210, 211, 212, 290, 291, 292. 25 credits in theatre history, dramatic literature, and criticism: DRAMA 102, 371, 372, 373, plus one course from DRAMA 416, 475, 476, 494. Electives at the 300-400 level to complete the balance.

Bachelor of Fine Arts Degree

A minimum of 243 credits is required for graduation with a Bachelor of Fine Arts degree. The Professional Actor Training Program course of study is for three years of intensive studio and performance work in acting, movement, voice, and speech.

Admission Requirements: Complete, or be in the process of final completion of, two years of general college study (90 credits). Entrance determined primarily by audition and interview. Students may enter only in Autumn Quarter. Application deadline is February 1 for auditions held in the spring, for which a $10 application fee is required. The student should contact the school for information about additional material required for application.

Major Requirements: In addition to the 90 credits required for admission, 45 credits in elective courses, plus three quarters each of DRAMA 457, 458, 459, and 555.

Graduate Program

The School of Drama offers programs of graduate study leading to the Master of Fine Arts and Doctor of Philosophy degrees. Areas of study for the M.F.A. degree are acting, stage direction, scene design, lighting design, costume design, and technical direction. Most students should expect to spend three years to complete requirements for the M.F.A. degree.

The Ph.D. program provides students with training for scholarly research in theatre history, dramatic literature, theory, and criticism. The traditionally interdisciplinary nature of the degree program encourages students to conduct research in tutorial with faculty members in drama as well as with adjunct faculty from such disciplines as architecture, art, Far Eastern languages and literature, Romance languages and literature, comparative literature, English, music, and Scandinavian languages and literature.

Admission Procedure

Acting: Application deadline is February 1. An audition is required ($10 fee); three letters of recommendation, statement of purpose, résumé, and picture.

Design (Costume, Lighting, and Scenery) or Technical Direction: Three letters of recommendation, résumé, statement of purpose for seeking the degree and career objectives, and a portfolio of designs, technical plots, or working drawings.

Directing: Three letters of recommendation, résumé, statement of purpose for acquiring a graduate degree, Graduate Record Examination scores (optional), and a directorial analysis (not to exceed ten typewritten pages, double spaced) to be chosen from the following list of plays: *The Sea Gull*, by Chekhov; *The Crucible*, by Miller; *The Good Person of Szechwan*, by Brecht (Arthur Willett, translator); *Major Barbara*, by Shaw; *The Matchmaker*, by Wilder; *The Mad Woman of Chaillot*, by Giradoux (Maurice Valency, translator); *Cat on a Hot Tin Roof*, by Williams; *MacBeth*, by Shakespeare; *The Father*, by Strindberg; *Hedda Gabler*, by Ibsen (Eva Le Gallienne, translator); *Curse of the Starving Class*, by Shepard; *Comedy of Errors*, by Shakespeare. The analysis should include interpretation of thematic and stylistic elements of the play; discussion of directorial problems involved in preparing the play for production; possibilities for solution of problems; ideas for style or scheme of production.

Doctor of Philosophy Degree: Three letters of recommendation; résumé, Graduate Record Examination scores, statement of purpose (educational and professional objectives), a piece of written work that represents the applicant's best. Students who enter the program are expected to have had some theatre experience, both practical and academic. Admission to this program is on a three-year cycle, with the next class to begin Autumn Quarter 1985.

Faculty

Director

Paul S. Hostetler

Professors

Conway, John A. (Emeritus), B.A., 1927, Carnegie Institute of Technology; scene design.

Crider, James R. (Emeritus), M.A., 1950, Washington; costume design.

Devin, Richard M.,* M.F.A., 1969, Yale; technical direction and design.

Haaga, Agnes M. (Emeritus), M.A., 1952, Northwestern; child drama.

Harrington, Donal (Emeritus), M.A., 1933, Columbia; directing.

Hobbs, Robert L.,* Ph.D., 1964, Northwestern; acting.

Hostetler, Paul S.,* Ph.D., 1965, Louisiana State; theatre history.

Loper, Robert B.,* Ph.D., 1957, Birmingham (England); acting.

Siks, Geraldine B. (Emeritus), M.A., 1940, Northwestern; child drama.

Sydow, John D.,* M.F.A., 1950, Yale; directing.

Associate Professors

Dahlstrom, Robert A.,* M.A., 1967, Illinois; design.

Forrester, William D.,* M.F.A., 1969, Yale; design.

Lorenzen, Richard L.,* Ph.D., 1968, Ohio State; theatre history.

Lounsbury, Warren D. (Emeritus), M.A., 1953, Washington; technical direction.

Valentinetti, Aurora S.,* M.A., 1949, Washington; child drama.

Witham, Barry B.,* Ph.D., 1968, Ohio State; theatre history.

Assistant Professors

Case, Sue-Ellen,* Ph.D., 1981, California (Berkeley); dramatic criticism.

Wolcott, John R.,* Ph.D., 1967, Ohio State; theatre history.

Lecturers

Gates, Sarah Nash, M.F.A., 1983, Boston; costume design.

Lane, Nancy, M.F.A., 1976, Minnesota; theatre speech.

Ridley, Jane M., M.F.A., 1974, Ohio State; movement.

Sedgwick, Geoffrey G., M.A., 1974, Washington; technical direction.

Course Descriptions

Courses for Undergraduates

DRAMA 101 Introduction to the Theatre (5) AWSp Introduction to the theatre as an art form with emphasis on the play in production. The role of the various theatre artists: actors, directors, designers, and playwrights. Required attendance at one or more performances. Lecture and discussion groups. For nonmajors.

DRAMA 102 Play Analysis (5) *Case, Lorenzen, Witham, Wolcott* Descriptive analysis of plays, both modern and historical, to provide tools for the student to read a text critically and creatively.

DRAMA 200 Drama and the Child (3) Introduction to the use of drama and its related arts as a means of developing the processes of self-expression and communication basic to a child's general education.

DRAMA 210, 211, 212 Theatre Technical Practice (4,4,4) AW,ASp,WSp Intensive lecture-laboratory in basic theories, techniques, and equipment of the stage. 210: scene construction and stage technical procedures. 211: costumes. 212: stage lighting.

DRAMA 230 Introduction to Children's Drama (2) *Valentinetti* Survey of children's drama with an emphasis on philosophies and practices. Includes children's theatre, creative dramatics, and puppetry. Open to nonmajors.

DRAMA 251, 252, 253 Acting (4,4,4) A,W,Sp Theory and practice of fundamentals. 251: development of fundamental aptitudes in acting (focus, recall, sense memory) through improvisation and basic scene work. 252: analysis and development of characterization. 253: advanced analysis, character rhythm, extended scene work. Prerequisites: 251 for 252; 252 for 253.

DRAMA 290, 291, 292 Theatre Technical Practices Laboratory (1,1,1) AWSp,AWSp,AWSp Laboratory course involving specific production assignment, either in-shop or in-theatre or both. Prerequisites: 210 for 290 or concurrent registration; 211 for 291 or concurrent registration; 212 for 292 or concurrent registration.

DRAMA 298 Theatre Production (1-2, max. 9) AWSp Laboratory course for students participating in School of Drama minor productions and projects. Prerequisite: being cast in a production or receiving a crew assignment.

DRAMA 314 Beginning Design for the Theatre (3) A *Dahlstrom, Forrester* Introduction to the conventions of developing and presenting designs for theatre environments. Focus on basic theatre design process and presentation technique and practices. Individual design project. Prerequisite: 210.

DRAMA 316 Theatrical Makeup (2) AWSp *Galstaun* Basic principles, with intensive practice in application of makeup for use on proscenium and arena stages. Open to nonmajors.

DRAMA 330 Children's Theatre (3) W History, theory, and techniques of performance for children's theatre. Emphasis on play selection, critical analysis, and rehearsal procedures. Recommended: 230.

DRAMA 331 Puppetry (3) AWSp *Valentinetti* Introduction to puppetry; construction and use of simple puppets as a visual aid in education, recreation, and therapy.

DRAMA 336 Drama in the Elementary School (3) Theory and practice of fundamentals of playacting as they relate to teaching children through improvisation and problem solving, emphasizing child development; correlation with language arts. Recommended: 230, 251.

DRAMA 337 Fundamentals of Creative Dramatics (3) Introduction to concepts and principles of creative dramatics. Intensive personal involvement in activities and exercises that illuminate the foundations of learning through drama. Emphasis on sensory awareness, play theory, creativity, and playmaking through improvisation. Recommended: 230.

DRAMA 338 Creative Dramatics (3) Analysis of basic principles and techniques of the creative process in informal drama. Recommended: 230.

DRAMA 351, 352, 353 Advanced Acting (3,3,3) A,W,Sp Intensive course sequence in acting with integrated laboratory work in movement and voice. Improvisation, mime, scene analysis, and emphasis on realistic acting with introduction to styles and genres. Prerequisites: audition for 351; 351 for 352; 352 for 353.

DRAMA 371 History of the Western Theatre and Its Literature to 1400 (5) A *Lorenzen, Wolcott* Theatre history and dramatic literature of ancient Greece and Rome and of the Middle Ages in Europe. Emphasis on the development of the physical theatre, the nature of dramatic production during these periods, and the relationship of playhouse to performance of dramatic texts. Primarily for drama majors; open to others with a background in the history and/or literature of the period. (Offered odd-numbered years only.)

DRAMA 372 History of the Western Theatre and Its Literature: 1400-1700 (5) W *Lorenzen, Wolcott* Theatre history and dramatic literature of the European and English Renaissance, with special focus on Italy, France, and England in the period 1400-1700. Introduces the student to the neoclassic theatre and the underlying neoclassic drama, to the commedia dell'arte, and to the theatre of Shakespeare, the court masques of Inigo Jones, and the theatrical activity of the English Restoration. Primarily for drama majors; open to others with a background in the history and/or literature of the period. (Offered even-numbered years only.)

DRAMA 373 History of the Western Theatre and Its Literature: 1700-1941 (5) Sp *Lorenzen, Wolcott* Theatre history and dramatic literature of Europe, England, and America. Development of the modern playhouse, and of modern dramatic and critical theory. The growth of the actor-manager and star systems; emergence of the director. Theatrical production and its response to romanticism and realism, to melodrama, social drama, and musical theatre forms. Primarily for drama majors; open to others with a background in the history and/or literature of the period. (Offered even-numbered years only.)

DRAMA 374 History of the Greek Theatre and Its Drama (5) *Wolcott* Examination of the relationship of the physical theatre and the productions that took place within that theatre, with particular emphasis on the text performed, styles of acting, scenic elements, and the critical theories that influenced the theatre of the period. Prerequisite: 371 or permission of instructor.

DRAMA 377 History of the European Renaissance Theatre and Its Drama (5) *Wolcott* See 374 for course description. Prerequisite: 372 or permission of instructor.

DRAMA 378 History of the English Theatre and Its Drama: 1500-1700 (5) *Lorenzen* See 374 for course description. Prerequisite: 372 or permission of instructor.

DRAMA 401 Summer Theatre (15, max. 30) S Intensive, practical experience in all aspects of the theatre arts. A modified stock company engages in extensive rehearsal and performance of selected plays, participates in workshop sessions in acting, costume, movement, scene construction, makeup and scene study, and supports both artistically and technically the summer theatre performywmance program. For persons with a strong commitment to all aspects of the drama in performance.

DRAMA 410 Advanced Theatre Technical Practices (2-4, max. 20) Production-related apprenticeship, in the areas of scene construction, scene painting, costume, or lighting. Prerequisites: 210, 211, 212, 418, or permission of instructor.

DRAMA 413 Advanced Scene Construction (3) A *Devin, Sedgwick* Special problems in scene construction materials and rigging. Prerequisites: 210, 212, 290, 292, 410 or equivalent practical experience, and 420.

DRAMA 414 Scene Design (3, max. 6) *Dahlstrom, Forrester* Theory, practice, and rendering of scene designs. Repeat of course involves intermediate designs, models, etc. Prerequisites: 210, 314, ART H 203, or equivalent.

DRAMA 415 Stage Costume Design (3, max. 6) W *Gates* Theory, practice, and rendering of costume designs for the theatre. Repeat of course involves intermediate designs. Prerequisites: 211, ART 109 and ART H 203 or equivalent or permission of instructor; 416 for repeat of course.

DRAMA 416 History of Clothing and Costume (5) A *Crider* Survey history of Western clothing and theatrical costume; emphasis on civil dress with attention to the distinctions in clothing for the stage. Open to nonmajors. Prerequisite: junior standing.

DRAMA 417 Advanced Stage Costume Construction (3, max. 6) W Techniques of costume construction, including study of fabrics; emphasis on creating patterns by draping. Prerequisites: 211, 416, or permission of instructor.

DRAMA 418 Scene Painting (3, max. 6) Sp *Dahlstrom, Forrester* Lecture-laboratory with focus on techniques and principles of scene painting. Uses of various media and types of equipment as applicable to varied scenic pieces. Prerequisite: 210 or permission of instructor.

DRAMA 419 Stage Lighting (3) W *Devin* Theories and methods of lighting with emphasis on the design process and lighting plots. Laboratories consist of analysis of lighting instruments and control, color experiments, and basic circuitries. Prerequisite: 212 or equivalent.

DRAMA 420 Design and Technical Drafting (2, max. 4) A *Devin, Sedgwick* Laboratory and project critique covering stage design graphics and technical drawing; specifically: designer's elevations, ground plans, sections, detail drawing, transposition of design drawing information to technical drawings. Prerequisite: 210.

DRAMA 421 Drawing and Rendering Techniques for the Theatre (2) AWSp *Forrester* Weekly figure-drawing laboratories with live model and weekly field-trips for laboratories in drawing natural phenomena and architectural detail. Studies in historical drawing styles. Practice in use of several media and techniques of expression. Prerequisites: 210 and 211.

DRAMA 430 Improvisation Performance Practicum (3) Developing performance through improvisation in small ensembles. Creation of short plays for performance in local schools, emphasizing story theatre, participation-play formats, and the demands of child audiences. Improvement of improvisation skills. Prerequisite: 253 or permission of instructor.

DRAMA 431 Fundamentals of Puppetry (3, max. 9) *Valentinetti* Puppetry as a theatre art; construction and use of puppets and marionettes for formal presentations; basic principles of playwriting and staging. Prerequisite: 331 or permission of instructor.

DRAMA 433 Children's Theatre Workshop: Performance for Young Audiences (3) Rehearsal and performance of polished scenes for young audiences in schools and community organizations. Examination of both children's theatre scripts and classic and modern scripts appropriate for junior and senior high school audiences. Prerequisite: 253 or permission of instructor.

DRAMA 434 Playwriting for Young Audiences (3) Basic principles of dramatic structure and play construction, with special attention to the demands of writing for young audiences. Adaptation of narrative material. Prerequisite: permission of instructor.

DRAMA 435 Theatre in the Schools (3) Practical experiences in researching, devising, rehearsing, and presenting actor/teacher, theatre-in-education programs to groups of school children in the Seattle area. Programs pertinent to school curriculum or to a particular group of children involve both performance by actors and participation of children. Prerequisite: 253 or permission of instructor.

DRAMA 436 Creative Drama Teaching Methods (3) Analysis of basic principles and techniques of leading informal drama. Examination of relationship between drama and selected theories of child development. Practical experience in planning and leading peers in drama sessions in class. Observation and teaching of children in laboratory classes. Prerequisite: 337 or 338 or permission of instructor.

DRAMA 438 Creative Dramatics and Laboratory (3) Application of basic principles and techniques of creative dramatics through leadership experience. Open to nonmajors. Prerequisite: 337 or permission of instructor.

DRAMA 451, 452, 453 Rehearsal and Performance (3,3,3) Theory and practice of period styles. 451: Shakespeare. 452: Molière and restoration. 453: classical and nonrealistic modern. Prerequisites: audition for 451; 451 for 452; 452 for 453.

DRAMA 457 Studio I (12, max. 36) AWSp *Hobbs, Lane, Ridley* Skill development in acting, voice, speech, and movement necessary for professional training in acting. Prerequisite: admission to the Professional Actor Training Program.

DRAMA 458 Studio II (12, max. 36) AWSp *Hobbs, Lane, Ridley* Continuation of 457. Prerequisites: 457 and completion of the first year of the Professional Actor Training program.

DRAMA 459 Studio III (6, max. 18) AWSp *Hobbs, Lane, Ridley* Specialized and individualized work relating to the main curriculum of the third year of the Professional Actor Training Program. Prerequisites: 458 and completion of the second year of the Professional Actor Training Program.

DRAMA 460 Introduction to Directing (3) A *Sydow* Student is introduced to the art of the stage director. Prerequisites: 102; 253 or 353; 210, 211, 212; and permission of instructor.

DRAMA 461, 462 Elementary Directing (3,3) W,Sp *Sydow* Elementary study of the art of the stage director. Prerequisites: 460 and permission of instructor for 461; 461 and permission of instructor for 462.

DRAMA 463 Beginning Directing Projects (4, max. 8) Directing practicum. One-act plays, scenes, or acts from full-length plays. Contemporary realistic, American drama. Prerequisites: 462 or equivalent and permission of instructor.

DRAMA 466 Stage Management (2-5, max. 15) AWSp *Devin* Study and practice of stage management. Prerequisites: 210, 211, 212, 290, 291, 292, or permission of instructor.

DRAMA 472 History of the English Theatre and Its Drama: 1700-1900 (5) *Lorenzen, Witham* Examination of the relationship of the physical theatre and the productions that took place within that theatre. Particular emphasis on the text performed, styles of acting, scenic elements, and the critical theories that influenced the theatre of the period. Prerequisite: 373 or permission of instructor.

DRAMA 473 History of the European Theatre and Its Drama From 1875 (5) Sp *Case, Witham* See 472 for course description. Prerequisite: 373 or permission of instructor.

DRAMA 475 Modern English Theatre and Drama (5) *Case, Witham* Major trends in contemporary English theatre, post-World War II to the present. Performers, dramatists, and designers who shaped the course of the theatre following the "angry young rebellion" of the 1950s. Prerequisite: 373 or permission of instructor.

DRAMA 476 Modern American Theatre and Drama (5) *Case, Witham* Major forces shaping modern American theatre, Eugene O'Neill to the present. Leading dramatists, directors, and designers of the post-World War II era. Experiments such as the federal theatre project, group theatre, and living theatre. Prerequisite: 373 or permission of instructor.

DRAMA 490 Special Studies in Acting-Directing (1-6, max. 6) AWSp Prerequisite: permission of instructor.

DRAMA 491 Special Studies in Design-Technical (1-6, max. 6) AWSp Prerequisite: permission of instructor.

DRAMA 492 Special Studies in Children's Drama (1-6, max. 6) AWSp Prerequisite: permission of instructor.

DRAMA 493 Playwriting (3, max. 9) Professional course. Focus on process of revision and practicalities of production experience. Prerequisite: ENGL 374 or permission of instructor.

DRAMA 494 Special Studies in Theatre and Drama (5, max. 20) AWSp *Case, Hostetler, Loper, Lorenzen, Witham, Wolcott* Topics in drama, history, and criticism. See the quarterly *Time Schedule* for specific topic to be offered in a given quarter. Prerequisites: 102, 473, 476, or permission of instructor.

DRAMA 496 Stage Costume Problems (2, max. 8) *Gates* Specific research problems of stage costume design and execution: accessories, masks, wigs, fabric modification, millinery and/or construction analysis for specialized costumes. Topics vary. Prerequisites: 211, 416, and permission of instructor.

DRAMA 497 Theatre Organization and Management (3) Sp *Devin* Theoretical and practical examination of the professional theatre organization and management: legal structures, funding, business practice, unions, and operational procedures. Open to nonmajors.

DRAMA 498 Theatre Production (1-2, max. 9) AWSp Laboratory course for students participating in School of Drama productions. Prerequisite: being cast in a production or receiving a crew assignment.

DRAMA 499 Undergraduate Research (1-5, max. 15) AWSp Prerequisite: permission of instructor.

Courses for Graduates Only

DRAMA 510 Design Studio I (3, max. 9) AWSp *Dahlstrom, Forrester, Gates* Three-quarter sequential investigation of space, light, texture, and color in total theatre design, concurrently stressing mastery of the media and methods of presentation and execution. Prerequisites: concurrent registration in 517 or 518 or 519 and permission of instructor.

DRAMA 511 Design Studio II (3, max. 9) AWSp *Dahlstrom, Forrester, Gates* Artistic principles and techniques as a basis for creative work in theatre design. Studio work in composition, color, line, space, and light and shade. Reports and outside reading may be required. Prerequisites: 510, 517, 518, 519, and permission of instructor.

DRAMA 512 Advanced Stage Lighting Design (3, max. 6) A *Devin* Advanced work in design of lighting for drama, opera, and dance; color theory; laboratory experimentation with color, fabric, paint, texture, and light; discussion of School of Drama production lighting. Prerequisites: 419 and 420 or permission of instructor.

DRAMA 513 Technical Direction (3, max. 9) AWSp *Devin, Sedgwick* Practical experience in mounting scenery for a current production; study of materials, techniques, management, and equipment of technical theatre; theatre planning and programming. Prerequisites: 413 and permission of instructor.

DRAMA 514 Design and Technical Theatre Colloquium (1, max. 9) AWSp Discussion of work in progress or completed in production, centering on the conceptual work of the designerdirector on the production and the methods of execution in the shops and on stage.

DRAMA 517, 518, 519 Studies in Historic Design (3,3,3) *Dahlstrom, Forrester, Gates* Investigation of artistic principles and modes that influenced the art, architecture, furniture, and decor of selected historic periods. Prerequisites: 517 for 518; 518 for 519, or permission of instructor.

DRAMA 520 Advanced Theatre Practicum (1-5, max. 15) AWSp Professional student internship with professional theatres: scenery, lighting, scene painting, costume, acting, directing, stage management, theatre management. Prerequisite: permission of instructor.

DRAMA 530 Directing for Young Audiences (3) Practical experience in directing plays for young audiences, with particular attention to story theatre, development of performance pieces through improvisation, and participation plays. Exposure to young audiences with a focus on developmental needs of audience age groups. Prerequisite: 462 or permission of instructor.

DRAMA 531 The Visual Image for Young Audiences (3) Application of basic principles of design to children's theatre. Both critical and creative involvement of students. Prerequisite: permission of instructor.

DRAMA 532 Management Principles for Children's Theatre (3) Provides theoretical and practical approach to management of children's theatre and related children's arts programs. Special focus on demands of touring companies, liaison with schools, season selection, publicity, fund-raising, budgets, community relationships, and the need for a philosophy of management. Prerequisite: graduate standing.

DRAMA 551, 552, 553 Teaching of acting (3,3,3,)A,W,Sp *Hostetler* Seminar discussion on problems in teaching acting to undergraduate students in 251, 252, and 253. Prerequisites, permission of instructor and being a teaching assistant in acting.

DRAMA 555 Special Problems in Acting (6, max. 18) AWSp *Hobbs, Lane, Ridley* Audition techniques, style problems, popular entertainment techniques. Prerequisites: 458 and completion of the second year of the Professional Actor Training Program.

DRAMA 560 Directing Apprenticeship (4, max. 12) Student works in close association with faculty and visiting directors for the entire rehearsal period in major productions of the School of Drama. Prerequisites: admission to the graduate directing program and permission of the instructor.

DRAMA 561 Intermediate Directing Projects (4, max. 8) Directing practicum. One-act plays, scenes, or acts from full-length plays. Contemporary, experimental American and European drama. Prerequisites: graduate standing in the directing program and 463.

DRAMA 562 Advanced Directing Projects (4, max. 12) Directing practicum. One-act plays, scenes, and acts from full-length plays. Historical and contemporary styles from world drama. Prerequisites: 8 credits in 561 and permission of instructor.

DRAMA 563 Seminar in Directing (2, max. 18) AWSp *Sydow* Seminar discussion of current productions; examination of problems of the stage director at the advanced level. Prerequisites: graduate standing in drama and permission of instructor.

DRAMA 571, 572, 573 Problems in Theatre History Research (3,3,3) A,W,Sp *Lorenzen, Witham, Wolcott* Methods and techniques of research in theatre history. Relationship of theatre arts to other arts and society in major periods of theatre history. Prerequisites: 571 for 572; 572 for 573.

DRAMA 575, 576, 577 Seminar in Theatre History (3,3,3) A,W,Sp *Lorenzen, Witham, Wolcott* Prerequisites: 571, 572, 573.

DRAMA 581, 582, 583 Analysis of Dramatic Literature (3,3,3) A,W,Sp *Case, Loper.* Modes of analysis intended for graduate students in drama (design, directing, and theatre history). Intensive analytical work on a limited number of play texts selected from the classical Greek period to the present.

DRAMA 585, 586, 587 Seminar in Drama (3,3,3) A,W,Sp *Case, Loper* Seminar in the historical development of dramatic criticism and theory.

DRAMA 599 Advanced Studies in Theatre Arts (1-5, max. 10) AWSp Independent projects or group study of specialized aspects of theatre arts. Prerequisite: permission of instructor.

DRAMA 600 Independent Study or Research (*) AWSp

DRAMA 700 Master's Thesis (*) AWSp

DRAMA 800 Doctoral Dissertation (*) AWSp

East Asian Studies

See International Studies.

Economics

301 Savery

The Department of Economics is concerned with the analysis of the ways in which societies organize the production of goods and services and the distribution of these among groups and individuals. Applied fields of study available to the student choosing the general economics option include: urban economics, money and banking, industrial organization, natural resource economics, labor economics, public finance, economic history, comparative systems and development, international trade, and econometrics. The department also offers a political economy option, which includes course work from economics and political science.

Undergraduate Program

Bachelor of Arts Degree

Admission Requirements: (1) A minimum of 45 transferable credits, including ECON 200, 201, 281 (or STAT 311), MATH 124 (or MATH 157), and at least 5 graded credits in English composition; (2) a cumulative grade-point average for all prior college work of at least 2.80; (3) grade-point average for the five courses required for entrance must average at least 2.80 with a minimum of 2.0 for each course (students who have repeated any of these five courses starting Winter Quarter 1983 must include both grades in the average); (4) transfer students must be enrolled at the University before they may apply.

Major Requirements: (1) Admission to the major; (2) a minimum of 50 credits in economics, including ECON 200, 201, 300, 301, 281 (or STAT 311), and at least five other upper-division courses in economics, excluding 400 and 401. At least three of these upper-division courses must be at the 400 level; (3) grades of 2.0 or better in ECON 300 and 301; (4) one calculus course (MATH 124, 134, 157, or equivalent) and any two courses from the following: MATH 125, 126, 135, 136; MATH 305; STAT 361, 362, 363; PHIL 120, 370, 470; and ACCTG 210 or equivalent (only one accounting course may be used for this requirement); (5) transfer students are required to complete a minimum of 25 upper-division credits in economics in residence at this university.

Graduate Program

Robert Halvorsen, Graduate Program Coordinator

The department offers programs of study leading to the Master of Arts and the Doctor of Philosophy degrees. The academic programs in economics are planned to develop trained economists for a variety of stimulating careers in teaching, in private industry, in government, and with international agencies at home and abroad. Frequent seminars—led by distinguished visitors from around the United States and from abroad, as well as by resident faculty and students—are conducted as an integral part of the department's broad agenda.

Special Requirements

Students need not have a full economics major as an undergraduate in order to apply, but should have taken intermediate-level courses in microeconomics and macroeconomics. Applicants should also have taken a minimum of one year of calculus and at least one course in statistics. Applicants are required to take the Graduate Record Examination General Test and are encouraged to take the Subject Test in Economics.

Graduate requirements for the M.A. degree include ECON 500, 501, 502, 503, 517, and either ECON 482 or 580. In addition to this core program, M.A. students must take six courses in economics at the graduate level. At least two of these courses must be in the same area (the field of specialization), and at least three of the courses must be in applied areas. M.A. students also must complete 6 credits of independent research or of work in a research intern program. Well-prepared students should be able to complete the M.A. program in two years.

Graduate requirements for the Ph.D. degree include ECON 500, 501, 502, 503, 517, 580, and 581. Ph.D. students are required to pass core examinations in microeconomics and macroeconomics. In addition to this core program, Ph.D. students must take six courses in economics at the graduate level. At least two of these courses must be in applied areas. Each Ph.D. student must satisfy the requirements for two fields of specialization. The fields of specialization include advanced macro-economic theory, advanced microeconomic theory, comparative systems and development, econometrics and statistics, economic history, government regulation and industrial organization, international trade, labor economics, natural resource economics, and public finance.

Ph.D. students must complete a doctoral dissertation. Foreign-language study is not required for either the M.A. or Ph.D. degree.

Financial Aid

A number of teaching and research assistantships are awarded each year to incoming and continuing graduate students.

Research Facilities

The Institute of Economic Research provides support for graduate student and faculty research. The Social Science Research and Computation Center maintains an extensive set of computer programs specifically designed for economic research, and the Databank service maintains a comprehensive economics data bank.

Correspondence and Information

Graduate Program Coordinator
307 Savery, DK-30

Faculty

Chairperson

Charles R. Nelson

Professors

Barzel, Yoram,* Ph.D., 1961, Chicago; economic theory, statistics, measurement of productivity change.

Brown, Gardner M., Jr.,* Ph.D., 1964, California (Berkeley); resource economics.

Cartwright, Philip W.,* Ph.D., 1950, Stanford; macroeconomics, state and local fiscal policy.

Cheung, Steven N. S.,* Ph.D., 1967, California (Los Angeles); theory, property and rights.

Crutchfield, James A. (Emeritus), Ph.D., 1954, California (Berkeley); economics.

Dowdle, Barney,*‡ (Forest Resources), Ph.D., 1962, Yale; growth and development of forest products industries, public forest land management.

Gillingham, J. Benton (Emeritus), M.A., 1941, Wisconsin; economics.

Halvorsen, Robert,* Ph.D., 1973, Harvard; natural resources, public finance.

Mah, Feng-Hwa,* (International Studies),† Ph.D., 1959, Michigan; Chinese economy and foreign trade.

Makin, John H.,* Ph.D., 1970, Chicago; international economics, monetary theory; theory of economic policy, macroeconomics.

McCaffree, Kenneth M. (Emeritus), Ph.D., 1950, Chicago; labor economics and the economics of medicine.

McGee, John S.,* Ph.D., 1952, Vanderbilt; industrial organization.

Morris, Morris D. (Emeritus) Ph.D., 1954, California (Berkeley); economic history and the economy of India.

Mund, Vernon A. (Emeritus), Ph.D., 1932, Princeton; economics.

Nelson, Charles R.,* (Statistics), Ph.D., 1969, Wisconsin; time series analysis, economic statistical analysis, advanced macroeconomic theory.

North, Douglass C. (Emeritus), Ph.D., 1952, California (Berkeley); economic history.

Parks, Richard W.,* Ph.D., 1966, California (Berkeley); econometrics.

Silberberg, Eugene,* Ph.D., 1964, Purdue; mathematical economics.

Thornton, Judith A.,* Ph.D., 1960, Radcliffe; comparative systems, Soviet economics.

Worcester, Dean A., Jr. (Emeritus), Ph.D., 1943, Minnesota; economic theory.

Yamamura, Kozo,*‡ (International Studies), Ph.D., 1964, Northwestern; economic development and economic history of Japan, comparative economic history.

Zerbe, Richard O.,*‡ (Public Affairs), Ph.D., 1969, Duke; economics of regulation, pollution control strategies.

Associate Professors

Bassett, Lowell R.,* Ph.D., 1966, Purdue; mathematical economics.

Hadjimichalakis, Michael G.,* Ph.D., 1970, Rochester; growth and general equilibrium.

Hartman, Richard C.,* Ph.D., 1971, California (Berkeley); mathematical economics, economic theory.

Hashimoto, Masanori,* Ph.D., 1971, Columbia; labor economics.

Kochin, Levis A.,* Ph.D., 1975, Chicago; macroeconomics, price theory, industrial organization, monetary, theory, agricultural economics.

Leffler, Keith B.,* Ph.D., 1977, California (Los Angeles); industrial organization, microeconomics.

Rao, Potluri M.,* Ph.D., 1969, Chicago; econometrics, statistics.

Stokes, Robert L.,*‡ (Marine Studies), Ph.D., 1975, Washington; natural resource economics, marine policy economics.

Thomas, Robert P.,* Ph.D., 1965, Northwestern; economic history.

Assistant Professors

Edlefsen, Lee E.,* Ph.D., 1977, Harvard; health economics, econometrics.

Kavoussi, Rostam M.,‡ (International Studies), Ph.D., 1976, Harvard; Middle East economics.

Koenig, Evan F.,* Ph.D., 1981, Harvard; microeconomic and macroeconomic theory and mathematical economics.

Mendelsohn, Robert O.,* Ph.D., 1978, Yale; environmental economics, public finance, regulation.

Ranney, Susan J., Ph.D., 1978, Wisconsin (Madison); international trade, economic development.

Swierzbinski, Joseph E.,* (Institute for Environmental Studies),† Ph.D., 1981, Harvard; resource economics, applied mathematics.

Wong, Kar-Yiu, Ph.D., 1983, Columbia; international trade, econometrics, economic development.

Lecturers

Cox, Judith B., M.A., 1965, Stanford; microeconomics, trade, public finance.

Heyne, Paul T., Ph.D., 1963, Chicago; introductory economics, history of economic thought.

Course Descriptions

Courses for Undergraduates

ECON 200 Introduction to Microeconomics (5) AWSpS Analysis of markets: consumer demand, production, exchange, the price system, resource allocation, government intervention.

ECON 201 Introduction to Macroeconomics (5) AWSpS Analysis of the aggregate economy: national income, inflation, business fluctuations, unemployment, monetary system, federal budget, international trade and finance.

ECON 260 Economic History of the Western World (5) Analysis of the sources of long-run economic change from Neolithic times to the present. Develops basic analytical concepts of economic change and applies them to human history. First half of the course deals with economic development up to settlement of the American colonies; last half deals with American economic development.

ECON 281 Introduction to Economic Statistics (5) Statistical concepts and their application in economics. Not open for credit to students who have taken STAT 311. Prerequisites: 200, 201.

ECON 299 Study Abroad: Economics (5, max. 10) For participants in the Study Abroad program. Specific course content determined by assigned faculty member and announced in Study Abroad bulletins.

ECON 300 Intermediate Price Theory (5) AWSpS Choice decisions of individuals and firms: consequences of these decisions in product and factor markets. Consumption production and cost, exchange. Prerequisites: 201 and MATH 157 or 124, or equivalent.

ECON 301 National Income Analysis (5) AWSpS Analysis of the determinants of the aggregate level of employment, output, prices, and income of an economy. Prerequisite: 300.

ECON 306 Development of Economic Thought (5) From the early modern period to the present, with some discussion of its relation to natural science and other social sciences. The main subjects treated are Adam Smith and the classical school, Karl Marx, the neoclassical reformulation and its critics, and the impact of J. M. Keynes. Prerequisites: 200, 201, or equivalent.

ECON 316 Urban Economics (5) Application of economic analysis to urban trends, problems, and prescriptions, such as changing urban form and function, urban public finance, housing and renewal, poverty and race, transportation, and environmental problems. Offered jointly with GEOG 316. Prerequisite: 201 or 400 or equivalent.

ECON 340 Labor Economics (5) AWSp Analysis of labor markets; factors determining size and composition of the labor force, demand for labor services, job search and unemployment, wage differences including discrimination, impact of labor unions on wages and resource allocations. Analysis of public policy. Prerequisites: 200, 201.

ECON 348 Economics of Health Care (3) Economic analysis of the health-care sector of economy: organization, demand and supply factors, pricing practices, financing mechanisms—public *vs.* private, impact of third party, insurance and prepayment, health and economic development. Prerequisite: 200 or equivalent.

ECON 347 Introduction to Population and Economic Dynamics (5) Relationship between population and economics. Historical record, focusing on Europe and Japan and developing countries since World War II; consequences of population growth with respect to per capita income and other measures of economic welfare; ways in which economic factors affect fertility, migration, and mortality; population policy. Prerequisites: 200, 201.

ECON 350 Public Finance (5) Elementary treatment of the theory of public finance. Theory of social welfare maximization, externalities and public goods, benefit-cost analysis, and evaluation of the distributional and allocational effects of alternative types of taxes. Prerequisites: 300 and 301 or equivalents.

ECON 370 Introduction to International Economics (5) AWSp The theory of international trade, commercial policy, balance of payments, and foreign exchange notes with applications. Prerequisites: 200 and 201. Highly recommended: 301.

ECON 390 Comparative Economic Systems (5) Study of resource allocation, growth, and income distribution in capitalist, market socialist, and centrally planned economies. The theoretical models of these systems are developed and then illustrated by case studies of selected countries. Prerequisites: 200 and 201 or equivalent.

ECON 391 Economic Development (5) Critical appraisal of theories and problems of growth with emphasis on the less-developed countries of the world today. Prerequisites: 200 and 201.

ECON 400 Fundamentals of Microtheory (3) Emphasis on applications to public policy. Designed primarily for graduate students majoring in fields other than economics. No credit given if 300 has been taken for credit. Prerequisite: permission of undergraduate adviser. Recommended: 200 or equivalent.

ECON 401 Fundamentals of Macrotheory (3) Emphasis on applications to public policy. Designed primarily for graduate students majoring in fields other than economics. No credit given if 301 has been taken for credit. Prerequisite: permission of undergraduate adviser. Recommended: 200 or equivalent.

ECON 403 The Economics of Property Rights (5) Property rights as constraints for individual competition and interaction in society. Implications of different property rights for affecting economic behavior and for resource allocation and income distribution. Costs of transactions as determinants of contractual and institutional arrangements in light of the recent advancement of the theory of economic organization. Prerequisite: 300.

ECON 404 Industrial Organization and Price Analysis (5) Competition, collusion, monopoly, and oligopoly in regulated and unregulated markets. Economics of firm management, market organization, sales practices, and the antitrust laws. Prerequisite: 300 or equivalent.

ECON 406 Undergraduate Seminar in Economics. (5) Provides undergraduate student an opportunity to apply the tools of economic analysis in a critical examination of theoretical and empirical work. A list of topics is available in the departmental office. Enrollment preference is given to majors in their junior or sophomore years. Prerequisites: 201, permission of instructor.

ECON 421 Money, Credit, and the Economy (5) Role of money and the banking system in the U.S. economy. Relation of money to inflation, interest rates, and business fluctuations. Monetary policy and Federal Reserve System. Prerequisites: 300 and 301 or B ECN 300 and 301; or equivalent.

ECON 422 Investment, Capital, and Finance (5) Accumulation and allocation of wealth by individuals; investment in producer and consumer durables by firms and households; separation of ownership from operating decisions via corporations; determination of market value; dividend policies and optimal investment criteria; introduction to financial decisions under uncertainty; elements of portfolio theory and the capital asset pricing model. Prerequisite: 300.

ECON 430 The Mixed Economy of Modern America (5) Study of interrelated economic, social, political, legal, and demographic factors in contemporary America. Attempt to comprehend synthetically the nature of the modern economy, with special attention given to governments, large corporations, and socioeconomic problems. Prerequisites: 300 and 301, or permission of instructor.

ECON 431 Government and Business (5) AWSp Economic effects of various governmental regulatory agencies and policies. Antitrust legislation as a means of promoting desired market performance. Observed economic effects of policies intended to regulate business practices, control prices, conserve resources, or promote competition. Prerequisite: 300 or equivalent.

ECON 435 Natural Resource Utilization and Public Policy (5) AWSp Special emphasis on elements of economic theory relating to resource-oriented industries. Case studies in the theory and practice of resource management dealing with both stock and flow resources. Benefit-cost analysis and the evaluation of multipurpose resource projects. Prerequisite: 201 or 400 or permission of instructor.

ECON 443 Labor Market Analysis (5) Alternate course to 340. Basic subject matter is the same, but the analysis is more rigorous. Prerequisites: 300 or equivalent and a statistics course.

ECON 445 Income Distribution and Public Policy (5) Income distribution implications and economic effects of public policies toward unemployment, illness, industrial accidents, old age, poverty, and discrimination from age, sex, or race. Prerequisites: 200, 201.

ECON 450 Public Finance I (5) Economic analysis of governmental activity: public goods and externalities, collective choice, cost-benefit analysis, public welfare programs. Prerequisites: 300, 301.

ECON 451 Public Finance II (5) Microeconomics of taxation: efficiency, incidence, effect on distribution of income, personal and corporate income taxes, sales and consumption taxes, taxation of property and estates. Prerequisite: 300.

ECON 452 Economic Theory as Applied to the Political System (5) Explanation and evaluation of political system, using elementary economics theory. Alternative voting rules, political effectiveness of various types of groups, causes and consequences of logrolling, and bureaucratic organizations. Offered jointly with POL S 416. Prerequisite: 200 or 400 or equivalent.

ECON 453 State and Local Public Finance (5) Not open for credit to students who have taken 451.

ECON 460 Economic History of Europe (5) Origins of the modern European economy; historical analysis of economic change and growth from medieval times that stresses the preconditions and consequences of industrialization. Offered jointly with HST 481. Recommended: 200, 201.

ECON 462 Economic History of the United States to the Civil War (5) Systematic study of the changing pre-Civil War economic conditions and the consequences of these changes for the American society. Prerequisites: 200 and 201, or equivalent.

ECON 463 Economic History of the United States From the Civil War to the Present (5) Systematic study of the changing economic conditions since the Civil War and the consequences of these changes for the American society. Prerequisites: 200 and 201, or equivalent.

ECON 466 Economic History of China: 1840-1949 (5) Study of the post-1840 Chinese economy, with a brief introduction to the socioeconomic background of the earlier period. Explanations of China's long economic stagnation, and analyses of the impact of external factors and the role of the government in China's economic development before 1949. Recommended: 200, 201.

ECON 471 International Trade (5) AWSp Theory of comparative advantage and different models of international trade. Trade and welfare; the theory and practice of commercial policy. Economic integration. Factor mobility and trade flows. The North-South debate. Prerequisites: 300, 301.

ECON 472 International Finance (5) AWSp Monetary problems in international trade and macroeconomics of the open economy. Features of different exchange-rate systems and their adjustment mechanisms. Money and international capital movements. Policies for internal and external balance. Prerequisites: 300, 301.

ECON 481 Introduction to Mathematical Statistics (5) Probability, generating functions, ß method, Jacobians, Bayes theorem, maximum likelihoods, Neyman-Pearson efficiency, decision theory, regression, correlation, bivariate normal. Offered jointly with STAT 481. Students receiving credit for either 341 or 390 may not receive credit for 481. Prerequisites: 281, STAT 311 or equivalent; MATH 124, 125, 126; and a course in linear algebra, which may be taken concurrently.

ECON 482 Introduction to Regression Analysis (5) Specification and estimation of economic models, using regression analysis. Prerequisites: 300; 281 or STAT 311.

ECON 483 Econometric Modeling (5) Availability of Washington State economic statistics, processing techniques, and econometric models. Build econometric models to meet stated assumptions to forecast regional economic variables. Prerequisites: 481, 482.

ECON 493 Economy of Modern China (5) Analytical survey of economic development of modern China, with special emphasis on the objectives, performance, and problems of the mainland Chinese economy under communism. Prerequisites: 200 and 201, or permission of instructor.

ECON 494 Economic Growth of Japan Since 1850 (5) Analysis of the economic growth of Japan since about 1850 to the present. The reasons for rapid industrialization, various effects of sustained economic growth, and significant contemporary issues are investigated. Prerequisites: 200 and 201, or permission of instructor.

ECON 495 The Economy of Soviet Russia (5) Analytical survey of techniques of planning and resource allocation in the Soviet economy. Criteria for evaluating economic performance, growth, and efficiency. Prerequisite: 300 or equivalent or permission of instructor.

ECON 498 Honors Seminar (5) W Honors and other superior students are given opportunity to develop research techniques, to pursue topics in breadth and depth, and to apply their tools of economic analysis to selected topics in economic theory and current issues of national and international economic policy. For seniors only. Prerequisite: permission of undergraduate adviser.

ECON 497 Honors Directed Study (5) Sp Students individually arrange for independent study of selected topics in economic theory and its application under the direction of a member of the economics faculty. The research paper, if accepted, is the student's senior thesis. Prerequisite: permission of undergraduate adviser.

ECON 499 Undergraduate Research (1-6) AWSpS May not be applied toward an advanced degree. Prerequisite: permission of undergraduate adviser.

Courses for Graduates Only

ECON 500 Microeconomic Analysis I (5) Consumer demand, cost, and supply and the theory of markets. Prerequisites: 300, and 517, or permission of instructor.

ECON 501 Microeconomic Analysis II (5) Production and factor demands, the supply factor. Factor markets and distribution of income. Capital theory and resource allocation over time. Prerequisite: 500.

ECON 502 Macroeconomic Analysis I (5) Analysis of theories of income, employment, and output under static conditions; quantity theory of money; relation of monetary and "real" theories; stability and instability of income over time; growth of the economy. Prerequisites: 300 and 301; 517 or permission of instructor.

ECON 503 Macroeconomic Analysis II (5) Recent developments. Prerequisite: 502.

ECON 504 Economic History and Economic Development (3) Analysis of determinants of long-run development, emphasizing institutional, demographic, and technological changes; consideration of both theoretical and empirical studies. Prerequisite: 300 or equivalent.

ECON 505 Microeconomic Theory: Problems and Applications (3) Seminar for graduate students who have completed the basic core sequence in price theory. Designed to extend the student's analytic and problem-solving abilities by working systematically through a programmed set of readings and problems. The material includes both formal analytical techniques and applications of economic theory. Prerequisite: 501.

ECON 507 History of Economic Thought (3) Classical and neoclassical economics with emphasis on alternative conceptions of the nature and significance of economic science.

ECON 511 Advanced Microeconomic Theory: Selected Topics (3, max. 12) Seminar in advanced microtheory. Selected topics of special interest and significance. Prerequisites: 500, 501.

ECON 512 Advanced Macroeconomic Theory: Selected Topics (3, max. 12) Seminar in advanced macrotheory. Selected topics of special interest and significance.

ECON 513 Mathematical Economics: Linear Analysis (5) Theory and application of linear algebra and linear economic models. Prerequisites: 300, MATH 124, 125, 126.

ECON 514 General Equilibrium Analysis (3) Study of the existence, uniqueness, and stability of general equilibrium models under the assumptions of competition. Emphasis is on recent developments in the literature with consideration given to both positive and normative economics.

ECON 517 Foundations of Economic Analysis (5) Sources of meaningful comparative status theorems in economics, with special emphasis on extremum problems and qualitative analysis. Necessary mathematical concepts are developed. Prerequisites: 300, MATH 124, 125, 126.

ECON 520 The Economics of Property Rights (3) Application of standard economic theory to analyze various forms of property rights as constraints of competition; the costs associated with delineation and enforcement of rights; the costs of negotiating and enforcing contracts for right transfers; resource allocation and income distribution implied by different property right and transaction cost constraints. Prerequisites: 500 and 501, or permission of instructor.

ECON 530 Government Regulation of Business (3) Public policy in the United States with respect to industrial organization and business conduct. Economic issues in antitrust policy emphasized. Prerequisites: 500, 501.

ECON 532 Economic Theory of Regulation (3) Develops a political-economy framework for analyzing regulations and regulatory reform. Influence of legal history. Theories of regulation and regulatory behavior. Offered jointly with SMT 532 and PB AF 532. Prerequisite: 400 or PB AF 516 or permission of instructor.

ECON 533 Price Policy and Industrial Organization (3) Advanced analysis of pricing, market structure, and industry performance. Recent empirical and theoretical literature emphasized. Prerequisites: 500, 501.

ECON 535 Economics of Natural Resources I (3) Pricing, allocation, and utilization of nonrenewable natural resources. Dynamic optimization, exploration, and technological relationships. Benefit-cost analysis and public investment criteria. Prerequisites: 500 and 501, or permission of instructor.

ECON 536 Economics of Natural Resources II (3) The second of two-course sequence. Renewable resources, including fisheries and forestry. Externality theory and pollution control policies. Prerequisite: 535.

ECON 537 Economic Aspects of Marine Policy (3) Development of pertinent economic concepts and their application to selected topics in marine policy decision making. Offered jointly with IMS 508. Prerequisite: IMS 500 or permission of instructor.

ECON 538 Economic Aspects of Marine Policy II (3) Development of pertinent economic concepts and their application to selected topics in marine policy. Offered jointly with IMS 538. Prerequisite: 537 or permission of instructor.

ECON 539 Economics of Natural Resources Seminar III (3) Selected advanced topics in the economics of natural resources. Recent empirical and theoretical research. Active participation in ongoing research projects by students is essential. Prerequisites: 535, 536.

ECON 541, 542 Labor Economics (3,3) Selected topics in labor economics.

ECON 543 Population Economics (3) Economic determinants and consequences of population growth; emphasis on formal theoretical models and on empirical analysis. Introduction to: formal demography; welfare economics of population change, including analyses of population effects on consumption, savings, investment, and technical change; and determinants of mortality, fertility, and migration. Prerequisites: 500 and 501, or permission of instructor.

ECON 546 Economic Studies of Health Care (3) Examination of topics related to the economics of health care, including supply and demand factors, financing of care, efficiency and cost of delivery, and allied areas. Offered jointly with HSERV 550. Prerequisite: graduate standing in the School of Public Health and Community Medicine; others by permission of instructor.

ECON 547 Advanced Seminar in Health Economics (3) Selected topics in health economics, including risk and insurance, medical malpractice, the market for physician services, and industry regulation. Offered jointly with HSERV 560. Prerequisites: 546 or HSERV 550, advanced-level microeconomic theory, or permission of instructor.

ECON 548 Economics of Labor and Human Resources (3) Economic analysis of policy-related topics in human resources. Topics include labor demand and supply, education and occupation, wage structures and income inequality, discrimination, and poverty. Offered jointly with PB AF 548. Not open to economics majors. Prerequisite: equivalent of 400.

ECON 550 Public Finance I (3) Theory of public finance with emphasis on public expenditures. Social welfare maximization, public goods and externalities, decreasing cost industries, theory of collective choice, second-best analysis, and benefit-cost analysis. Prerequisite: 500, 501, or permission of instructor.

ECON 551 Public Finance II (3) Theory of public finance with emphasis on taxation. Second-best analysis, optimal taxation, general equilibrium incidence analysis, issues in personal income taxation and corporate income taxation. Prerequisite: 500, 501, or permission of instructor.

ECON 553 Economic Analysis and Government Programs (3) Applications of economic analysis to public enterprises and programs. Prerequisites: 400 and 401, or equivalent.

ECON 554 Advanced Seminar in Cost-Benefit Analysis (3) Techniques of, and theoretical foundation for, cost-benefit analysis as applied to the public sector. Offered jointly with SMT 554 and PB AF 554. Prerequisite: SMT 553 or PB AF 553.

ECON 556 Seminar in Urban Economics (3) Use of economic theory to explain land-use trends, transportation, housing and renewal, the ghetto, and the public economy in urban areas. Offered jointly with GEOG 556. Prerequisites: 300 and 301, or equivalent.

ECON 561 European Economic History (3) Economic growth of the Western world since the decline of the Roman Empire. Prerequisite: 504.

ECON 562 American Economic History (3) Analytical methods; sources and reliability of data; consideration of some major issues in current research. Prerequisites: 500, 504.

ECON 571 International Trade Theory (3) Application to international trade and investment of microeconomics, general equilibrium theory, and welfare economics. Prerequisites: 500 and 501.

ECON 572 International Finance (3) Analysis of open economy macro models with emphasis on exchange rates and balance of payments determination. Prerequisites: 502 and 503.

ECON 580 Econometrics I (3) Estimation and testing in the classical linear regression model. Extensions of the model and applications to the analysis of economic data. Prerequisites: 481, 513.

ECON 581 Econometrics II (3) Continuation of 580. Topics include serial correlation, distributed lag models, multiple equation models. Prerequisite: 580.

ECON 582 Topics in Econometrics (3) Explores advanced econometric problems arising in current research and the techniques to handle them. Seminar format; examples from recent econometric literature. Topics vary.

ECON 590 Theory and Practice of Economic Planning (3) Analysis of incentives for, and methods of, government intervention in socialist and developing countries, with a focus on microeconomic issues.

ECON 591 Theoretical Issues in Economic Development (3) Analysis of issues in economic development with application to the less-developed countries of the world today. Prerequisites: 500 and 501, or permission of instructor.

ECON 595 Analysis of Socialist Economies (3) *Thornton* Analysis of economic planning, resource allocation, and the performance of economic units in centralized and decentralized socialist economies. Prerequisite: permission of instructor.

ECON 600 Independent Study or Research (*)

ECON 601 Internship (3-9, max. 9)

ECON 700 Master's Thesis (*)

ECON 800 Doctoral Dissertation (*)

English

A101 Padelford

Undergraduate Program

The Department of English offers courses in English, American, and related literature; literary history and criticism; expository and creative writing; and related subjects. Courses in the English curriculum cover a wide range of interests in the study of cultural and intellectual history, pertinent to many vocations and careers, on the premise that a knowledge of language and literature is fundamental to a university education.

Bachelor of Arts Degree

MAJOR REQUIREMENTS

Language and Literature: A minimum of 55 credits in English at the 200 level and above, including at least 40 credits in 300- and 400-level courses. These 55 credits must include 5 credits each in courses approved for Periods I through V, with 5 additional credits in Period I or Period II, for a total of 30 credits. 5 writing credits will be accepted within this 55-credit curriculum. A brochure describing the English major in detail is available from the English advising office in Padelford Hall. The five historical periods required for majors are Period 1: Medieval and Renaissance; Period 2: Seventeenth- and Eighteenth-Century British Literature; Period 3: Nineteenth-Century British Literature; Period 4: American Literature to 1917; Period 5: Twentieth-Century British and American Literature.

Composition and Advanced Writing: This curriculum includes 20 credits in advanced writing in addition to 35 credits in language and literature. At least 40 credits must be in 300- and 400-level courses. These 55 credits must include six period courses (30 credits) as required for the curriculum in language and literature, 5 elective credits in language or literature courses, and a minimum of 20 credits in advanced writing courses (15 credits of 300- and 400-level courses in at least two forms [e.g., short story, novel, drama, poetry, expository writing]).

Graduate Program

Carolyn J. Allen, Graduate Program Coordinator

The Department of English offers a complete program of graduate courses and seminars designed to provide aspirants for the Master of Arts and Doctor of Philosophy degrees with a knowledge of literature and the necessary scholarship for training in literary criticism and theory, literary history, language study, and rhetoric and composition theory. The M.A. program in advanced creative writing emphasizes projects in imaginative writing, supported by courses in criticism and literary periods and types. A special degree program, the Master of Arts for Teachers, is offered for English teachers in secondary schools and community colleges and for those interested in teaching English as a second language. The graduate program permits completion of the master's degree in one calendar year and the doctoral degree in an additional three years. In a typical four-year program, a student is encouraged to complete course requirements (normally 80 credits) during the first two years, the General Examination for the Ph.D. in the third year, and the dissertation in the fourth year.

Financial Aid

The department annually awards approximately sixteen new teaching assistantships. To apply, a student should write to the English graduate program coordinator to request an application form. The completed application must reach the English graduate office by February 15 for the following academic year.

Master of Arts Degree

Admission Requirements: Bachelor of Arts degree. Major in English equivalent to that at the University of Washington preferred. Graduate Record Examination aptitude and advanced literature in English tests. Two letters of recommendation, three for those applying for teaching assistantships. Writing sample required of candidates for creative writing program.

Graduation Requirements: Literature—Intermediate-level proficiency in a foreign language. 25 credits, of which a substantial number must be in courses numbered 500 or above. A maximum of 5 quarter transfer credits may be accepted if taken while a graduate student in another acceptable graduate school. An 11-credit essay, researched and written over two quarters.

Creative Writing—Intermediate-level proficiency in a foreign language. 36 credits, of which 15 must be in advanced literature seminars. One of those seminars must be selected from courses numbered 506-509. At least 15 credits in advanced writing courses. A creative writing thesis for 10 credits. Final oral examination.

Master of Arts for Teachers Degree

Admission Requirements: Same as for the Master of Arts degree, but usually including prior teaching experience.

Graduation Requirements: 40 credits, of which 25 must be in courses numbered 500 or above; 15 of these may be taken outside the department in courses related to the teaching of English, subject to approval. A maximum of 5 credits may be transferred from an accredited graduate program elsewhere. Intermediate-level proficiency in a foreign language. A final comprehensive written examination.

Master of Arts for Teachers Degree (English as a Second Language)

Admission Requirements: Bachelor of Arts degree, Graduate Record Examination aptitude test, statement of purpose, two letters of recommendation. Students with baccalaureate degrees in fields other than languages, linguistics, or English are required to take ENGL 390 or its equivalent. Students without training in linguistic method and theory must take LING 400 as a prerequisite for 400-level linguistics courses.

Graduation Requirements: 46-49 credits, including ENGL 555, 556, and 557; 5-6 credits in ENGL 558, or LING 445 and LING 449; 15 credits from approved list of linguistics courses; 5 credits from approved list of English courses; 3-6 credits of ENGL 560 (Teaching Practicum); at least one approved elective. Language competency: for native speakers of English, at least two years of university-level foreign-language study in a single language, or equivalent as measured on a proficiency examination for nonnative speakers of English, demonstrated oral and written fluency in English.

Doctor of Philosophy Degree

Admission Requirements: By petition to Graduate Studies Committee upon completion of the M.A. degree in literature. Students transferring into the program with a master's degree from another institution may be required to submit an equivalent to the master's essay. Students transferring with a University of Washington M.A. degree in creative writing or an M.A.T. degree must complete the course work and language requirements for the M.A. degree in literature. Admission is granted when the total record is a convincing indication of the aspirant's capabilities to complete the doctoral degree.

Graduation Requirements: No specific courses, although individual students may be required by their doctoral committees to take courses necessary for successful completion of their academic projects. 80 credits. (A total of 15 credits may be transferred from other departments. It is advisable to take a substantial number of 500-level seminars in accumulating 80 credits.) Fluency in at least one foreign language, plus whatever additional language study the doctoral committee thinks advisable. A General Examination, including departmental written examinations in four areas (historical period, major authors, specialized field of study, individual topic) and an Oral Examination (a lecture by the student addressing a question set by the doctoral committee on a subject with close relationship to the proposed dissertation and questions on the areas of the written examinations). Dissertation. Final Examination based upon the dissertation.

Faculty

Chairperson

Richard J. Dunn

Professors

Adams, Hazard S.,* (Comparative Literature),† Ph.D., 1953, Washington; romanticism, history of literary theory, Anglo-Irish literature.

Adams, Robert P. (Emeritus), Ph.D., 1937, Chicago; Renaissance literature.

Alexander, Edward,* Ph.D., 1963, Minnesota; Victorian literature.

Altieri, Charles F.,* (Comparative Literature),† Ph.D., 1969, North Carolina; twentieth-century literature, critical theory, history of criticism.

Bentley, G. Nelson,* M.A., 1945, Michigan; poetry writing.

Blake, Kathleen A.,* Ph.D., 1971, California (San Diego); Victorian literature, children's literature, women's studies.

Brown, Malcolm J. (Emeritus), Ph.D., 1936, Washington; Anglo-Irish literature (nineteenth and twentieth centuries).

Burns, Wayne (Emeritus), Ph.D., 1946, Cornell; Victorian literature.

Dunn, Richard J.,* Ph.D., 1964, Western Reserve; Victorian literature, English novel.

Eby, E. Harold (Emeritus), Ph.D., 1927, Washington; American literature.

Emery, Donald W. (Emeritus), M.A., 1928, Iowa; English grammar.

Fowler, David C.,* Ph.D., 1949, Chicago; medieval literature.

Gerstenberger, Donna L.,* Ph.D., 1958, Oklahoma; twentieth-century literature, Anglo-Irish literature, feminist criticism.

Harris, Markham (Emeritus), M.A., 1931, Illinois; fiction writing.

Heilman, Robert B. (Emeritus), Ph.D., 1935, Harvard; drama.

Irmscher, William F.,* Ph.D., 1950, Indiana; rhetoric and theory of composition.

Johnson, Charles R.,* M.A., 1973, Southern Illinois; fiction writing.

Jones, Frank W. (Emeritus), Ph.D., 1941, Wisconsin; comparative literature.

Kartiganer, Donald M.,* Ph.D., 1964, Brown; twentieth-century literature.

Korg, Jacob,* Ph.D., 1952, Columbia; Victorian, twentieth-century literature.

Lockwood, Thomas F.,* Ph.D., 1967, Rice; eighteenth-century literature.

Matchett, William H. (Emeritus), Ph.D., 1957, Harvard; Renaissance literature, Shakespeare.

McCracken, David,* Ph.D., 1966, Chicago; eighteenth-century literature.

McElroy, Colleen W.,* Ph.D., 1973, Washington; Black literature, women writers, poetry writing.

Pellegrini, Angelo M. (Emeritus), Ph.D., 1942, Washington; Shakespeare.

Reinert, Otto,* (Comparative Literature, Drama),† Ph.D., 1952, Yale; comparative literature, eighteenth-century literature.

Russ, Joanna,* M.F.A., 1960, Yale; fiction writing.

Sale, Roger H.,* Ph.D., 1957, Cornell; Renaissance literature.

Simonson, Harold P.,* Ph.D., 1958, Northwestern; American literature.

Stevick, Robert D.,* Ph.D., 1956, Wisconsin; medieval language and literature.

Stirling, Brents (Emeritus), Ph.D., 1934, Washington; Renaissance literature.

Wagoner, David R.,* M.A., 1949, Indiana, twentieth-century literature, fiction and poetry writing.

Zillman, Lawrence J. (Emeritus), Ph.D., 1936, Washington; romanticism.

Associate Professors

Abrams, Robert E.,* Ph.D., 1973, Indiana; American literature.

Allen, Carolyn J.,* Ph.D., 1972, Minnesota; twentieth-century literature, women writers, contemporary critical theory.

Brenner, Gerald J.,* Ph.D., 1969, New Mexico; American literature, fiction writing.

Butwin, Joseph M.,* Ph.D., 1971, Harvard; Victorian literature.

Coldewey, John C.,* Ph.D., 1972, Colorado; Renaissance literature, medieval drama.

Cox, Gerard H. III,* Ph.D., 1968, Stanford; Renaissance literature, Shakespeare, seventeenth-century literature.

Duckett, Margaret R. (Emeritus), M.A., 1941, North Carolina; American literature.

Dunlop, William M.,* M.A., 1964, Cambridge; Shakespeare, nineteenth-century literature, poetry writing.

Fisher, Alan S.,* Ph.D., 1969, California (Berkeley); Renaissance, seventeenth- and eighteenth-century literature, history of literary criticism.

Frey, Charles H.,* Ph.D., 1971, Yale; Renaissance literature, Shakespeare.

Gere, Anne R.,* Ph.D., 1974, Michigan; rhetoric and theory of composition.

Gould, Florence J. (Emeritus), M.A., 1931, Oregon; creative writing.

Griffith, John W.,* Ph.D., 1969, Oregon; American literature.

Hartman, Charles O.,* Ph.D., 1976, Washington (St. Louis); modern poetry, critical theory.

Hatfield, Glenn W., Jr.,* Ph.D., 1964, Ohio State; eighteenth-century literature.

Hudson, Lois P.,* M.A., 1951, Cornell; fiction writing.

Kaplan, Sydney J.,* Ph.D., 1971, California (Los Angeles); twentieth-century literature, women writers, feminist criticism.

Kolpacoff, V. Ivan,* M.A., 1966, San Francisco State; fiction writing.

LaGuardia, Eric H.,* Ph.D., 1961, Iowa; Renaissance literature.

Longyear, Christopher R.,* Ph.D., 1961, Michigan; linguistics.

Modiano, Raimonda,* (Comparative Literature), Ph.D., 1973, California (San Diego); romanticism.

Mussetter, Sally A.,* Ph.D., 1975, Cornell; medieval language and literature.

Palomo, Dolores J.,* Ph.D., 1972, State University of New York (Buffalo); Renaissance literature, women writers.

Person, Henry A. (Emeritus), Ph.D., 1942, Washington; English language.

Phillips, William L. (Emeritus), Ph.D., 1949, Chicago; American literature.

Searle, Leroy F.,* Ph.D., 1970, Iowa; twentieth-century literature, critical theory, American studies.

Shulman, Robert P.,* Ph.D., 1959, Ohio State; American literature.

Smith, Eugene H.,* Ph.D., 1963, Washington; rhetoric and theory of composition.

Stanton, Robert B. (Emeritus), Ph.D., 1953, Indiana; American literature.

Stewart, Ann H.,* Ph.D., 1972, Princeton; medieval literature, language.

Streitberger, William R.,* Ph.D., 1973, Illinois; Renaissance literature, textual criticism, paleography.

Tollefson, James W.,* Ph.D., 1978, Stanford; English as a second language, language planning.

Vaughan, Micael F.,* (Comparative Literature),† Ph.D., 1973, Cornell; medieval language and literature.

Watkins, Evan P.,* Ph.D., 1972, Iowa; critical theory, modern and contemporary British and American literature.

Webster, John M.,* Ph.D., 1974, California (Berkeley); Renaissance literature.

Willeford, William O.,* (Comparative Literature),† Ph.D., 1966, Zurich (Switzerland); Renaissance literature, literature and psychology.

Yaggy, Elinor M. (Emeritus), Ph.D., 1946, Washington; American literature, expository and fiction writing.

Assistant Professors

Altieri, Joanne S., Ph.D., 1969, North Carolina; Renaissance literature.

Griffith, Malcolm A.,* Ph.D., 1966, Ohio State; twentieth-century literature, modern criticism, American literature.

Patterson, Mark R.,* Ph.D., 1981, Princeton; American literature.

Posnock, Ross,* Ph.D., 1980, Johns Hopkins; American literature.

Rivenburgh, Viola K. (Emeritus), M.A., 1926, Hawaii; expository writing.

Schuster, Charles I.,* Ph.D., 1977, Iowa; rhetoric and theory of composition, nineteenth-century British literature.

Silberstein, Sandra V.,* Ph.D., 1982, Michigan; English as a second language, sociolinguistics.

van den Berg, Sara J.,* Ph.D., 1970, Yale; Renaissance and seventeenth-century literature.

Lecturers

Bowie, Dorothee N. (Emeritus), M.A.T., 1968, Washington; expository writing.

Clemens, Lois D. (Emeritus), M.A., 1956, Washington; expository and fiction writing.

Willis, Leota S. (Emeritus), Ph.D., 1931, Pennsylvania; seventeenth-century literature.

Course Descriptions

Courses for Undergraduates

Upper-division courses are open to all undergraduate students and are intended for general education. The lists of names in the course descriptions for literature courses indicate the kind of material covered, but are neither inclusive nor exclusive of all significant figures covered.

Courses are listed below in numerical order. Courses include studies of historical periods, major authors, literary forms, and a diversity of topics.

Expository writing courses include: ENGL 111, 121, 122, 171, 181, 182, 271, 379, 421.

Creative writing courses include: ENGL 274, 277, 386, 388, 422, 425, 427, 430.

Language study courses include: ENGL 390, 391, 392, 393, 394.

Major authors, special topics, conference, and *seminar courses* include: ENGL 395, 396, 397, 398, 443, 444, 489, 490, 491, 492, 493, 494, 495, 499.

Courses primarily for teaching candidates include: ENGL 441, 442, 443, 444.

Internships in English are offered under ENGL 496. See English advising office for details.

Introductory Courses

ENGL 100 Intermediate ESL for International Students (0) Offered as two separate sections. One section concentrates on reading, vocabulary, and basic writing skills. The other concentrates on listening, note taking, oral summarizing, idioms, pronunciation and intonation. Sections may be taken concurrently. Five hours of student effort recognized for each section. Special $175 fee required for each section. Prerequisite: placement examination.

ENGL 101 High Intermediate ESL for International Students (0) Two sections. One section on improvement of reading comprehension and vocabulary, and organizing and developing ideas in expository prose. The other focuses on listening and speaking, presenting arguments effectively. Sections may be taken concurrently. Five hours of student effort recognized for each section. Special $175 fee required for each section. Prerequisite: placement examination.

ENGL 102 Advanced Reading and Writing for ESL Students (0) Study of word derivation; practice in writing for varied purposes and audiences. Special $175 fee required. Prerequisite: placement examination.

ENGL 103 ESL for EOP Students (5) Improvement of reading comprehension and vocabulary; emphasis on organizing and developing ideas in various modes of expository prose. Prerequisite: placement examination.

ENGL 104-105 Introductory Composition (5-5) AWSp, AWSp Development of writing skills: sentence strategies and paragraph structures. Expository, critical, and persuasive essay techniques based on analysis of selected readings. For Educational Opportunity Program students only, upon recommendation by the Office of Minority Affairs.

ENGL 106 Practical Forms of Writing (5) Sp Instruction in writing essay examinations, reports, reviews, and research papers. For Educational Opportunity Program students only, upon recommendation by the Office of Minority Affairs. Prerequisites: 104 and 105, or special placement.

ENGL 111 Writing About Literature (5) AWSp Interpretive and critical writing, based upon selected works in fiction, drama, and poetry.

ENGL 121 Issues, Topics, and Modes (5) AWSp Argumentative and persuasive writing, based upon reading drawn from a variety of sources—ancient and modern, informative and imaginative literature—arranged by themes, to be announced in advance.

ENGL 122 Issues, Topics, and Modes (5) AWSp Content varies. See quarterly departmental descriptions.

ENGL 170 Sentence Strategies (5) *Schuster* Demonstrates, and gives practice in, combining the fundamental grammatical units that constitute a sentence. Common errors in sentence structure and ways of achieving variety and emphasis in the sentence, qualities found in a mature writing style.

ENGL 171 College Writing (3) AWSp Development of writing skills. Students are encouraged to develop their own resources and to acquire new techniques for more meaningful and effective expression. Related readings in expository prose.

ENGL 181 Expository Writing (5) AWSp Emphasis upon clear, coherent, correct writing. Not recommended for students who have taken 171.

ENGL 182 The Research Paper (5) WSp Includes study of library resources, the analysis of reading materials, and writing preparatory papers as basic to writing a reference or research paper. Open to all undergraduates. Prerequisite: one of 111, 121, 122, 171, 181.

ENGL 197 Interdisciplinary Writing/Humanities (5, max. 15) Expository writing based on material presented in a specified humanities lecture course. Assignments include drafts of papers to be submitted in the linked course, and other pieces of analytical prose. Concurrent registration in the linked course required (see quarterly *Time Schedule* for lectures linked).

ENGL 198 Interdisciplinary Writing/Social Science (5, max. 15) Expository writing based on material presented in a specified social science lecture course. Assignments include drafts of papers to be submitted in the linked course, and other pieces of analytic prose. Concurrent registration in linked course required (see quarterly *Time Schedule* for lectures linked).

ENGL 199 Interdisciplinary Writing/Natural Science (5, max. 15) Expository writing based on material presented in a specific natural science lecture course. Assignments include drafts of papers to be submitted in the linked course, and other pieces of analytical prose. Concurrent registration in the linked course required (see quarterly *Time Schedule* for lectures linked).

Lower-Division Courses

ENGL 200 Reading Literature (5) Techniques and practice in reading and enjoying literature. Examines some of the best works in English and American literature and considers such features of literary meaning as imagery, characterization, narration, and patterning in sound and sense. Emphasis on literature as a source of pleasure and knowledge about human experience.

ENGL 201 Writers and Their Works (5) Introduction to literature from the writer's point of view: a study of selected writers, why they wrote, how they wrote, what relation their literary output has to the lives they actually led, and the various general conditions under which they led them. Most offerings include at least three writers.

ENGL 202 Great Books: The Middle Ages and the Renaissance (5) Introduction to literature from the broadly cultural point of view: the themes, ideas, and issues of a world rather different from ours. A.D. 700 to about 1600.

ENGL 203 Great Books: Early Modern and Contemporary (5) Introduction to literature from the broadly cultural point of view: the themes, ideas, and issues of our time and of the times immediately preceding, about 1600 to the present, although exact boundaries will differ.

ENGL 204 Great Books: World Literature (5) Introduction to literature from various ages, languages, and cultures, Western and non-Western, by writers of major literary and historical significance.

ENGL 205 Method, Imagination, and Inquiry (5) Examines ideas of method and imagination in a variety of texts, in literature, philosophy, and science. Particularly concerned with intellectual backgrounds and methods of inquiry that have shaped modern Western literature.

ENGL 221 Popular Literature (5) Investigations of themes, conventions, and world views of imaginative works having wide audience appeal. Discussion of their place in our shared cultural experience.

ENGL 223 Children's Literature Reconsidered (5) An examination of books that form a part of the imaginative experience of children, as well as a part of a larger literary heritage, viewed in the light of their social, psychological, political, and moral implications.

ENGL 231 Shakespeare (5) Survey of Shakespeare's career as dramatist. Study of representative comedies, tragedies, romances, and history plays.

ENGL 267 Introduction to American Literature (5) Survey of the major writers, modes, and themes in American literature, from the beginnings to the present. Specific readings vary, but often included are: Taylor, Edwards, Franklin, Poe, Hawthorne, Melville, Emerson, Thoreau, Whitman, Dickinson, Twain, James, Eliot, Stevens, O'Neill, Faulkner, Hemingway, Ellison, and Bellow.

ENGL 271 Intermediate Expository Writing (5) Writing papers communicating information and opinion to develop accurate, competent, and effective expression. Recommended: sophomore standing.

ENGL 274 Beginning Verse Writing (5) Intensive study of the ways and means of making a poem. Recommended: sophomore standing.

ENGL 277 Beginning Short Story Writing (5) Introduction to the theory and practice of writing the short story. Recommended: sophomore standing.

Upper-Division Courses

ENGL 300 Critical Reading of Major Texts (5) Intensive examination of one or a few major works of literature. Classroom work to develop skills of careful and critical reading. Book selection varies, but reading consists of major works by important authors and of selected supplementary materials.

ENGL 301 English Literary Culture: To 1750 (5) Ideas, feelings, aspirations, and assumptions found in English literature, with attention to shifts and changes undergone as one period follows the next: from the end of the Middle Ages to the mid-eighteenth century. (301 and 302 may be taken either as a sequence or as separate courses.)

ENGL 302 English Literary Culture: 1750-1914 (5) Ideas, feelings, aspirations, and assumptions found in English literature, with attention to shifts and changes undergone as one period follows the next: from the mid-eighteenth century to the early twentieth. (301 and 302 may be taken either as a sequence or as separate courses.)

ENGL 309 The Bible as Literature (5) Introduction to the development of the religious ideas and institutions of ancient Israel, with selected readings from the Old Testament and New Testament. Emphasis on reading the Bible with literary and historical understanding.

ENGL 310 English Literature: The Middle Ages (5) Literary culture of Middle Ages in England, as seen in selected works from earlier and later periods, ages of *Beowulf* and of Geoffrey Chaucer. Read in translation, except for a few later works, which are read in Middle English.

ENGL 311 Chaucer (5) Chaucer's *Canterbury Tales* and other poetry, with attention to Chaucer's social, historical, and intellectual milieu.

ENGL 313 English Literature: The Age of Queen Elizabeth (5) The "golden age" of English poetry, with poems by Shakespeare, Spenser, Sidney, and others; drama by Marlowe and other early rivals to Shakespeare; prose by Sir Thomas More and the great Elizabethan translators.

ENGL 314 Shakespeare to 1603 (5) Shakespeare's career as dramatist before 1603 (including *Hamlet*). Study of history plays, comedies, and tragedies.

ENGL 315 Shakespeare After 1603 (5) Shakespeare's career as dramatist after 1603. Study of comedies, tragedies, and romances.

ENGL 321 English Literature: The Late Renaissance (5) A period of skepticism for some, faith for others, but intellectual upheaval generally. Poems by John Donne and the "metaphysical" school; poems and plays by Ben Jonson and other late rivals to Shakespeare; prose by Sir Francis Bacon and other writers.

ENGL 322 Milton (5) Milton's early poems and the prose; *Paradise Lost, Paradise Regained,* and *Samson Agonistes,* with attention to the religious, intellectual, and literary contexts.

ENGL 325 English Literature: The Augustan Age (5) Selections from wits and satirists; poems by John Dryden and Alexander Pope; plays by Dryden, William Congreve, and other wits; the great satires of Jonathan Swift, and the first stirring of the novel.

ENGL 326 English Literature: The Age of Samuel Johnson (5) Classic age of English prose. Essays, biography, and criticism by Samuel Johnson, Oliver Goldsmith, and others; comedies by Goldsmith and Richard Brinsley Sheridan; fiction by Henry Fielding and others; poetry by a variety of writers.

ENGL 327 Rise of the English Novel (5) Study of the development of this major and popular modern literary form in the eighteenth century. Readings of the best of the novelists who founded the form, and some minor ones, from Defoe to Fielding, Richardson, and Sterne, early Austen, and the gothic and other writers.

ENGL 328 Rise of American Fiction (5) A literary form in which America has found its distinctively American expression. Selected readings among important novelists from the beginnings until 1900, including Cooper, Hawthorne, Melville, Twain, Chopin, James, and Wharton.

ENGL 330 English Literature: The Romantic Age (5) Literary, intellectual, and historical ferment of the period from the French Revolution to the 1830s. Readings from major authors in different literary forms; discussions of critical and philosophical issues in a time of change.

ENGL 331 Romantic Poetry I (5) Blake, Wordsworth, Coleridge, and their contemporaries.

ENGL 332 Romantic Poetry II (5) Byron, Shelley, Keats, and their contemporaries.

ENGL 333 English Novel: Early and Middle Nineteenth Century (5) Studies in the novel in one of its classic phases. Authors include Austen, the Brontës, Dickens, Thackeray.

ENGL 334 English Novel: Later Nineteenth Century (5) Studies in the novel as it passes from a classic format to formats more experimental. Authors include George Eliot, Thomas Hardy, Joseph Conrad, and others.

ENGL 335 English Literature: The Age of Victoria (5) Literature in an era of revolution that also sought continuity, when culture faced redefinition as mass culture and found in the process new demands and creative energies, new material and forms, and transformations of old ones. Readings range from works of Tennyson, Browning, Arnold, Shaw, to Dickens, Eliot, Hardy.

ENGL 340 The Modern Novel (5) The novel on both sides of the Atlantic in the first half of the twentieth century. Includes such writers as Joyce, Woolf, Lawrence, Stein, Hemingway, Faulkner, and others.

ENGL 341 Modern Poetry (5) Poetry in the modernist mode, including such poets as Yeats, Eliot, Pound, Auden, and Moore.

ENGL 342 English Literature: The Early Modern Period (5) Experiments in fiction and poetry. Novels by Joyce, Woolf, Lawrence, and others; poetry by Eliot and Yeats and others.

ENGL 343 English Literature: Contemporary England (5) Return to more traditional forms in such writers as Bowen, Orwell, Waugh, Cary, Lessing, Drabble.

ENGL 344 Modern Anglo-Irish Literature (5) Principal writers in English of the modern Irish literary movement—Yeats, Joyce, Synge, Gregory, and O'Casey among them—with attention to traditions of Irish culture and history.

ENGL 346 Critical Practice (5) Exercise in interpretive practices; a consideration of their powers and limits. Survey of the varieties of critical and interpretive practice from the earliest interpreters of scripture and myth to present-day critics.

ENGL 347 History of Literary Criticism and Theory I (5) Literary criticism and theory from its beginnings in Plato through the early twentieth century. Philosophical and theoretical grounds for critical practice put forward by philosophers and critics.

ENGL 348 History of Literary Criticism and Theory II (5) Contemporary criticism and theory and its background in the New Criticism, structuralism, and phenomenology.

ENGL 351 American Literature: The Colonial Period (5) Responses to the New World and literary strategies in the literature of the colonies and the early republic. Works by Taylor, Edwards, Franklin, and others.

ENGL 352 American Literature: The Early Nation (5) Conflicting visions of the national destiny and the individual identity in the early years of America's nationhood. Works by Emerson, Thoreau, Hawthorne, Melville, and such other writers as Poe, Cooper, Irving, Whitman, Dickinson, and Douglass.

ENGL 353 American Literature: Later Nineteenth Century (5) Literary responses to an America propelled forward by accelerating and complex forces. Works by Twain, James, and such other writers as Whitman, Dickinson, Adams, Wharton, Howells, Crane, Dreiser, DuBois, and Chopin.

ENGL 354 American Literature: The Early Modern Period (5) Literary responses to the disillusionment after World War I, experiments in form and in new ideas of a new period. Works by such writers as Anderson, Toomer, Cather, O'Neill, Frost, Pound, Eliot, Cummings, Hemingway, Fitzgerald, Faulkner, Stein, Hart Crane, Stevens, and Porter.

ENGL 355 American Literature: Contemporary America (5) Works by such writers as Ellison, Williams, O'Connor, Lowell, Barth, Rich, and Hawkes.

ENGL 356 Classic American Poetry: Beginnings to 1917 (5) Poetry by Taylor, Whitman, Dickinson, and such others as Poe, Bradstreet, Crane, Robinson. The lineage and characteristics of lyric and epic in America.

ENGL 358 The Literature of Black America (5) Selected works by Afro-American writers, with emphasis on twentieth-century literature.

ENGL 359 Contemporary Novel (5) Recent efforts to change the shape and direction of the novel by such writers as Murdoch, Barth, Hawkes, Fowles, and Atwood.

ENGL 361 Contemporary Poetry (5) Recent developments by such poets as Hughes, Heaney, Rich, Kinnell, and Hugo.

ENGL 364 Dramatic Literature: Comedy (5) Studies of the comic mode that celebrates social life in all its variety. Emphasis on the romantic and satiric forms of comedy, or on the historical development of the types of comedy inherited from the Greeks and Romans, or on theories of the comic and the laughable. Emphasis on drama previous to the twentieth century.

ENGL 365 Dramatic Literature: Tragedy (5) Studies of the tragic mode as a universal pattern of experience. Emphasis on drama previous to the twentieth century.

ENGL 366 Twentieth-Century Dramatic Literature (5) Modern and contemporary plays by such writers as Shaw, Synge, O'Casey, O'Neill, Yeats, Eliot, Beckett, Pinter, and Albee.

ENGL 367 Studies in Short Fiction (5) The American and English short story, with attention to the influence of writers of other cultures. Aspects of the short story that distinguish it, in style and purpose, from longer fiction.

ENGL 368 The Art of Prose (5) Techniques and varieties of prose—autobiography, biography, personal essay, reflective and meditative writing, social and scientific inquiry, and persuasive writing. Special attention to use of poetic, fictional, and dramatic devices. Recommended: introductory literature course.

ENGL 369 Fiction and Film (5) Comparative study of technique and meaning in written narratives and films. Short stories and novels selected from American and English literature, and films that employ similar or contrasting techniques in constructing fiction.

ENGL 370 Fantasy (5) Nonnaturalistic literature, selected folktales, fairytales, fables, nonsense, ghost stories, horror stories, science fiction, and/or utopian literature—the supernatural and surreal, the grotesque, the fantastical. Readings and emphasis vary.

ENGL 371 Modern European Literature in Translation (5) Fiction, poetry, and drama from the development of modernism to the present. Works by such writers as Mann, Proust, Kafka, Gide, Hesse, Rilke, Brecht, Sartre, and Camus.

ENGL 372 Modern Jewish Literature in Translation (5) Survey of Jewish experience and its expression during the past hundred years. Typical writers studied are Sholom Aleichem, Peretz, Reisen, Babel, Kafka, I. B. Singer, Wiesel, Grade, Halpern, and Agnon.

ENGL 373 Pacific Northwest Literature (5) Concentrates in alternate years on either prose or poetry of the Pacific Northwest. Prose works examine early exploration, conflicts of native and settlement cultures, various social and economic conflicts. Pacific Northwest poetry includes consideration of its sources, formative influences, and emergence into national prominence.

ENGL 374 Study Abroad Program (5) This course, for students in the Study Abroad program, relates major works of literature to the landscape and activities of its setting.

ENGL 375 Women and the Literary Imagination (5, max. 15) Study of women writers or ways various writers have portrayed woman's image, social role, and psychology.

ENGL 376 Women Writers (5, max. 15) Study of the work of women writers in English and American literature.

ENGL 377 Contemporary American Indian Literature (5) Creative writings—novels, short stories, poems—of contemporary Indian authors; traditions out of which they evolved. Differences between Indian writers and writers of the dominant European/American mainstream. Offered jointly with AIS 377.

ENGL 379 Advanced Expository Writing (5) Concentration on the development of prose style for experienced writers. Recommended: sophomore standing.

ENGL 382 The Novel: Special Studies (5, max. 10) Readings may be English or American and drawn from different periods, or they may concentrate on different types—gothic, experimental, novel of consciousness, realistic novel. Special attention to the novel as a distinct literary form. Specific topic varies from quarter to quarter.

ENGL 383 Poetry: Special Studies (5, max. 10) A poetic tradition or group of poems connected by subject matter or poetic technique. Specific topics vary, but might include poetry as a geography of mind, the development of the love lyric, the comic poem.

ENGL 384 Dramatic Literature: Special Studies (5, max. 10) Study of a particular dramatic tradition (such as expressionism or the absurd theatre) or character (the clown) or technique (play-within-a-play, the neoclassical three unities). Topics vary.

ENGL 388 Intermediate Seminar: Verse Writing (5, max. 10) Intensive study of the ways and means of making a poem. Further development of fundamental skills. Emphasis on revision. Recommended: 274.

ENGL 388 Intermediate Seminar: Short Story Writing (5) Exploring and developing continuity in the elements of fiction writing. Methods of extending and sustaining plot, setting, character, point of view, and tone. Recommended: 277.

ENGL 390 English Language Study (5) Wide-range introduction to the study of written and spoken English. The nature of language; ways of describing language; the use of language study as an approach to English literature and the teaching of English.

ENGL 391 English Syntax (5) Description of sentence, phrase, and word structures in present-day English. Recommended: 390.

ENGL 392 Language Variation in Current English (5) Examination of geographical, social, and occupational varieties of American English. Relationship between societal attitudes and language use.

ENGL 393 History of the English Language (5) Evolution of English sounds, forms, structures, and word meanings from Anglo-Saxon times to the present. Recommended: 390.

ENGL 394 The Language of Literature (5) Roles of explicitly describable language features in the understanding and appreciation of various verbal forms. Emphasis on literature, but attention also may be given to nonliterary prose and oral forms.

ENGL 395 American Writers: Studies in Major Authors (5, max. 15) Concentration on one writer or a special group of American writers.

ENGL 396 British Writers: Studies in Major Authors (5, max. 15) Concentration on one writer or a special group of British writers.

ENGL 397 Topics in American Literature (5, max. 15) Exploration of a theme or special topic in American literary expression.

ENGL 398 Topics in British Literature (5, max. 15) Themes and topics of special meaning to British literature.

ENGL 407 Literary Modernism (5) Various modern authors, from Wordsworth to the present, in relation to such major thinkers as Kant, Hegel, Darwin, Marx, Nietzsche, Bergson, and Wittgenstein, who have helped create the context and the content of modern literature. Recommended: 302 or other 300-level course in nineteenth- or twentieth-century literature.

ENGL 408 Literature and the Other Arts and Disciplines (5, max. 10) Relationships between literature and other arts, such as painting, photography, architecture, and music, or between literature and other disciplines, such as science. Content varies.

ENGL 413 Arthurian Legends (5) Medieval romance in its cultural and historical setting, with concentration on the evolution of Arthurian romance. (Offered alternate years.)

ENGL 414 The Popular Ballad (5) The origin, development, and transmission of both texts and tunes of English and Scottish folk ballads in Great Britain and North America. (Offered alternate years.)

ENGL 415 Introduction to the Folktale Among Literate Peoples (3) Techniques of classification, geographic-historical distribution, theories of origin and interpretations, and related areas of investigation of the oral prose folk narrative of literate peoples.

ENGL 416 Introduction to American Folklore (5) Study of different kinds of folklore inherited from America's past and to be found in America today.

ENGL 417 Utopias and Social Ideals (5) Reading of major works in the Utopian tradition of English and American literature (e.g., More, *Utopia;* Bellamy, *Looking Backward;* Mill, *On Liberty;* Huxley, *Brave New World).*

ENGL 421 Special Studies in Expository Writing (5) Individual projects in various types of nonfictional prose, such as biographical sketches, informational reports, literary reviews, and essays. Recommended: sophomore standing.

ENGL 422 Advanced Seminar: Verse Writing (5, max. 15) Intensive study of ways and means of making a poem. Recommended: 386.

ENGL 425 Advanced Seminar: Short Story Writing (5, max 10) Experience with the theory and practice of writing the short story. Recommended: 388.

ENGL 427 Seminar: Novel Writing (5, max. 15) Experience in planning, writing, and revising a work of long fiction, whether from the outset, in progress, or in already completed draft.

ENGL 430 Seminar: Playwriting (5, max.10) Experience in planning, writing, and revising a play, whether from the outset, in progress, or in already completed draft.

ENGL 441 The Composition Process (5) Consideration of psychological and formal elements basic to writing and related forms of nonverbal expression and the critical principles that apply to evaluation.

ENGL 442 Language Learning (5) Consideration of how an individual achieves psychological and esthetic grasp of reality through language; relates language development to reading skills, literary interpretation, grammar acquisition, oral fluency, discursive and imaginative writing.

ENGL 443 Current Developments in English Studies: Conference (5)

ENGL 444 Special Topics in English for Teachers (3-5, max. 10)

ENGL 450 Literature of Developing Countries (5) Readings of major novelists from selected areas of the developing world with emphasis on impact of technological change of traditional cultures. Offered jointly with HSS 450.

ENGL 489 Special Studies in Literature (3 or 5, max. 10) Themes and topics offering special approaches to literature.

ENGL 490, 491 Major Conference (3,3) Individual study by arrangement with instructor. Prerequisite: permission of undergraduate chairperson.

ENGL 492 Major Conference for Honors (5) Individual study (reading, papers) by arrangement with the instructor. Required of, and limited to, honors seniors in English.

ENGL 493, 494 Advanced Writing Conference (3-5,3-5) Tutorial arranged by prior mutual agreement between individual student and instructor. Revision of manuscripts is emphasized, but new work may also be undertaken. Prerequisite: permission of director of creative writing.

ENGL 495 Major Conference for Honors in Creative Writing (5) Special projects available to honors students in creative writing. Required of, and limited to, honors students in creative writing.

ENGL 498 Internship (1-6, max. 12) Supervised experience in local businesses and other agencies. Open only to upper-division English majors. Offered on credit/no credit basis only. Prerequisite: 25 credits in English.

ENGL 499 Honors Seminar (5, max. 10) Seminar study of themes and topics offering special approaches to literature. Required of, and limited to, honors students.

Courses for Graduates Only

ENGL 500 Reading Medieval Literature (5) Special problems involved in the study and interpretation of medieval texts, selected examples drawn from the beginnings of English literature to 1500.

ENGL 501 The Renaissance and Literary Tradition (5) Examination of selected texts from 1500 to 1750, concentrating on specific problems of interpretation and scholarship characteristic of the study of works written before 1750.

ENGL 502 Backgrounds of Modern Literature (5) Intensive study of selected issues in modern literature, concentrating on a few influential English and American texts written after 1750.

ENGL 504 Approaches to Teaching Composition (5) Readings in composition theory and discussion of practical classroom applications. Prerequisite: previous experience or concurrent assignment in teaching writing.

ENGL 505 Graduate English Studies (5)

ENGL 506 Studies in Literary Genres (5, max. 15)

ENGL 507, 508, 509 Literary Criticism (5,5,5)

ENGL 510, 511, 512 The Renaissance and Spenser (5,5,5)

ENGL 513 Shakespeare's Dramatic Contemporaries (5)

ENGL 515, 516 Chaucer (5,5)

ENGL 517, 518, 519 Shakespeare (5,5,5)

ENGL 521, 522, 523 Seventeenth-Century Literature (5,5,5)

ENGL 524, 525, 526 American Literature (5, max. 10; 5, max. 10; 5, max. 10)

ENGL 527, 528 Studies in Medieval Literature (5,5)

ENGL 530 The English Language (5)

ENGL 531 Introductory Reading in Old English (5)

ENGL 532 Advanced Reading in Old English (5)

ENGL 533 Foundations of American English (5)

ENGL 534 American English Dialectology (5)

ENGL 535 Comparative Grammars (5) Prerequisite: teaching experience.

ENGL 538, 539, 540 Early Nineteenth-Century Literature (5,5,5)

ENGL 541, 542, 543 Victorian Literature (5, max. 10; 5, max. 10; 5, max. 10)

ENGL 544, 545, 546 Eighteenth-Century Literature (5,5,5)

ENGL 547 Rhetoric (5)

ENGL 548, 549, 550 Twentieth-Century Literature (5,5,5)

ENGL 553 Current Rhetorical Theory (5) Prerequisite: teaching experience.

ENGL 555 Colloquium in Teaching English as a Second Language (5, max. 10) Prerequisite: LING 445 or permission of instructor.

ENGL 556 Methods and Materials for Teaching English as a Second Language (5) Prerequisite: LING 445 or permission of instructor.

ENGL 557 Research Methods in Second-Language Acquisition (5) Prerequisite: 556, LING 449, or permission of instructor.

ENGL 558 Testing and Evaluation in English as a Second Language (5) Evaluation and testing of English language proficiency, including testing theory, types of tests, and teacher-prepared classroom tests. Prerequisites: 555 and 556 or permission of instructor.

ENGL 560 Practicum in Teaching English as a Second Language (3) Discussion and practice of second-language teaching techniques. Three hours per week teaching required in addition to regular class meetings. Prerequisite: 555 or permission of instructor.

ENGL 580 Critical Approaches to Literary Texts (5)

ENGL 581 Textual Criticism (5) Introduction to paleography, codicology, analytical and descriptive bibliography; examination of the major contributions to textual theory in the nineteenth and twentieth centuries; practice in applying textual theory in editing literary works. Recommended: 505.

ENGL 584 Advanced Fiction Workshop (5, max. 10) Prerequisite: graduate standing.

ENGL 585 Advanced Poetry Workshop (5, max. 10) Prerequisite: graduate standing.

ENGL 586 Graduate Writing Conference (5)

ENGL 590-591 Master's Essay (5-6, max. 11) Two-quarter research and writing project under the close supervision of a faculty member expert in that field of study. Work is independent and varies; one quarter of the project used for background reading and research and the other quarter for presentation of an original thesis in written form.

ENGL 599 Special Studies in English (5, max. 15)

ENGL 600 Independent Study or Research (*)

ENGL 601 Internship (3-9, max. 9)

ENGL 700 Master's Thesis (*)

ENGL 800 Doctoral Dissertation (*)

Environmental Studies

201 Engineering Annex

The Institute for Environmental Studies is an interdisciplinary educational unit that offers students an opportunity to broaden their understanding of the complexity of many of today's environmental issues and concerns.

The institute's main undergraduate introductory offering is a series of three core courses. The first two discuss the contributions of the natural and social sciences to an understanding of environmental issues, and the third is a laboratory and field course. At more advanced undergraduate levels, the institute offers a small number of courses aimed at integrating humanistic and scientific inquiry and exploring the framework of environmental law.

Undergraduate Program

Environmental Studies is one of several interdisciplinary programs whose degrees are granted through General Studies. A student must be admitted two years prior to graduation and must design an integrated program approved by faculty advisers. An internship or research project and a senior thesis are required. A complete list of requirements appears in the institute's brochure, *Undergraduate Program in Environmental Studies*. Either a Bachelor of Arts degree or a Bachelor of Science degree may be earned. Since most environmentally related careers require a thorough grounding in a traditional discipline, the institute encourages students to consider a double major. This choice may necessitate up to an extra year of study beyond the normal time required for a baccalaureate degree. Additional information is available from the institute's undergraduate adviser.

Faculty

Professors

Charlson, Robert J.,* (Civil Engineering, Geophysics), Ph.D., 1964, Washington; air resources, geochemical cycles, environmental chemistry.

Morrill, Richard L.,* (Geography),† Ph.D., 1959, Washington; spatial organization, migration, diffusion and population, regional planning and development, inequality.

Orians, Gordon H.,* (Zoology), Ph.D., 1960, California (Berkeley); ecology and ethology.

Associate Professors

Boersma, P. Dee,* (Zoology), Ph.D., 1974, Ohio State; population ecology.

Cormick, Gerald W. (Research), Ph.D., 1971, Michigan; conflict studies and dispute settlement.

Lee, Kai N.,* (Political Science),† Ph.D., 1971, Princeton; American government, politics and public policy.

Zaret, Thomas M.*‡ (Research), (Zoology), Ph.D., 1971, Yale; ecology and evolutionary biology.

Assistant Professors

Eaton, David L., (Environmental Health),† Ph.D., 1978, Kansas; environmental health.

Swierzbinski, Joseph E.,* (Economics),† Ph.D., 1981, Harvard; resource economics.

Course Descriptions

Courses for Undergraduates

ENV S 101 Introduction to Environmental Studies (5) ASp Natural history and human modifications of the natural world. Evolutionary biology, physical geography, toxicology, energy, economics, law, public policy.

ENV S 204 Natural Sciences and the Environment (5) A *Boersma* Climate, water, soil, geological processes, natural selection, and dynamics of plant and animal populations and the communities they form. For students wishing to obtain a broad picture of basic processes of ecosystems and their implications for human manipulations of environments. Not recommended for students who have had more than 15 credits of natural sciences.

ENV S 205 Social Sciences and the Environment (5) W *Swierzbinski, Wise* Insights and approaches to environmental decision making from the standpoints of psychology, economics, and other social sciences.

ENV S 208 Laboratory in Ecosystem Processes (3) Sp *Boersma* Laboratory and field exercises on the role of climate, soils, geological processes, and animal and plant population dynamics on the structure and functioning of ecosystems. Field trips to natural and human-modified ecosystems; weekend field trips required. Prerequisite: 204.

ENV S 301 Energy and Society (5) W *Lee* Energy use in industrial societies. Interaction of social choice and technological change in energy technology, energy-consuming technology, and practices of energy use. Social and individual choice in light in current use trends and models of human behavior from economics, psychology, and political science.

ENV S 305 Toxic Chemicals in the Environment (3) W Basic principles governing the behavior and effects of toxic chemicals released into the environment; sources, distribution, and fate of toxic chemicals in the environment; chemicals and cancer; chemicals and birth defects; ecological effects of chemicals; government regulation of chemical hazards. Offered jointly with ENVH 305. Prerequisites: BIOL 101-102 and CHEM 102, or equivalent.

ENV S 352 Environmental Assessment (5) History of concepts, methods, and practice of environmental assessments. Emphasis on integrating environmental assessment into planning processes. Prerequisite: 204, 205, 206, or permission of instructor.

ENV S 361 Environmental Values and Perceptions (5) Sp How individual and cultural values affect our perception of, and relation to, the environment. Explores role of individual characteristics in perceptual acuity and value formation, conflicting values within and between societies, impingement of these conflicts on environmental problems, and possible methods of resolution with emphasis on American environmental experience. Prerequisite: 206 or equivalent.

ENV S 408 Geochemical Cycles (4) Sp *Charlson* Descriptive and quantitative aspects of the earth as a biogeochemical system. Fundamental methods for study of equilibria, transport processes, chemical kinetics and biological processes and their application to the carbon, sulfur, nitrogen, phosphorus, and other elemental cycles. Emphasis on stability of biogeochemical systems and the nature of human perturbations of their dynamics. Offered jointly with GPHYS 408. Prerequisites: CHEM 150, 350, MATH 238.

ENV S 425 Ecology of Population and Food Production (5) *Boersma* Human population growth and food production from an international perspective, in relation to climate and climatic change, development of new crop strains, cost and availability of supplemental energy sources, ecosystem functioning, and quality of human life. For students with background in one of the following areas: food, population, or policy. Prerequisite: 204 or permission of instructor.

ENV S 441 Economics of Environmental Management (3) Sp *Swierzbinski* Alternative economic policies for managing man's use of the environment. Economics of pollution and residual control, recreation, common pool resources, conservation of renewable and nonrenewable resources. Prerequisite: ECON 201 or permission of instructor.

ENV S 453 Practicum in Environmental Assessment (3-5) Preparation of model environmental impact assessment. Students form multidisiplinary teams to study in depth environmental problems and develop courses of action. Prerequisites: 352 or impact assessment course in another department, and permission of instructor.

ENV S 481 Environmental Law (5) W Legislative, administrative, and common law dealing with the environment. Introduces the student to the fundamental concepts and classic issues underlying the body of law and policy dealing with the environment. Includes air and water quality, noise, energy policy and management, and land use. For nonlaw students. Prerequisite: permission of instructor.

ENV S 482 Special Topics in Environmental Law (3-5) Sp Examination of current environmental law issues. Topics to be announced. Prerequisite: 481.

ENV S 498 Special Topics in Environmental Studies (1-5, max. 10) Lecture; seminar, and/or team study of topics varying from quarter to quarter. Prerequisite: permission of instructor.

ENV S 499 Undergraduate Research (*, max. 20) Individual or team research of selected environmental topics. Prerequisite: permission of instructor.

Courses for Graduates Only

ENV S 515 Environmental and Occupational Toxicology (4) Sp *Eaton* Principles of toxicology, with emphasis on the biological fate and mechanisms of toxic action of chemicals encountered in the workplace and general environment. Offered jointly with ENVH 515. Prerequisites: organic chemistry, introductory physiology and biochemistry, or permission of instructor.

ENV S 520 Seminar in Environmental Studies (1-3, max. 12) Study and research in advanced topics of environmental studies, with focus on unpublished areas of research; conducted by visiting professors and institute or department faculty. Prerequisite: permission of instructor.

ENV S 530 Science and Environmental Policy (4) W *Lee* Role of science and scientists in formulating public policy related to the environment. Conceptualizes policy processes as a means of understanding opportunities for, and limits of, science in development and implementation of public policy. Prerequisites: concurrent registration in 531 and ECON 435 or equivalent.

ENV S 531 Science and Environmental Policy: Case Histories (3) W Examples of the use of scientific analysis in the development of environmental policies. Prerequisite: concurrent registration in 530.

ENV S 532 Internship Seminar (1) AWSp *Lee* Preparation for an analytical paper concerning the role of science in decision making. Focuses on the agency or firm in which the student served as an intern. Prerequisites: 530, 531.

ENV S 577 Risk Assessment for Environmental Health Hazards (3) A *Omenn* Context, methodologies, types of data, uncertainties and institutional arrangements for risk assessment. Both qualitative and quantitative approaches to the identification, characterization, and control of environmental hazards to health emphasized through didactic and case studies. Offered jointly with ENVH 577, CEWA 577, and PB AF 577. Prerequisites: either 305 or 515 and BIOST 511, EPI 511, or permission of instructor.

ENV S 599 Special Topics in Environmental Studies (*) Research-level lectures, seminars, or discussions of topics of current interest in the area of environmental studies. Subject matter varies from quarter to quarter. Prerequisites: permission of the instructor and institute director.

General and Interdisciplinary Studies

Course numbers under this heading are reserved by the Division of General and Interdisciplinary Studies for curricular innovations. Descriptions of GIS course offerings are available during preregistration and in-person registration.

General Studies

B10 Padelford

General Studies provides students with an opportunity to obtain an interdisciplinary degree. Students may pursue an individually designed "atypical major" or one of several organized interdisciplinary programs.

Undergraduate Program

Bachelor of Arts, Bachelor of Science Degrees

Admission Requirements: A written statement describing the proposed major and a list of 50 to 70 credits specifically related to the proposal. Approval of two faculty sponsors and a General Studies adviser.

Major Requirements: Completion of the approved curriculum and a 5-credit required senior study. Awarding of the Bachelor of Arts or Bachelor of Science degree depends on the content of each student's program.

Course Descriptions

Courses for Undergraduates

G ST 350 Independent Fieldwork (1-6, max. 18) Off-campus independent fieldwork in community agencies, apprenticeships, internships, as approved for College of Arts and Sciences credit. Faculty sponsor is required. Prerequisite: permission of faculty sponsor and General Studies adviser.

G ST 391 Supervised Study in Selected Fields (*, max. 15) AWSpS Special supervised study in a field represented in the College of Arts and Sciences. Prerequisites: permission of supervisor of study and General Studies adviser.

G ST 493 Senior Study (5) AWSpS For General Studies majors only. Prerequisites: permission of supervisor of study and General Studies adviser.

Genetics

J205 Health Sciences

An undergraduate degree is not offered. Students who desire an undergraduate curriculum emphasizing subject matter in genetics are advised to refer to the Cell and Molecular Biology listing under Biology.

Graduate Program

Breck E. Byers, Graduate Program Coordinator

The Department of Genetics offers graduate programs leading to the degrees of Master of Science and Doctor of Philosophy. A student may choose among a wide variety of research areas, while, at the same time, receiving a broad training in genetics. New graduate students join a research project in one of the faculty laboratories during each of the three quarters in residence. New students thereby become acquainted with several different experimental approaches in research in genetics, and the projects help them choose an adviser for their thesis work at the end of the first year. In addition to graduate courses offered by the Department of Genetics, students can choose among a large number of courses in related departments to broaden their perspective. Graduate students also participate in undergraduate teaching after gaining expertise in pertinent areas. A General Examination is taken at the end of the second year to gain formal admittance to candidacy for the Ph.D. degree.

Applications for graduate work are invited from students who have emphasized biology, the physical sciences, or mathematics in their undergraduate careers. Applicants are asked to submit Graduate Record Examination scores and three letters of recommendation.

Financial Aid

The Department of Genetics offers financial support to promising students who wish to work toward the Ph.D. degree.

Research Facilities

The department is housed in a modern, well-equipped building shared with the Department of Biochemistry. Students benefit from interdisciplinary research and teaching programs in collaboration with departments having related interests.

Correspondence and Information

Graduate Program Coordinator
J205 Biochemistry-Genetics, SK-50

Faculty

Chairperson

Benjamin D. Hall

Professors

Bendich, Arnold J.,*‡ (Botany), Ph.D., 1969, Washington; nucleic acids as evolutionary indicators, DNA sequence organizations in plants, plant cancers.

Byers, Breck E.,* (Biochemistry), Ph.D., 1967, Harvard; cell biology: mitosis and meiosis, mechanisms of nuclear division and crossing-over in yeast.

Champoux, James J.,*‡ (Microbiology and Immunology), Ph.D., 1970, Stanford; DNA replication, tumor biology.

Doermann, August H.,* Ph.D., 1946, Stanford; genetics control of capsid morphogenesis in bacteriophage.

Fangman, Walton L.,* Ph.D., 1965, Purdue; molecular genetics: control of replication of yeast chromosomes and extra chromosomal elements.

Felsenstein, Joseph,* (Statistics), Ph.D., 1968, Chicago; theoretical population genetics, models of long-term evolutionary processes and estimation of evolutionary trees.

Gallant, Jonathan A.,* Ph.D., 1961, Johns Hopkins; molecular genetics, control mechanisms in bacteria; accuracy of translation.

Gartler, Stanley M.,* Ph.D., 1952, California (Berkeley); mammalian somatic cell genetics with emphasis on the mechanism of X-chromosome inactivation.

Hall, Benjamin D.,* (Biochemistry), Ph.D., 1958, Harvard; molecular genetics, analysis of eukaryotic gene structure in relation to function, gene expression in yeast.

Hartwell, Leland H.,* Ph.D., 1964, Massachusetts Institute of Technology; genetic analysis of chromosome transmission and of the control of division by hormones in yeast.

Hawthorne, Donald C. (Emeritus), Ph.D., 1955, Washington; yeast genetics, chromosome mapping, supersuppressors.

Laird, Charles D.,‡ (Zoology), Ph.D., 1966, Stanford; cell and developmental biology.

Martin, George M.,*‡ (Pathology), M.D., 1953, Washington; pathology.

Motulsky, Arno G.,* M.D., 1947, Illinois; clinical population genetics and human biochemical genetics, delineation and mechanisms of disease susceptibility, pharmacogenetics.

Pious, Donald A.,‡ (Pediatrics), M.D., 1956, Pennsylvania; pediatrics.

Roman, Herschel L. (Emeritus), Ph.D., 1942, Missouri; yeast genetics, factors affecting genetic recombination.

Sandler, Laurence M.,* Ph.D., 1956, Missouri; chromosome behavior in *Drosophila*: examination of meiosis through analysis of mutations resulting in abnormal recombination and/or disjunction in the meiotic divisions; the biological function of heterochromatin.

Stadler, David R.,* Ph.D., 1952, Princeton; mutation and genetic repair in *Neurospora*.

Young, Elton T.,*‡ (Biochemistry), Ph.D., 1967, California Institute of Technology; biochemistry.

Associate Professors

Furlong, Clement E.* (Research), Ph.D., 1968, California (Davis); human biochemical genetics and biochemistry of membrane transport systems.

Schubiger, Gerold A.,*‡ (Zoology), Ph.D., 1967, Zurich; developmental biology of insects, embryonic determination in *Drosophila*, regeneration, transdetermination.

Sibley, Carol H.,* Ph.D., 1974, California (San Francisco); mammalian cell genetics: function, structure, and regulation of cell membrane receptors in differentiation of normal cells and their tumor counterparts.

Assistant Professor

Garber, Richard L., Ph.D., 1977, Yale; developmental genetics, molecular analysis of *Drosophila* homeotic genes.

Course Descriptions

Courses for Undergraduates

GENET 351 Human Genetics: The Individual and Society (3) WSp *Stadler* Principles of Mendelism inheritance as illustrated by human traits and diseases; chromosomes and sex determination; distribution of genes in populations; natural selection and evolution; counseling and genetic engineering. Appropriate for nonscience majors.

GENET 451 Genetics (5) AWSpS General course recommended for majors in the biological sciences and for those other students who are interested in the role of genetics in modern biology. Prerequisite: 10 credits in the biological or physical sciences or mathematics.

GENET 453 Genetics of the Evolutionary Process (3) W *Felsenstein, Sandler* Contributions of genetics to the understanding of evolution. Processes of mutation, selection, and random genetic events as they affect the genetic architecture of natural populations and the process of speciation. Emphasis on experimental data and observation, rather than mathematical theory. Prerequisite: 451.

GENET 455 Molecular Genetics (3) Sp *Fangman* The structure of genes and molecular mechanisms of gene expression. First part of the course draws upon information obtained with viruses and bacterial cells and serves as background for a study of eukaryotic cells in the second part. Prerequisites: 451, CHEM 232, or permission of instructor.

GENET 456 Genetic Mutation (3) W *Stadler* Measurement of mutation rates and dose-response relationships; analysis of mutational lesions; molecular mechanisms of mutation and DNA repair; mutation method for measurement of genetic size; hazard of environmental mutagens. Prerequisite: 451 or equivalent. (Offered alternate years.)

GENET 457 The Genetic Analysis of Complex Biological Systems (3) Formal genetic analysis designed to follow 451. Considers, primarily in mammals (including humans) and *Drosophila*, the elucidation of three complex biological systems—cell division, embryological development, and some aspect of behavior—by the discovery and analysis of mutations that cause these systems to function abnormally. Prerequisite: 451.

GENET 461 Genetics Laboratory (3) *Hartwell* An unsolved problem in microbial genetics is investigated collaboratively by the whole laboratory section. Prerequisites: 451, which may be taken concurrently, and permission of instructor. (Offered alternate years.)

GENET 463 Statistics for Genetics Research (3) W *Felsenstein* Statistical theory and applied statistics oriented toward applications in genetics. Discrete and continuous distributions, means, variances, transformation of variables, theory of estimation, hypothesis testing, tests on small samples, regression and correlation, analysis of variance. Prerequisites: graduate standing and permission of instructor. (Offered alternate years.)

GENET 499 Undergraduate Research (*) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

GENET 501 Introduction to Research Materials (3, max. 9) AWSp The student is assigned to one of the several research areas of the department to work with a research group for a quarter at a time. Prerequisite: graduate standing in the Department of Genetics or permission of graduate program coordinator.

GENET 520 Seminar (1, max. 15) AWSpS Prerequisite: permission of graduate program coordinator.

GENET 531 Human Genetics (3) A *Gartler, Motulsky, Stamatoyanopoulos* General course in human genetics for graduate students. Areas covered: pedigree analysis, cytogenetics, biochemical genetics, and population genetics. Prerequisites: 451, BIOC 440, or equivalent. (Offered alternate years; offered Autumn Quarter 1985.)

GENET 551 Mutation and Recombination (3) First course in a three-quarter sequence in molecular and microbial genetics: mutation rates; recombination analysis in phage, bacteria, and fungi; mechanism of recombination.

GENET 552, 553 Structure and Function of Genetic Material I, II (3,3) Chromosome structure and DNA replication; formal genetics of gene expression; physical analysis of DNA; gene expression in relation to DNA structure. Prerequisite: 551 or permission of instructor.

GENET 554 Topics in Genetics (2, max. 6) AWSp Current problems and research methods. Prerequisite: permission of instructor.

GENET 560 Chromosomal Behavior (3) W *Sandler* Properties of meiotic chromosomes with special emphasis on recombination and segregation. Prerequisite: permission of instructor. (Offered alternate years; offered Winter Quarter 1986.)

GENET 561 Cytogenetics (3) S *Roman* Discussion of cytological investigations of normal and aberrant chromosomal behavior, with particular reference to the structure of the chromosome and its response to mutagenic agents. Prerequisite: permission of instructor. (Offered alternate years.)

GENET 562 Population Genetics (3) A *Felsenstein* Mathematical and experimental approaches to the genetics of natural populations, especially as they relate to evolution. Emphasis on theoretical population genetics. Prerequisite: permission of instructor.

GENET 564 Molecular Cytogenetics (3) W *Byers* Cellular processes of gene transfer in mitosis, meiosis, and gametogenesis, with emphasis on ultrastructure and macromolecular mechanisms. Prerequisite: permission of instructor. (Offered alternate years; offered Winter Quarter 1985.)

GENET 571 Immunogenetics (3) Sp Genetic approaches to the biology of cells of the immune system. Using the immune system as a model system, genetic, developmental and biochemical concepts and techniques are examined as they apply to eukaryotic cells. Cell-cell interactions, histocompatibility, host resistance to infectious disease, and evolution of the immune system. (Offered alternate years; offered Spring Quarter 1985.)

GENET 575 Mammalian Developmental Genetics (3) *Sibley* Explores the genetic control of early mammalian development, emphasizing systems in which both cellular and molecular approaches have made significant contributions to understanding. Prerequisite: permission of instructor. (Offered alternate years; offered Spring Quarter 1985.)

GENET 584 Genetic and Biochemical Analysis by Electron Microscopy (1-5) *Byers* Practical application of electron microscopic methods for determining cellular and macromolecular structure, with emphasis on genetic systems. Prerequisite: permission of instructor.

GENET 590 Population Genetics Seminar (1) AWSp *Felsenstein* Weekly presentation by participants of current literature and ongoing research in evolutionary genetics of natural populations, human population genetics, and quantitative genetics applied to animal and plant breeding. May be repeated for credit. Prerequisite: 562 or permission of instructor.

GENET 600 Independent Study or Research (*) AWSpS

GENET 700 Master's Thesis (*) AWSpS

GENET 800 Doctoral Dissertation (*)

Geography

408A Smith

Geography is a small but lively discipline providing a distinctive spatial approach to many of today's societal problems and issues: regional economic inequality, residential and educational segregation, health-care delivery, urban growth management, efficient transportation system, environmental and pollution problems, economic impacts of natural catastrophes or of major investments or technological changes, appropriate utilization of water and energy resources, spatial efficiency of industrial production, the activities of international corporations, and many more. Geography may be defined as the study of how individuals, groups, and societies use and organize their territorial space. One of its major concerns is the relation between the physical environment and human activities (e.g., between climate, energy demands, and energy resource supplies). Geography also seeks to understand the complex processes that result in observed patterns of settlement, location of economic activities, patterns of development, and the linkages and direction of trade and communication.

Individual undergraduate and graduate programs are built around seven related "tracks" or research specialties:

1. *Social geography: population and welfare.* Human population distribution, settlement, and migration. Patterns of ethnicity and race, well-being, health, and disease.

2. *Urban geography/urban studies.* Systems of cities and the internal structure of cities: housing, neighborhoods, transportation, services, health care.

3. *Regional development and industrial geography.* Regional economic development, regional analysis, industrial location, corporate spatial behavior.

4. *Trade and transportation.* Domestic and international trade; market area analysis; land, air, and water transportation networks and systems.

5. *Environment and natural resource management.* Human-environment interaction, natural hazards, water and energy resource management, land use and land-use conflict, environmental sources of disease.

6. *Cartography/computer graphics.* Role, design, and reproduction of conventional and computer mapping.

7. *Regional studies and international relations.* Focus on Japan, China, USSR, Europe, North America.

Special Research and Teaching Facilities

The University library maintains separately the Edward L. Ullman Geography Library, with subscriptions to five hundred periodicals and an extensive collection of atlases. Departmental facilities include a spatial analysis laboratory containing several interactive graphics terminals, several microcomputer systems, digitizers, a plotter, and an optical scanner, which are used independently as well as being tied into the University's CDC CYBER 170/750 main research computer and a VAX 11/780 computer, which is devoted to instructional use. Located in the department are also a fully equipped cartography laboratory, two darkrooms, and extensive cartographic equipment.

Undergraduate Program

Bachelor of Arts Degree

MAJOR REQUIREMENTS AND TRACKS

Core requirements: GEOG 258 or 360; 326 or 426; three from 100 (or 202), 200, 205, 207, 277; one 300-level systematic and one 300-level regional; two 400-level systematic and one 400-level regional; maintenance of a 2.50 grade-point average within geography.

Students choose one of two options. Both require the core courses mentioned above. Core courses count toward the number of geography credits required for each option.

1. General geography. 70 credits in geography, including a broad range of systematic, regional, and technical courses.

2. The more specialized tracks (see above) require 50 credits in geography and 30 in closely related fields.

Graduate Program

George H. Kakiuchi, Graduate Program Coordinator

The Department of Geography has flexible programs of graduate study leading to the Master of Arts and Doctor of Philosophy degrees.

The prospective aspirant for the M.A. degree (minimum of 36 credits, of which 18 must be in courses at the 500 level or above, including 9 credits of thesis) is expected to complete all work for the degree in four to six quarters. The prospective aspirant for the Ph.D. degree is expected to undertake two years of post-master's study and must take a departmental diagnostic examination upon entry, pass the General Examination, normally demonstrate reading knowledge of one foreign language, and successfully complete a dissertation. Normally, Ph.D. program students complete all degree requirements in three to four years.

Admission Requirements

Admission to the graduate program normally requires a minimum grade-point average of 3.00 (on a 4.00 scale), or B, during the junior and senior years. Students holding a master's degree must meet this minimum scholastic requirement, but also should have achieved a grade-point average higher than 3.00 for graduate studies completed. North American applicants must take the Graduate Record Examination. Specific information regarding application procedures may be obtained by writing to the graduate program adviser.

Financial Aid

The department usually awards approximately thirteen teaching assistantships for the academic year. Most of the assistantships are for teaching quiz sections for a larger lecture class. A few of the more-advanced doctoral candidates may teach a class. Normally, several research assistantships are available.

Correspondence and Information

Graduate Program Coordinator
408A Smith, DP-10

Faculty

Chairperson

Morgan D. Thomas

Professors

Beyers, William B.,* (Landscape Architecture), Ph.D., 1967, Washington; regional science, economic geography, location theory, regional analysis, environment of the Pacific Northwest.

Fleming, Douglas K.,* (Marine Studies), Ph.D., 1965, Washington; transportation geography (especially ocean and air), regional organization of western Europe.

Hudson, G. Donald (Emeritus), Ph.D., 1934, Chicago.

Jackson, W. A. Douglas,* (International Studies),† Ph.D., 1953, Maryland; political systems, nature and culture, Soviet Union, Canada.

Krumme, Gunter,* Ph.D., 1966, Washington; economic geography, regional economics, location theory, organization and decision theory, European regional development and planning.

Marts, Marion E.,* Ph.D., 1950, Northwestern; water resources, conservation, resource policy.

Morrill, Richard L.,* (Environmental Studies),† Ph.D., 1959, Washington; spatial organization, migration, diffusion and population, regional planning and development, inequality.

Sherman, John C.,* Ph.D., 1947, Washington; cartography, graphics communication, remote sensing.

Thomas, Morgan D.,* (Nursing), Ph.D., 1954, Queen's (Belfast); regional economics, regional planning and development, technical innovation.

Velikonja, Joseph,* Ph.D., 1948, Rome (Italy); social and political geography, international migration, immigrants in America, eastern Europe.

Associate Professors

Chang, Kuei-sheng,* (International Studies),† Ph.D., 1955, Michigan; economic geography of China, historical geography of exploration, Third World development.

Hodge, David C.,* Ph.D., 1975, Pennsylvania State; urban social and political geography, mass transportation, spatial equity, research methods.

Kakiuchi, George H.,* (International Studies),† Ph.D., 1957, Michigan; Japan, agriculture, internal migration, regional geography.

Mayer, Jonathan D.,* (Family Medicine), Ph.D., 1977, Michigan; urban geography (including historical), transportation, medical geography, geographic philosophy and methods.

ZumBrunnen, Craig,* (International Studies),† Ph.D., 1973, California (Berkeley); natural resource management and conservation, environmental quality, methods of resource analysis, physical, Soviet Union.

Assistant Professor

Kooser, Jaime C., Ph.D., 1980, California (Berkeley); energy policy, resource development, social geography, time geography.

Lecturer

Haney, Barbara B., Ph.D., 1971, Washington; USSR, historical geography.

Course Descriptions

Courses for Undergraduates

Prerequisites: In addition to specified prerequisites for individual courses, students should meet the general course-level requirements as indicated by the numbers, except where they may have special preparation or background in geography or in related fields.

Introduction to Geography

GEOG 100 Introduction to Geography (5) *Jackson, Mayer* Basic patterns of human occupance of the earth; analysis of population, settlement, and resource-use problems; introduction to geographic theories pertaining to spatial organization, interaction, and environmental perception.

GEOG 200 Introduction to Human Geography (5) *Velikonja* Noneconomic components of patterns and systems of human occupancy of the world. Emphasis on cultural processes, dynamic change, functional relations and networks.

GEOG 202 World Regions (5) *Kakiuchi* Spatial study of world regions, based on historical, cultural, political, economic, and other factors. An attempt to understand the underlying forces that have led to the formation of regions and regional patterns.

GEOG 205 Introduction to the Physical Environment (5) *ZumBrunnen* Major atmospheric, hydrologic, and geomorphic processes used to interpret the character, distribution, and human significance of different natural and human-altered environments. Includes laboratory exercises for science and nonscience majors, geography majors and nonmajors.

GEOG 207 Economic Geography (5) *Beyers, Krumme, Mayer, Thomas* Spatial order and changing locational patterns of man and his economic activities. Emphasis on concepts and theories pertaining to primary, secondary, and tertiary production; to transportation; and to the geography of consumption. Special attention given to cities and the distribution of activities within cities.

GEOG 227 Geographic Perspectives on Minorities in the United States (5) *Hodge, Morrill* Geographic aspects of race relations through analysis of past and present geographic distribution of minorities in the United States, and the processes of migration and segregation that created those patterns. Focus especially on the experiences of Asian, Black, Chicano, and native Americans.

GEOG 258 Maps and Map Reading (3) *Sherman* Categories of maps and aerial photographs and their special uses; map reading and interpretation.

GEOG 277 Geography of Cities (5) *Hodge, Mayer* Spatial and functional orderliness of cities; their location, distribution, function, and spread. Particular emphasis on current urban problems—sprawl, city decline, and metropolitan transportation.

Systematic Fields

GEOG 300 Concepts of Regions (5) *Fleming, Kakiuchi* Historical development and application of the concept of region. Examines systematically how varied societies constitute parts of a total world order. Recommended: 100.

GEOG 301 Cultural Geography (5) *Jackson* Analysis of the role of culture in the formation of landscape patterns; components of culture that contribute not only to a "sense of place," but also to the mosaic of settlement patterns and occupancy that can be traced to culture. Prerequisite: 100 or equivalent.

GEOG 303 Nature and Culture (5) *Jackson* The main theses of man's relationship to nature as expressed in Western and Asian geographic thought; emphasizes the sources of man-environmental dualism and dialectic leading to contemporary ecological discussion in geography. Introduction to the history of geographic thought.

GEOG 316 Urban Economics (5) Application of economic analysis to urban trends, problems, and prescriptions, such as changing urban form and function, urban public finance, housing and renewal, poverty and race, transportation, and environmental problems. Offered jointly with ECON 316. Prerequisite: ECON 201 or equivalent.

GEOG 325 Historical Geography of the United States (5) *Haney, Morrill* Changing geography of the United States from the time of modern European contact to the early twentieth century. Emphasis on the evolving settlement, land use, landscape, and regional patterns.

GEOG 342 Geography and Inequality in the United States (3) *Morrill* Geography of social and economic inequality. Spatial distribution of wealth and poverty and the possible causes. Geographic and other aspects of the alleviation of poverty. The geography of racial and ethnic discrimination, from Indian reservations to ghettos, as well as religious and age discrimination.

GEOG 349 Geography of International Trade (5) *Fleming* Processes and patterns of international commerce. Geographical dimensions of trade linkages. Emergence of trading blocks, problems of "north-south" trade arrangements, and role of multinationals in the global trading system. Recommended: 207.

GEOG 350 Urban-Regional and Market-Area Analysis (5) Methods and concepts for analysis of small regions, market areas, and their economic development. Tools for population, employment, and consumer profiles. Industrial and service locations, trading patterns, commodity flows. Spatial constraints on behavior of producers, consumers. Economic impact analysis, feasibility studies. Prerequisite: 207 or 277 or permission of adviser.

GEOG 370 Problems in Resource Management (5) *Kooser, ZumBrennen* Principles and practices of effective conservation and utilization of natural resources. Role of technology in resource use. Physical, political, and economic aspects of resource management for food, population, land, water, air, energy, and timber resources. Prerequisite: 100.

GEOG 375 Geopolitics (5) *Jackson* Spatial aspects of international politics, with attention to perceptions of national space, the way states organize territory, and the strategic use of geography to advance state goals. Offered jointly with SIS 375. Prerequisite: 100 or equivalent.

GEOG 380 Geographic Patterns of Health and Disease (4) Geography of infectious and chronic diseases at local, national, and international scales; environmental, cultural, and social explanations of those variations; comparative aspects of health systems. Prerequisite: 100 or equivalent.

GEOG 399 Future Patterns of Settlement (3) *Morrill, Schneider* Possible future patterns of human use of the environment from apocalyptic to glorious. Review of landscape evolution. Problems of long-range regional and national planning. Offered jointly with URB P 399. Prerequisite: 207 or 277 or URB P 340, or permission of department adviser.

GEOG 436 Geographical Exploration (5) *Chang* Comparative study of discoveries made by the world's great explorers and expeditions, their motivations, and the effect on geographical thought, relations between cultures, and the development of civilization.

GEOG 440 Regional Analysis (5) *Beyers, Krumme* Regional industrial structures and economic change. Application of shift and share, cohort, multiplier, input-output, location-interaction, and programming models to the analysis and to the projection of urban and regional population patterns, and to income distributions, interurban and interregional growth differentials, regional and interregional linkages and flows, as well as urban and regional impacts of government expenditures. Prerequisite: 207 or permission of department adviser.

GEOG 442 Social Geography (5) *Morrill, Velikonja* Spatial patterns of population distribution and settlement, of migration and the spread of ideas, of social characteristics and social relations, social regions.

GEOG 443 Location and Movement Models (5) *Morrill* Application of models of optimum location and allocation; assignment, transportation, and spatial equilibrium; spatial interaction; geographic simulation; and spatial diffusion.

GEOG 444 Geography of Water Resources (3) *Marts* Analysis and appraisal of water resources in land and industrial development; problems and policies of river basin planning with emphasis on the Pacific Northwest.

GEOG 445 Population Distribution and Migration (5) *Morrill* Relation of population distribution to environment, economic development, and culture. Frontier and rural settlement, urbanization, and suburbanization. Regional variation in age, ethnicity, fertility, and mortality. Causes and effects of migration from the world to the local scale. Recommended: 100 or 200 or SOC 331.

GEOG 447 The Geography of Air Transportation (3 or 5) *Fleming* Geographic analysis of world air routes, passenger and cargo flows, and airport activities; consideration of physical, economic, political, and institutional determinants of routes and flows. 207 and 277 recommended; junior standing or above preferable.

GEOG 448 Geography of Transportation (5) *Mayer* Circulation geography, principles of spatial interaction emphasizing commodity flow, the nature and distribution of rail and water transport, the role of transport in area development.

GEOG 449 Geography of Ocean Transportation (5) *Fleming* Geographic analysis of ocean trade routes, cargo and passenger flows, and port activities. Evaluation of the role of the transportation carrier in international trade. Prerequisite: 207 or permission of department adviser.

GEOG 450 Theories of Location (5) *Krumme* Systematic presentation of classical, neoclassical, and modern theories of location, land use, and spatial structure, including introduction to decision-making concepts. Location principles, patterns, and processes in the context of rural, commercial, industrial, residential, and recreational activities focusing on the effects of transportation, communication, uncertainty, and other factors. Prerequisite: 207 or 277 or 350 or permission of adviser.

GEOG 466 Regional Development (3 or 5) *Thomas* Process of implementing regional development policies in economically advanced and lesser-developed countries. Resultant changes in the distribution and structure of economic activities and settlement patterns. Prerequisites: 207 or ECON 200 or equivalent.

GEOG 471 Methods of Resource Analysis (5) *ZumBrunnen* Economic and noneconomic criteria for resource analysis. Theory and methods of linear models of natural resource analysis. Includes materials-balance modeling, residuals management, constrained system optimization approaches to water quality analysis, land-use patterns and interregional energy use, and multiple objective planning techniques applied to natural resource problems. Prerequisite: 370 or permission of instructor.

GEOG 473 Geography of Energy: Resource Use and Development (5) *Kooser* Spatial analysis of patterns of energy resources and consumption. Choice of energy technologies, social impacts associated with energy development. Limitations on resource utilization and impacts of energy scarcity on urban morphology and transportation. Prerequisite: 370 or permission of instructor.

GEOG 475 Geography of International Relations (5) *Jackson, Velikonja* Selected problems of spatial patterns and dynamic relationships. Geographical problems of regional, national, and international organization. Offered jointly with SIS 475. Prerequisite: 375 or permission of department adviser.

GEOG 478 Intraurban Spatial Patterns (5) Geographic patterns and processes within metropolitan areas. Economic land-use patterns (commercial and industrial location), social land-use patterns (segregation, housing, and neighborhood change), urban political geography, analysis of urban infrastructure, and assessment of contemporary and future trends in urban development. Prerequisite: 277 or permission of instructor.

Regional Fields

GEOG 302 The Pacific Northwest (3) *Beyers* Economy of the Pacific Northwest in the light of factors of location, resources, resource-oriented industries, and resource policies. An introduction to regional studies on a local scale.

GEOG 304 Western Europe (5) *Fleming* Physical and socioeconomic characteristics of western Europe. Contemporary political and economic integration trends in their regional context.

GEOG 305 Eastern Europe (5) *Velikonja* Physical, historical, and socioeconomic characteristics of eastern Europe.

GEOG 308 Canada: A Geographic Interpretation (5) *Jackson* Study of Canada; emergence of political-geographic and cultural entity and identity in North America that presents significant contrasts to the United States. Components that have helped shape Canadian earth-space and landscape.

GEOG 313 East Asia (5) *Kakiuchi* Nature and geographic setting of Far Eastern civilization. Origins, development, and present outlines of settlement; cultures, resource use, and economic structures in China, Japan, and Korea.

GEOG 333 Russia's Changing Landscape (5) *Jackson* Russian/Soviet landscape as it has been affected by migration and settlement, urbanization, collectivization, industrialization, and the growth of a transport network.

GEOG 335 Geography of the Developing World (5) *Chang* Characteristics and causes, external and internal, of Third World development and obstacles to that development. Special attention to demographic and agricultural patterns, resource development, industrialization and urbanization drawing on specific case studies from Asia, Africa, and Latin America. Prerequisite: 100. (Formerly 235).

GEOG 336 China (5) *Chang* China's physical environment. Human response to varied geographical conditions. Pattern and process of development in agriculture, manufacturing, and urbanization. Prerequisite: 100.

GEOG 402 United States (5) *Morrill, Velikonja* Spatial pattern of economic and social life in America—how it evolved, the role of the environment and resources; problems of regional inequality in development.

GEOG 404 Problems in the Geography of Western Europe (5) *Fleming* Problems stemming from contemporary political and socioeconomic changes under way in Europe. Topics include urbanization, regional development, economic integration and patterns of trade.

GEOG 405 Problems of Eastern Europe (5) *Velikonja* Selected geographical aspects of eastern Europe. Natural and human resource base, social and political organization. Their relationships and interdependence. Prerequisite: 305 or permission of instructor.

GEOG 410 Immigrants and the American West (5) *Velikonja* Historic-geographic appraisal of European and Asiatic immigration to the West. Geographic precondition and processes of immigrant settlement. Assessment of the role of ethnicity. Recommended: 325.

GEOG 433 Soviet Resource Use and Management (5) *Jackson, ZumBrunnen* Implications of Soviet industrial growth for resources; use of resources and associated problems; conservation in theory and practice.

GEOG 434 Southeast Asia: Conflict and Development (5) *Chang* Study of complexity of ethnic, cultural, and socioeconomic background in relation to division and rivalry in past; conflict and development in contemporary southeast Asia. Prerequisite: 100.

GEOG 435 Resources and Industrialization in China (5) *Chang* Analysis of China's resources, foundations and development, population growth and control, major industrial bases, and international relations underlining programs of industrialization and modernization.

GEOG 437 Contemporary Japan (5) Topical and regional study of Japan's physical, industrial, and agricultural geography. Analysis of contemporary spatial patterns, considering both cultural and environmental factors. Aspects of historical development are examined to provide time perspective. Recommended: 313.

Cartography and Computer Cartographics

GEOG 360 Principles of Cartography (5) *Sherman* Map scales, grid systems, symbolism, and map reproduction. Laboratory experience in application of these principles to map design and construction.

GEOG 361 Experimental Cartography (5) *Sherman* Application of, and experimentation with, cartographic techniques and materials. Problems of relief representation, mapping of quantitative data, and their relation to reproduction processes. Prerequisite: 360.

GEOG 363 Aerial Photographs as Source Materials (3) *Sherman* Training in the use of aerial photographs as source materials in map compilation and other geographic purposes. Prerequisite: 360.

GEOG 365 Introduction to Computer Cartography (5) *Hodge* Origins, development, and methods of automated cartography. Experiments with a user-oriented package of computer mapping programs capable of performing most thematic mapping operations. Requires normal use of the Computer Center with special emphasis on the Calcomp plotter, line printer, and cathode-ray tube display. Prerequisites: 360 and a computer programming course, or permission of instructor or department adviser.

GEOG 458 Map Intelligence (3) *Sherman* Analysis and appraisal of United States and foreign maps and atlases; mapping agencies, coverage, organization, and indexing; symbolism, scales, projections, and military grids; map library problems and operation.

GEOG 462 Problems in Map Compilation and Design (5) *Sherman* Application and analysis of map intelligence procedures as related to map compilation. Measurement and experimental study of psychophysiological factors in design of map elements. Prerequisite: 360.

GEOG 463 Microcomputer Processing of Geographic Data Bases (5) Design and implementation of geographic information systems using microcomputers. Conceptual organization of data structures, programming microcomputers (in BASIC), interfacing with peripheral equipment, and computer graphic presentation.

GEOG 464 Problems in Map Reproduction (3) *Sherman* Processes and photographic techniques applicable to cartographic and geographic presentations. Prerequisite: 360.

GEOG 465 Computer Cartographics (5) Methods and techniques of programming used in computer graphics applications in cartography. Basic concepts and operating procedures for batch and interactive graphics, including simple and hierarchical data structures. Development of skills in computer graphics programming. Students are encouraged to develop and implement computer cartographic applications. Use of variety of graphics devices including the Calcomp 936 plotter and the Tektronix 4010/4014 CRT terminal. Prerequisites: 365 or elementary FORTRAN programming ability or permission of instructor or department adviser.

Research Techniques

GEOG 326 Introduction to Geographic Research (5) *Kooser* Approaches to geographic pattern solving. Topics include defining geographic problems; methods of analysis, seeking, organizing, and analyzing spatial data; and modeling spatial processes.

GEOG 426 Quantitative Analysis of Spatial Distributions (5) *Hodge, Morrill* Application of statistics to spatially ordered data. Descriptive and inferential statistics of spatial (bivariate) distributions. Theoretical spatial distributions. Problems of spatial autocorrelation and pattern analysis. Trend surface, factorial ecology, and regionalization. Prerequisite: basic statistics course.

GEOG 490 Field Research: The Seattle Region (6) Investigation of settlement and economic development of the Seattle region, including role of environment and institutions. Field analysis of contemporary regional planning issues: transportation, land use, location of employment, shopping and housing, political fragmentation, and environmental degradation. Field report required. Prerequisite: 100 or 205 or 207.

GEOG 495 Special Topics (*, max. 10) Topics vary and are announced in the preceding quarter.

GEOG 497 Tutorial in Geography (2, max. 6) Intensive directed study and tutoring. Literature reviews, formulations of project outlines and research designs, orientation in contemporary geographic thought and trends. Directed writing. Required for honors students. Prerequisites: advanced status, permission of undergraduate adviser for juniors and seniors.

GEOG 498 Undergraduate Seminar in Economic Geography and Regional Science (3) *Krumme* Selected advanced topics and current problems in location theory and analysis as well as urban and regional-economic development, analysis and planning. Emphasis on conceptual frameworks and analytical tools does not preclude a problem-oriented selection of predominantly local and regional empirical research subjects. Prerequisite: permission of department adviser or instructor.

GEOG 499 Special Studies (*, max. 15) Supervised reading programs, undergraduate and graduate library and field research; special projects for undergraduate honors students. Prerequisites: senior class, graduate standing, or permission of instructor or department adviser.

Courses for Graduates Only

GEOG 500 Contemporary Geographic Thought (4, max. 8)

GEOG 501 Geographic Analysis (3)

GEOG 503 Research Seminar: Eastern Europe (3, max. 6) *Velikonja*

GEOG 504 Research Seminar: Western Europe (3, max. 6) *Fleming*

GEOG 505 Research Seminar: China and Northeast Asia (3, max. 6) *Chang*

GEOG 506 Research Seminar: Southeast Asia (3, max. 6)

GEOG 509 Research Seminar: Japan (3, max. 6) *Kakiuchi*

GEOG 510 Research Seminar: Settlement and Urban Geography (3, max. 9) *Mayer*

GEOG 520 Research Seminar: Cartography (3, max. 6) *Sherman*

GEOG 526 Advanced Quantitative Methods in Geography (4) *Morrill*

GEOG 529 Urban Region Geocoding and Land-Based Information Systems (3) *Horwood* Multipurpose street network and land-based information systems. The United States census geocoding system, automated map overlay systems, and cadastral file information use. Applications to land surveying, urban and transportation planning, and geographic analysis. Offered jointly with CETS 529 and URB P 529.

GEOG 533 Research Seminar: Soviet Union (3, max. 6) *Jackson*

GEOG 538 Research Seminar: Geography of Transportation (3, max. 6) *Fleming, Mayer*

GEOG 539 Research Seminar: Utilization of Water Resources (3, max. 6) *Marts*

GEOG 540 Research Seminar: Industrial Geography (3, max. 6) *Beyers*

GEOG 542 Research Seminar: Social and Population Geography (3, max. 6) *Morrill, Velikonja*

GEOG 545 Research Seminar: Time Geography, Temporal Aspects of Spatial Analysis (3, max. 6) Sp *Kooser* Consideration of time in describing activity spaces and movement patterns of population, goods, and services. Current research efforts, problems of application to various planning needs.

GEOG 550 Research Seminar in Location Theory (3) *Krumme* Selected research-oriented topics in classical, neoclassical, and behavioral location theory. Theoretical problems of locational analysis. Relationships between location theory and regional development and planning concepts. Location concepts for urban analysis.

GEOG 551 Location Strategies of Corporate Organizations (3) *Krumme* Geographic dimensions of organizational behavior. Emphasis on locational strategies of large corporations. Industrial location, organization, regional development, and interregional trade and investment as factors influencing spatial patterns and processes of multiregional and multinational corporations.

GEOG 555 Landscape Analysis (3) Methods of landscape analysis; search for a sense of place, transformation of territory into meaningful landscape; science and significance of regions; concepts of landscape change.

GEOG 556 Seminar in Urban Economics (3) Use of economic theory to explain land-use trends, transportation, housing and renewal, the ghetto, and the public economy in urban areas. Offered jointly with ECON 556. Prerequisites: ECON 300, 301, or equivalent.

GEOG 566 Regional Development Seminar (3) *Thomas* Regional planning and development theories and methodologies. Critical evaluation of regional planning in selected economically advanced and lesser-developed countries. Prerequisite: 466.

GEOG 567 Research Seminar: Geography and Development (3, max. 6) *Thomas*

GEOG 570 Research Seminar: Natural Resources Analysis (3, max. 6) *ZumBrunnen*

GEOG 575 Research Seminar: Political Geography (3, max. 6) *Jackson*

GEOG 577 Research Seminar: Internal Spatial Structure of Cities (3, max. 9)

GEOG 580 Medical Geography (3) *Mayer* Geography of human disease, with spatial consideration in health services systems planning. Description and analysis of disease distributions; diffusion models, migration studies, and geographic inputs to the discovery of disease causation. Application of distance, gravity, optimal location models to health systems planning; emergency medical services; distribution of health professionals; and cultural variations in health behavior. Prerequisites: familiarity with social science research; familiarity with health-related issues.

GEOG 598 Geography Colloquium (1, max. 3) Participation in, and critique of, student thesis and dissertation research, faculty research, and visitor contributions.

GEOG 600 Independent Study or Research (*)

GEOG 700 Master's Thesis (*)

GEOG 800 Doctoral Dissertation (*)

Geological Sciences

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The geological sciences include the collection and interpretation of field data as well as the application of principles of physics, chemistry, biology, and mathematics to the study of the earth, its environment, its origin, and the processes by which it has been transformed and reconstituted through time. The curriculum of the department provides a base of required courses for the undergraduate and contains a wide variety of more specialized upper-division courses that reflect the diversity of the geological sciences.

The department is well equipped with modern analytical and experimental facilities and has sizable research/teaching collections of rock, minerals, and fossils.

Undergraduate Program

Bachelor of Science Degree

Admission Requirements: CHEM 140; 150 (or 145, 155) and MATH 124, 125, and 126 (or STAT 311), all with grades not lower than 2.0.

Major Requirements: GEOL 205, 206, 311, 320, 321, 340, 401 plus 13 (biology option) or 15 credits at the 400 level in geological sciences, excluding GEOL 498 and 499; MATH 124, 125, and 126 or STAT 311; CHEM 145 or 140, 155 or 150; PHYS 121, 122, 123. Recommended: MATH 238, 327, 328; and PHYS 224, 225, 226, or BIOL 101-102. (Biology option: PHYS 121; BIOL 101-102 or two courses chosen from BIOL 210, 211, 212 may substitute for PHYS 122, 123.) All required courses must be completed with grades not lower than 2.0.

Graduate Program

The Department of Geological Sciences offers graduate programs leading to the degrees of Master of Science and Doctor of Philosophy. The department emphasizes a rigorous scientific approach to significant problems in the geological sciences. Study in virtually all branches of geology is possible; any emphasis on field, laboratory, or theoretical work is largely dictated by the nature of the research problem selected.

Research Facilities

Analytical and experimental research facilities include: wet chemistry laboratory with an atomic absorption spectrophotometer, automated electron microprobe, forty-eight-channel ICP unit for elemental analysis, automated single-crystal and powder x-ray diffraction and analytical equipment, remote sensing laboratory with an image processing system with LANDSAT tape library and spectral reflectance equipment, gas-atmosphere-controlled furnaces, a Bridgman press and other high-pressure and temperature devices, and a heating-freezing microscope stage. Additional facilities are provided by the Burke Memorial Washington State Museum with paleontological laboratory and collections (extensive reference collections of invertebrate, vertebrate, and plant fossils; petrologic and mineralogic collections) and the Quaternary Research Center (scanning and transmission electron microscopes, K-Ar dating, radiocarbon and oxygen-isotope research, palynology, snow and ice research, periglacial laboratory).

Master of Science Degree

Graduation Requirements: With Thesis—36 credits, of which 18 must be in courses at the 500 level or above and up to 9 may be for thesis (GEOL 700). Final examination consists of oral presentations and defense of thesis. *Without Thesis*—45 credits, of which 18 must be in courses at the 500 level or above, which includes a 5-credit research paper (GEOL 600). Final examination is written or oral and is administered by the supervisory committee. All students must present approved field courses or other approved field experience. A maximum of 9 credits of field geology may be applied.

Doctor of Philosophy Degree

Admission Requirements: Either Master of Science or Master of Arts degree in geological sciences or related field.

Graduation Requirements: Credits variable; one-half total program, including dissertation, must be in courses at the 500 level or above; a minimum of 27 credits for thesis (GEOL 800); at least 18 credits completed with numerical grade in courses numbered 300, 400, and 500. Completion of two years of graduate study, passage of qualifying examination, General Examination (both written and oral parts), and admission to candidacy; completion of acceptable dissertation and passage of Final Examination.

Financial Aid

The department awards annually a number of teaching assistantships, research assistantships, minority fellowships, and a museum curatorial assistantship. Industry-sponsored grants are also available. Qualified students are strongly encouraged to apply for National Science Foundation and other fellowships available through national and private agencies.

Correspondence and Information

Graduate Program Coordinator
63 Johnson, AJ-20

Faculty

Chairperson

John B. Adams

Professors

Adams, John B.,* Ph.D., 1961; Washington; planetology, remote sensing.

Bostrom, Robert C.,* (Geophysics),† D.Phil., 1961, Oxford; geophysics.

Coombs, Howard A. (Emeritus), Ph.D., 1935, Washington; engineering geology.

Creager, Joe S.,* (Oceanography),† Ph.D., 1958, Texas A&M; marine geology.

Dunne, Thomas,* Ph.D., 1969, Johns Hopkins; geomorphology and hydrology.

Evans, Bernard W.,* D.Phil., 1959, Oxford; petrology and mineralogy.

Ghose, Subrata,* Ph.D., 1959, Chicago; x-ray crystallography, mineralogy, applications of solid-state physics techniques to mineralogy.

Mallory, V. Standish,* Ph.D., 1952, California (Berkeley); biostratigraphy, micropaleontology, paleoecology.

McCallum, I. Stewart,* Ph.D., 1968, Chicago; petrology.

Merrill, Ronald T.,* (Geophysics, Oceanography),† Ph.D., 1967, California (Berkeley); geomagnetism.

Misch, Peter (Emeritus), D.Sc., 1932, Goettingen (Germany); structural geology, metamorphic petrology.

Porter, Stephen C.,* Ph.D., 1962, Yale; Quaternary geology and geomorphology.

Rensberger, John M.,* Ph.D., 1967, California (Berkeley); Cenozoic mammalian evolution, taxonomy, and biostratigraphy.

Smith, J. Dungan,* (Geophysics, Oceanography),† Ph.D., 1968, Chicago; oceanography, fluid mechanics, sediment transport processes.

Stuiver, Minze,* (Quaternary Research Center),† Ph.D., 1958, Groningen (The Netherlands); geochronology, isotope geology.

Washburn, Lincoln A. (Emeritus), Ph.D., 1942, Yale; geomorphology, periglacial processes and environments.

Wheeler, Harry E. (Emeritus), Ph.D., 1935, Stanford; stratigraphy, historical interpretation.

Associate Professors

Cheney, Eric S.,* Ph.D., 1964, Yale; economic geology, application of light isotopes to ore deposits.

Cowan, Darrel S.,* Ph.D., 1972, Stanford; structural geology and regional tectonics.

Hallet, Bernard,* Ph.D., 1975, California (Los Angeles); glaciology, permafrost studies, geomorphology.

Stewart, Richard J.,* (Oceanography), Ph.D., 1969, Stanford; sedimentary petrology, diagenesis of sediments.

Vance, Joseph A.,* Ph.D., 1957, Washington; igneous and metamorphic petrology, general geology.

Assistant Professors

Bourgeois, Joanne,* Ph.D., 1980, Wisconsin; stratigraphy, sedimentation.

Bruner, William M., Ph.D., 1980, California (Los Angeles); structural geology.

Ghiorso, Mark S.,* Ph.D., 1980, California (Berkeley); geochemistry.

Grootes, Pieter M. (Research), Ph.D., 1977, Groningen (The Netherlands); carbon isotope dating.

Quay, Paul D. (Research), (Oceanography),† Ph.D., 1977, Columbia; chemical oceanography, geochemistry of stable carbon isotopes.

Lecturer

Chernicoff, Stanley E., Ph.D., 1980, Minnesota; geomorphology.

Course Descriptions

Courses for Undergraduates

GEOL 101 Introduction to Geological Sciences (5) AWSpS Survey of the physical systems that give the earth its form. Emphasizes the dynamic nature of interior and surface processes and their relevance to mankind and stresses the value of rocks and earth forms in the understanding of past events. A course with laboratory for nonscience majors. Field trips.

GEOL 205 Physical Geology (5) ASp Introduction to geology, with laboratory, for science majors, with emphasis on the physics, the chemistry, and the history of the earth. Not open to students who have taken 101. Recommended: background in physics, chemistry, and mathematics.

GEOL 206 Evolution of the Earth (5) W Earth and its physical and biological aspects through time. Origin of earth, its early history, and development of continents and ocean basins as chronicled by the rock and fossil record. Field trips required. Prerequisite: 101 or 205.

GEOL 308 Geology of the Northwest (5) SpS Geologic history of Washington, Oregon, and Idaho. Emphasis on use of geologic principles in interpreting evidence found in landscapes and rocks. Prerequisite: 101 or 205 or equivalent.

GEOL 311 Introductory Geomorphology (5) A *Dunne, Hallet* Processes that generate landscapes. Two one-day field trips. Prerequisites: 101 or 205, and prior or concurrent enrollment in PHYS 121.

GEOL 312 Volcanoes and Glaciers of the Pacific Northwest (3) Introduction to volcanic and glacial processes, emphasizing examples in the Pacific Northwest. Volcanic products, landforms, hazards, prediction, and history. Relationship to tectonics. Nature and distribution of present and former glaciers in Washington. Two all-day Saturday field trips to Cascade volcanoes required.

GEOL 313 Environmental Geology (4) W *Dunne* Analysis of geologic constraints upon human activity and the environmental consequences of such activity. Topics include hillslope processes, fluvial processes, earthquake and volcanic hazard, and environmental aspects of the development of water, energy, and mineral resources. The laboratory/discussion section often is replaced by an afternoon or weekend field trip. Prerequisites: 101, 205, or permission of department.

GEOL 320 Mineralogy (5) AW *Ghiorso, Ghose, McCallum* Introduction to mineralogy, including elementary crystallography (lattice types, external morphology, stereographic projection), elementary crystal physics (relationship of physical properties, including tensor properties to crystal symmetry), and elementary crystal chemistry (structures, bonding, etc.), especially of the silicates. Prerequisites: CHEM 101 or 140, MATH 124.

GEOL 321 Principles of Petrology (5) WSp *Evans, McCallum, Vance* Description, classification, and origin of igneous, metamorphic, and sedimentary rocks, with laboratory hand specimen study of rock specimens. Two one-day field excursions. Prerequisite: 320 or equivalent.

GEOL 340 Structural Geology (5) ASp *Cowan, Stewart* Mechanics of rock deformation; description, classification, origin, and tectonic significance of common structures. Emphasizes interpretation and analysis of geologic maps and cross-sections. Prerequisites: MATH 124, PHYS 121.

GEOL 401 Field Geology (6) S Off-campus fieldwork in general geology, emphasizing field techniques, geologic mapping and report writing. Taught during a period of approximately 24 days in September. Prerequisites: 205, 206, 320, 321, 340, and permission of department.

GEOL 402 Field Geology and Mapping (15) Sp A full-quarter course recommended for students planning to continue on to graduate school or a career in geology. Entails mapping problems in several different geologic terrains and at different scales. Preparation of geological maps, cross-sections and written reports emphasized. Prerequisites: 205, 206, 311, 320, 321, 340.

GEOL 403 Principles of Paleobiology (4) Sp *Rensberger* Fossil record and methods of analysis. Biologic systems in geologic time, including preservation, variation, population structure, adaptation, functional morphology, biostratigraphy, paleoecology, evolution, and biogeography. Prerequisites: 101 or 205, and 206.

GEOL 405 The Earth's Interior (3) Sp *Bostrom* Geophysical evidence as to the earth's interior regionalization and workings; development of the major surface features.

GEOL 410 Introduction to Geological Remote Sensing (4) A *Adams* Principles of image interpretation for geologists. Study of land forms, structure, lithology, surface processes using aircraft and satellite data. Use of digital multispectral images and radar images for geological mapping. Prerequisite: 311.

GEOL 412 Fluvial Geomorphology (5) Sp *Dunne* Hydraulic, sedimentologic, and morphological characteristics of streams and valley floors. Landscape evolution by stream erosion and deposition. Interpretation of fluvial sedimentary environments. Five field exercises emphasize the quantitative analysis of fluvial processes and channel forms and the acquisition of various skills, such as mapping, topographic surveying, and report writing. Prerequisites: 311, MATH 125, PHYS 121. (Offered odd-numbered years.)

GEOL 413 Hillslope Geomorphology (5) Sp *Dunne* Theoretical, laboratory, and field study of hillslope evolution by mass wasting and water erosion. Five field exercises emphasize the quantitative analysis of geomorphic processes and the acquisition of various skills, such as mapping, topographic surveying, and report writing. Prerequisites: 311, MATH 125, PHYS 121. (Offered even-numbered years.)

GEOL 414 Interpretation of Aerial Photographs (3) W *Adams, Porter* Geologic interpretation using stereoscopic aerial photographs. Emphasis on solving field problems. Prerequisites: 311, 340 or equivalent, and permission of department.

GEOL 415 Principles of Glaciology (4) A *Hallet, Maykut, Porter, Raymond, Stuiver, Warren* Snow deposition and metamorphism, avalanches, heat and mass balance at snow and ice surfaces, glacier flow, ice sheets, sea ice, permafrost, methods of paleoclimate reconstruction, Ice Age theories. Offered jointly with GPHYS 415. Prerequisite: permission of instructor.

GEOL 416 Glacial Geology (3) Processes involved in glacial erosion and deposition. Interpretation of glacial history through study of sediments and landforms, with emphasis on climatic implications, chronology, and correlation. Recommended: 311, 415, and 455.

GEOL 417 The Late Cenozoic Glacial Ages (3) A *Leopold, Porter* Physical and biological evidence, both terrestrial and marine, for cyclic climatic change during the late Cenozoic, emphasizing regional stratigraphic patterns, dating, and correlation. Growth and dissipation of Quaternary ice sheets and alpine glaciers, as indicated by the geologic record. Use of this data to evaluate theories on causes of glacial ages and potential for predicting future climatic variations. Offered jointly with QUAT 417. Prerequisite: introductory course in earth science and biological science.

GEOL 418 Periglacial Geology (3) W *Hallet* Geomorphic features and fundamental processes active in areas subjected to subfreezing temperatures. Geotechnical and environmental problems characteristic of periglacial areas. Prerequisites: 311 and prior or concurrent enrollment in 455; recommended: CHEM 350.

GEOL 419 Glacial Geomorphology (3) Sp *Hallet* Processes involved in glacial erosion and deposition. Glaciological analyses of the generation of glacial landforms and deposits. Prerequisites: 311 and 415; recommended: 416, 455, and GPHYS 512. (Offered odd-numbered years.)

GEOL 420 Advanced Mineralogy (3) W *Ghose* Symmetry and crystal structure, chemical bonding, magnetic, electric, optical, and elastic properties of the common minerals. Detailed crystal chemistry of the rock-forming silicates with respect to phase equilibria and natural occurrence. Prerequisites: 320, 321, PHYS 121, 122, 123, CHEM 140 or 145.

GEOL 423 Optical Mineralogy (4) A *Vance* Petrographic microscope and recognition of common minerals in thin section. Prerequisite: 320 or equivalent.

GEOL 424 Petrography and Petrology of Igneous Rocks (5) W *McCallum, Vance* Systematic study of igneous rocks and their origin, using the petrographic microscope. Prerequisite: 423 or equivalent.

GEOL 425 Petrography and Petrology of Metamorphic Rocks (5) Sp *Evans* Mineralogy, textures, and origins of metamorphic rocks; metamorphic facies and metamorphic phase equilibria; controls of metamorphism. Prerequisites: 423, 424 or equivalents.

GEOL 426 Petrology and Petrography of Sedimentary Rocks (5) W *Bourgeois, Stewart* Mineralogy, textures, and origin of sedimentary rocks, using petrographic microscope. Prerequisites: 320, 423, or equivalents.

GEOL 430 Macroscopic Invertebrate Fossils (5) A *Mallory* Important larger invertebrate groups; morphology, classification, stratigraphic distribution, evolution, paleoecology. Prerequisite: 101 or 205, or equivalent. (Offered even-numbered years.)

GEOL 436 Micropaleontology (5) A *Mallory* Principles of paleontology as applied to micropaleontology; the systematic study of foraminifera. Prerequisite: 430 or permission of department. (Offered odd-numbered years.)

GEOL 437 Evolution of the Vertebrates (5) W *Rensberger* Osteology and evolution of the major groups of vertebrates. Prerequisite: BIOL 101- or BIOL 210. (Offered even-numbered years.)

GEOL 438 Evolution and Classification of the Mammals (5) W *Rensberger* Evolutionary changes and classification of the major groups of mammals from the Mesozoic to the present. Prerequisite: 437 or equivalent.

GEOL 443 Tectonics (4) W *Cowan* The development of orogenic belts in space and time, with particular emphasis on the Cenozoic and Mesozoic evolution of western North America; brief survey of the principles of plate tectonics and their geologic applications; characteristics of modern and ancient convergent plate boundaries. Prerequisite: 340.

GEOL 450 Techniques in Geophysics (3) A *Bostrom* Geophysics of the solid earth, outlining instruments, techniques, and interpretation. Prerequisite: senior standing in geology or permission of instructor.

GEOL 452 Principles of Sediment Transport by Turbulent Flow (3) Sp *J. D. Smith* Theoretical and experimental techniques used in studying erosion, transportation, and deposition of sediment. Analysis of sediment samples, initial motion of sediments, bed-load motion, suspension of sediment by turbulent flows, erosion and deposition of sediments, and applications of sediment transport theory to problems of geological interest. Offered jointly with OCEAN 452 and GPHYS 452. Prerequisite: 410.

GEOL 455 Introduction to Geomechanics (3) W *J. D. Smith* Basic principles of continuum mechanics as applied to geological problems and their application to flow of water, mud, and magma and to deformation of soil, rock, and ice. Emphasis on sound physical understanding of these principles and on use of elementary mathematics in their application to important earth sciences problems. Offered jointly with GPHYS 455. Prerequisites: MATH 126, PHYS 123 or equivalent.

GEOL 461 Stratigraphy (3) W *Bourgeois* Systematic study of spatial relations of surface-accumulated rocks and their space-time implications. Prerequisites: 206, 321, or equivalent.

GEOL 462 Depositional Environments (4) Sp *Bourgeois* Principles of sedimentary facies analysis, including survey of modern processes that produce sedimentary sequences. Recognition of various depositional environments represented in the geologic record, including terrestrial, marine terrigenous, and carbonate environments. Two field trips required. Prerequisite: 206 or equivalent historical geology; recommended: 311 and 321.

GEOL 472 Introduction to Geochemistry (4) A *Ghiorso* Thermodynamics; practical application of thermodynamic data to geologic problems. Crystal chemistry. Phase equilibria and phase diagrams. Aqueous geochemistry. Organic geochemistry. Systematics of radiometric dating. Stable isotope equilibria. Prerequisites: CHEM 150 or CHEM 155; 320, 321, or permission of instructor.

GEOL 474 Introduction to X-ray Crystallography (3) W *Ghose* Point groups and space groups. Reciprocal lattice. Theory of X-ray diffraction from single crystals. Powder diffraction; identification of unknowns and determination of precise cell dimensions. Single crystal camera (precession and Weissenberg) techniques; determination of cell dimensions and space groups; study of exsolution and phase transformation in rock-forming silicates. Structure factor formula and the use of three-dimensional Fourier and Patterson series in the determination of crystal structures. Prerequisites: 320 and PHYS 123.

GEOL 476 Isotope Geology (3) Sp *Stuiver* Methods involving the application of radioactive isotopes in age dating (radiocarbon, ionium, potassium-argon dating, etc.), and of stable isotope variations in nature in determining the temperature history of the earth and igneous rock formations. Applications of global aspects of the hydrologic cycle, age dating in archaeology, and geochemical cycling of elements. Prerequisite: background in introductory mathematics.

GEOL 481 Mineral Industry Economics (4) A *Anderson* World mineral resources, their distribution, exploitation, and depletion, social economic and political effects, international control and trade, industrial organization, government policies, taxation, tariffs, marketing, and pricing; elements of production costs. Offered jointly with MSE 481. Prerequisite: 205 or MSE 350 or permission of instructor.

GEOL 485 Principles of Economic Geology (5) Principles of economic geology and exploration as illustrated by selected types of metallic and nonmetallic ore deposits and coal. Prerequisites: 321, 340, and senior standing in geological sciences.

GEOL 488 Economic Field Geology (5) Sp *Adams, Bostrom, Cheney* Identification of hydrothermally altered rocks, oxidation, and supergene enrichment; principles of exploration geochemistry and remote sensing. Four-to-eight-day trip to mining districts for field inspection of ore deposits. Two weekends (three days each) mapping mineral deposits. Prerequisites: 485 or equivalent and permission of instructor.

GEOL 490 Special Topics (2-5, max. 10) AWSpS

GEOL 498 Undergraduate Thesis (5) AWSp The thesis must be submitted at least one month before graduation. Prerequisite: permission of department.

GEOL 499 Undergraduate Research (*, max. 5) AWSp Prerequisite: permission of department.

Courses for Graduates Only

GEOL 511 Seminar in Geomorphology and Hydrology (*) AWSp *Dunne, Hallet, Porter* Prerequisite: permission of instructor.

GEOL 512 Seminar in Quaternary Research (2) *Porter* Seminar with advanced readings and discussion stressing current problems in Quaternary research. Prerequisite: permission of instructor.

GEOL 519 Advanced Geological Remote Sensing (4) Sp *Adams* Critical examination of remote sensing methods that are used to determine chemistry, mineralogy, and structure of the earth's surface and the surfaces of solar system bodies. Photographic and digital multispectral imagery, reflectance spectroscopy, thermal infrared spectroscopy, gamma ray spectroscopy, radar imagery, and other techniques. Emphasis on the application of satellite and aircraft measurements to terrestrial geologic problems. Prerequisite: 410 or equivalent. (Offered even-numbered years.)

GEOL 521 Metamorphic Minerals (5) A *Evans* Structures, compositions, optical properties, stability, occurrence, and paragenetic associations of rock-forming metamorphic minerals. Significance of these observations in the determination of metamorphic environments. Laboratory study using the polarizing microscope. Prerequisite: 425 or equivalent. (Offered even-numbered years.)

GEOL 522 Metamorphic Parageneses (5) A *Evans* Metamorphic parageneses and processes in the context of tectonic environment. Laboratory study of material from contrasting metamorphic belts. Prerequisite: 425 or equivalent. (Offered odd-numbered years.)

GEOL 523 Advanced Optical Mineralogy (4) A Universal stage, petrofabrics, advanced optical theory, feldspar determination.

GEOL 524 Petrogenesis of Igneous Rocks (3) Sp *McCallum, Vance* Origin of one or more of the major groups of igneous rocks. Selected petrogenetic problems in light of tectonic setting, petrography, geochemistry, and experimental studies. Prerequisite: 424 or equivalent. (Offered alternate years.)

GEOL 525 Theoretical Metamorphic Petrology (4) W *Evans* Theoretical treatment of metamorphic mineral assemblages and metamorphic processes. Prerequisites: 425, CHEM 456, or equivalent.

GEOL 526 Theoretical Igneous Petrology (4) A *McCallum* Review of thermodynamics, with emphasis on solutions. Crystalliquid equilibria. Physical properties of silicate melts. Oxidation states of magmas. Magmatic gases. Quantitative treatment of fractionation, assimilation, and magma mixing. Trace elements and isotope ratios. Stable isotopes as tracers. Nucleation and crystal growth. Diffusion in melts. Cooling and crystallization models. Elementary fluid dynamics applied to magma flow. Prerequisite: 424, CHEM 456 or equivalents. (Offered odd-numbered years.)

GEOL 527 Phase Equilibria in Silicate Systems (4) A *McCallum* Phase equilibria in 1-, 2-, 3-, 4-, and multi-component systems appropriate to igneous rocks. Geometrical aspects stressed. Effect of H_2O, CO_2, and variable oxidation states on phase equilibria. Application to the petrogenesis of common igneous rocks. Prerequisite: 424 or equivalent. (Offered even-numbered years.)

GEOL 531 Stratigraphic Paleontology (5) Sp *Mallory* Principles of stratigraphic paleontology and chronologic biostratigraphy. Prerequisites: 430, 461, or equivalent. (Offered odd-numbered years.)

GEOL 532 Paleoecology of Invertebrates (5) Sp *Mallory* Properties of fossil populations and interpretation of habit and habitat in the geologic past. Prerequisites: 321, 430, or permission of instructor. (Offered odd-numbered years.)

GEOL 533 Seminar in Vertebrate Paleontology (3, max. 9) AWSp *Rensberger* Advanced topics in vertebrate evolution, morphology, classification, function, ecology, and stratigraphy. Subject to be chosen by class at beginning of quarter. Prerequisite: advanced standing in paleontology, vertebrate zoology, or physical anthropology.

GEOL 548 Tectonic Evolution of Western North America (4) Sp *Cowan* Survey of each of the major Mesozoic and Cenozoic tectonic provinces in western North America, emphasizing structural styles, tectonic framework, and plate-tectonic setting. Provinces include: Laramide, Rocky Mountain foothills, Basin and Range, Cordilleran core complexes, San Andreas, Sierran-Klamath, Franciscan-Great Valley, Vancouver Island-San Juan Islands-North Cascades. Prerequisites: 340, 443. (Offered odd-numbered years.)

GEOL 549 Small-Scale Structures in Deformed Rocks (5) Sp *Cowan* Origin, geometry, tectonic significance of small-scale structures, including foliation, lineations, folding and boudinage, brittle and ductile fault zones; qualitative strain analysis and principles of structural analysis. Includes work with deformed rocks in the field. Prerequisites: 340, 423. (Offered even-numbered years.)

GEOL 556 Planetary Surfaces (3) *Adams* Comparison of surface processes and conditions on Mercury, Venus, earth, moon, Mars, asteroids, and satellites of the great planets. Emphasis on understanding how and why planetary surfaces differ from one another and on the implied course of solar-system evolution. Analysis of data from earth-based telescopes and from manned and unmanned space missions. Offered jointly with ASTR 556 and GPHYS 556. (Offered odd-numbered years.)

GEOL 557 Origin of the Solar System (3) *Brownlee* Nebular and nonnebular theories of the origin of the solar system; collapse from the interstellar medium, grain growth in the solar nebula, formation of planetesimals and planets, early evolution of the planets and other possible planetary systems; examination of the physical and chemical evidence upon which the ideas concerning the origin of the solar system are based. Offered jointly with ASTR 557 and GPHYS 557.

GEOL 560 Mechanics of Erosion and Sediment Transport (3) A *J. D. Smith* Physics of erosion, deposition, and transportation of sediments by turbulent flows. Use of theoretical fluid mechanics to formulate and solve problems of bed load and suspended load transport. Offered jointly with GPHYS 560 and OCEAN 560. Prerequisites: 452 and MATH 329. (Offered odd-numbered years.)

GEOL 561 Seminar in Geological Fluid Mechanics (3) W *J. D. Smith* Reading and discussion of topics of current interest in geological fluid mechanics. Course work includes a report on a specializedtopic. Offered jointly with OCEAN 561 and GPHYS 561. Prerequisite: permission of instructor.

GEOL 562 Mechanics of Sediment-Transporting Flows (3) A *J. D. Smith* Comprehensive investigation of mechanics of turbulent, near-bottom flows responsible for erosion and transportation of sediment. How bed load and suspended load transport modify characteristics of these flows. Marine, estuarine, and fluvial systems. Offered jointly with GPHYS 562 and OCEAN 562. Prerequisites: 452 and 455. (Offered even-numbered years.)

GEOL 563 West Coast Cenozoic Stratigraphy (5) Sp *Mallory* Lithologic and faunal studies of the West Coast Cenozoic. (Offered even-numbered years.)

GEOL 564 Sedimentology of Carbonate Rocks (2-4) *Bourgeois* Petrographic and environmental interpretation of carbonate sediments and rocks. Hand-specimen and thin-section studies, with references to modern and ancient carbonate environments. (Offered even-numbered years.)

GEOL 565 Interpretation of Sedimentary Structures (2-4) *Bourgeois* Physical and environmental analysis of sedimentary structures, including biogenic sedimentary structures. Clastic rocks. (Offered odd-numbered years.)

GEOL 572 Solution Geochemistry (4) W *Ghiorso* Solution chemistry and thermodynamics as applied to solid and liquid silicates and aqueous fluids. Modeling configurational entropies in solids, activity coefficients and complexes in aqueous solution, and modeling chemical mass transfer in geologic systems. Prerequisite: 472 or equivalent.

GEOL 573 Application of Microprobe Techniques (4) W *Mathes*

GEOL 574 Advanced X-ray Crystallography (4) Sp *Ghose* Theory of x-ray diffraction; determination of crystal structures with special emphasis on minerals and inorganic compounds, through the application of three-dimensional Patterson function, Fourier series, and direct methods; structure refinement; determination of cation distribution, exsolution, and antiphase domain structure through x-ray diffraction. Prerequisite: 474 or permission of instructor.

GEOL 576 Geochronometry (4) A *Stuiver* Principles, methods, and applications of dating rocks and organic materials.

GEOL 592 Seminar in Sedimentology (2) W *Stewart* Lectures, discussions, and readings on selected problems of current interest.

GEOL 586 Economic Geology of Sedimentary Rocks (5) W *Cheney* Description and origin of metallic and nonmetallic ore deposits indigenous to regoliths, sediments, and sedimentary rocks. Prerequisite: 485 or equivalent or permission of instructor. (Offered even-numbered years.)

GEOL 587 Economic Geology of Igneous and Metamorphic Rocks (5) W *Cheney* Description and origin of metallic and nonmetallic ore deposits formed in igneous and metamorphic rocks or by igneous and metamorphic processes. Prerequisite: 485 or equivalent or permission of instructor. (Offered odd-numbered years.)

GEOL 590 Special Topics (2-5, max. 10)

GEOL 600 Independent Study or Research (*) AWSpS

GEOL 700 Master's Thesis (*) AWSpS

GEOL 800 Doctoral Dissertation (*) AWSpS

Geophysics

202 Atmospheric Sciences-Geophysics

Geophysics is an interdisciplinary physical science concerned with the nature of the earth and its environment. It seeks to apply the techniques of physics, mathematics, and chemistry to the structure and dynamic behavior of the earth and other planets. Included in this interdisciplinary area are a large number of complex and interrelated natural processes ranging from convection in the mantle to electron precipitation in the magnetosphere, with a wide variety of possibilities in between. An undergraduate degree is not offered.

Graduate Program

The Geophysics Program offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. These degrees, like the field that they encompass, cover a broad range of topics in which the analytic techniques of physics and mathematics are brought to bear on problems of the earth and its environment. Major areas of interest are the internal and surface structures of planets, dynamical processes within the earth, oceans, and atmosphere, and the associated environmental applications of these processes.

The required curriculum is flexible so as to permit pursuit of the wide variety of scientific disciplines that may be necessary for approaching a specific geophysical problem. However, a core curriculum of basic physics and mathematics and a sequence of courses dealing with some of the important problems encountered in the atmosphere, the oceans, and the solid earth usually are taken during the first year. Additional specialized course work necessary before embarking on a thesis project is handled on an individual basis by the student and a faculty committee.

Special Requirements

A written qualifying examination is given once each year in the late spring. Normally, students take this examination during their first year. A grade of pass with distinction is required if the student is to continue study for a Ph.D. degree.

Financial Aid

Most financial aid is provided through graduate research assistantships that enable students to work with individual faculty members on important research projects. However, two teaching assistantships also are awarded each year.

Research Facilities

Research facilities include a laboratory for high-pressure and high-temperature studies of the elastic properties of rocks and minerals; a permanent statewide seismic network; a portable telemetered seismic network for use in the study of volcanoes and active faults in western North America; a cold laboratory for study of problems in snow-cover geophysics, glaciology, and sea-ice research; a laboratory for the study of deformation of rocks at pressures and temperatures corresponding to the mantle of the earth; and a laboratory for the study of heat flow and convection processes within the earth. Many of the geophysics faculty members also have laboratories or access to laboratories in other departments, thus making possible a wide diversity of research opportunities. This is particularly valuable in such fields as aeronomy, tropospheric aerosols, radioactive age dating, and geophysical fluid mechanics. In addition to laboratory work, field programs are carried out at a number of remote sites, particularly in the Washington Cascades and Olympics. In marine geophysics, joint geophysics/oceanography projects provide opportunities for study of the earth's structure and tectonic processes on the sea floor. Facilities for heat-flow determination, reflection profiling, long-range seismic refraction, and magnetic measurements are available.

Correspondence and Information

Chairperson, Geophysics Program
202 Atmospheric Sciences-Geophysics, AK-50

Faculty

Chairperson

J. Dungan Smith

Professors

Booker, John R.,* Ph.D., 1968, California (San Diego); geomagnetism, fluid mechanics, inverse theory.

Bostrom, Robert C.,* (Geological Sciences),† Ph.D., 1961, Oxford; geotectonics.

Businger, Joost A. (Emeritus), (Atmospheric Sciences),† Ph.D., 1954, Utrecht; energy transfer, air-sea interface.

Charlson, Robert J.,* (Civil Engineering, Environmental Studies, Atmospheric Sciences),† Ph.D., 1964, Washington; air chemistry.

Clark, Kenneth C.,* (Physics),† Ph.D., 1947, Harvard; spectroscopy of upper atmosphere.

Criminale, William O., Jr.,* (Applied Mathematics, Oceanography),† Ph.D., 1960, Johns Hopkins; geophysical fluid dynamics.

Crosson, Robert S.,* Ph.D., 1966, Stanford; seismology.

LaChapelle, Edward R. (Emeritus), (Atmospheric Sciences),† D.Sc. (Hon.), 1957, Puget Sound; snow-cover geophysics.

Leovy, Conway B.,* (Atmospheric Sciences),† Ph.D., 1963, Massachusetts Institute of Technology; planetary atmospheres.

Lewis, Brian T. R.,* (Oceanography),† Ph.D., 1970, Wisconsin; marine geophysics.

Lister, Cliver R. B.,* (Oceanography),† Ph.D., 1962, Cambridge; marine geophysics, heat flow.

Merrill, Ronald T.,* (Geological Sciences, Oceanography),† Ph.D., 1967, California (Berkeley); geomagnetism.

Parks, George K.,* (Atmospheric Sciences, Physics), Ph.D., 1966, California (Berkeley); magnetospheric and space plasma physics.

Raymond, Charles F.,* Ph.D., 1969, California Institute of Technology; glaciology.

Smith, J. Dungan,* (Geological Sciences, Oceanography),† Ph.D., 1968, Chicago; geophysical fluid dynamics, sediment transport mechanics.

Smith, Stewart W.,* Ph.D., 1961, California Institute of Technology; earthquake seismology.

Untersteiner, Norbert,* (Atmospheric Sciences, Applied Physics),† Dozent, 1961, Vienna; glaciology, arctic sea ice.

Associate Professor

Baker, Marcia B.,* (Civil Engineering, Atmospheric Sciences),† Ph.D., 1971, Washington; atmospheric geophysics.

Assistant Professors

Holzworth, Robert H. II,* (Physics), Ph.D., 1977, California (Berkeley); space physics and electrical fields.

Warren, Stephen G.,* (Atmospheric Sciences),† Ph.D., 1973, Harvard; radiation and climate, glaciology.

Course Descriptions

GPHYS 403 Geophysics: The Earth (3) A The earth and its interior; gravity, magnetism, heat flow, seismology. Earth's outer structure, studied through the unifying concepts of plate tectonic theory. Quantitative approaches to problems, using techniques of classical physics. Prerequisite: PHYS 322 or permission of instructor.

GPHYS 404 Geophysics: The Ocean (3) W Introduction to geophysical fluid dynamics. An overview of fluids in geophysics with emphasis on the oceans. A nonrigorous development of the equations of motion with examples drawn from dynamical oceanography. Prerequisite: MATH 238 or equivalent.

GPHYS 405 Geophysical Continuum Mechanics (3) W Analysis of stress. Finite and infinitesimal strain. Measurement and interpretation of strain in geological materials. Elasticity applied to determine stress in the earth's crust. Creep of solids and flow of geological materials. Prerequisite: MATH 238 or equivalent.

GPHYS 406 Geophysics: The Atmosphere (3) Sp Structure and composition of the atmosphere, atmospheric radiation and thermodynamics; humidity and cloud processes and energy transport within the atmosphere. Offered jointly with ATM S 406. Prerequisite: 404 or permission of instructor.

GPHYS 407 Geophysics: Space (3) A Survey of various phenomena occurring in the outer regions of the earth's atmosphere, the ionosphere, the magnetosphere, and the Van Allen radiation belts. Behavior of charged particles in the geomagnetic field and simple concepts of plasma and magnetohydromagnetic waves. Prerequisite: PHYS 323 or equivalent.

GPHYS 408 Geochemical Cycles (4) Sp *Charlson, Staff* Descriptive and quantitative aspects of the earth as a biogeochemical system. Fundamental methods for study of equilibria, transport processes, chemical kinetics and biological processes and their application to the carbon, sulfur, nitrogen, phosphorus, and other elemental cycles. Stability of biogeochemical systems and the nature of human perturbations of their dynamics. Offered jointly with ENV S 408. Prerequisites: CHEM 150, 350, MATH 238.

GPHYS 409 Introduction to Atmospheric Electricity (3) W *Holzworth* Electric fields and current systems in atmosphere as generated from thunderstorm and extraterrestrial sources; review of undergraduate electromagnetic theory. Weather and magnetospheric-related electric current generating mechanisms; interactions between systems. AC and DC electromagnetic perturbations. Offered jointly with ATM S 409. Prerequisites: PHYS 321 sequence or equivalents, or permission of instructor.

GPHYS 415 Principles of Glaciology (4) A *Hallet, Maykut, Porter, Raymond, Stuiver, Warren* Snow deposition and metamorphism, avalanches, heat and mass balance at snow and ice surfaces, glacier flow and erosion, ice sheets, sea ice, frozen ground, methods of paleoclimate reconstruction, Ice Age theories. Offered jointly with GEOL 415. Prerequisite: permission of instructor.

GPHYS 431 Seismology and Earthquake Engineering (3) A *Evans, S. Smith* Overview of earthquake processes and details of the characteristics of destructive ground motion; effects of such motion on engineering structures; current practice in estimating earthquake hazards for important structures such as nuclear power plants. Offered jointly with CESM 431. Prerequisite: MATH 238 or permission of instructor.

GPHYS 452 Principles of Sediment Transport by Turbulent Flow (3) Sp *J. D. Smith* Theoretical and experimental techniques used in studying erosion, transportation, and deposition of sediment. Analysis of sediment samples, initial motion of sediments, bed-load motion, suspension of sediment by turbulent flows, mass movement of sediments, and applications of sediment transport theory to problems of geological interest. Offered jointly with GEOL 452 and OCEAN 452. Prerequisite: GEOL 410.

GPHYS 455 Introduction to Geomechanics (3) W *J. D. Smith* Basic principles of continuum mechanics as applied to geological problems and their application to flow of water, mud, and magma and to deformation of soil, rock, and ice. Emphasis on sound physical understanding of these principles and on use of elementary mathematics in their application to important earth sciences problems. Offered jointly with GEOL 455. Prerequisites: MATH 126, PHYS 123 or equivalent.

GPHYS 480 Special Topics in Geophysics (2-6, max. 12) AWSp Intensive treatment of a selected geophysical topic presented through faculty lectures, guest lectures, and student reports. For students in geophysics and related fields. Subject varies from year to year. Prerequisites: one year each of physics and calculus, and permission of instructor.

GPHYS 499 Independent Study for Undergraduates (1-5, max. 10) AWSp Prerequisite: permission of instructor.

Courses for Graduates Only

GPHYS 501 Earth Potential Fields (3) A *Lister* Basic potential theory, with emphasis on qualitative understanding of theorems. Application to gravity and geoid anomalies, mention of comparable results in magnetism where appropriate. Extension of potential theory to thermal problems, with examples drawn from measurement of the earth's heat flow. Prerequisite: 403 or equivalent. (Offered alternate years.)

GPHYS 502 Geophysics of Solids (3) W *Merrill* Applications of solid-state physics to various geophysical problems. Topics vary, but usually include the thermal properties of relevant geophysical materials, the equation of state for the earth's mantle and core, defects in solids and their roles in tectonophysics. Prerequisite: permission of instructor. (Offered alternate years.)

GPHYS 503 Elements of Seismology (3) Sp *S. Smith* Propagation of elastic waves and techniques of determining the properties of the deep interior of the earth. The nature of earthquakes and their relation to geologic processes. Prerequisite: 405.

GPHYS 504 Geophysical Data Collection and Analysis (3) W *Crosson* Theory and practical application of data collection and analysis applied to geophysical problems. Digital processing of signals; filtering and spectral analysis. Laboratory sessions include problem solving on computer-based processing system.

GPHYS 505 Geophysical Inverse Theory (3) Sp *Booker* Introduction to the mathematical techniques for estimating properties of physical systems, such as the earth or atmosphere, from data that is insufficient for a precise specification of the system. Emphasis is on the concept of the resolving power of data sets. The ideas developed are quite general and have a wide range of applicability in the field of data interpretation. Prerequisites: 504 and permission of instructor.

GPHYS 506 Physics of Marine Geologic Processes (5) W Thermomechanics of hot material upwelling at spreading centers and formation of characteristic physical structures; lithosphere thickening with age and related geophysical observables; mechanics of subduction zones; fate of sinking slabs and deep mantle recycling; geometry of plate tectonics on a sphere; causes of vertical motions at the earth's surface. Offered jointly with OCEAN 506. Prerequisite: permission of instructor.

GPHYS 510 Physics of Ice (3) A *Raymond* Structure of the water molecule. Crystallographic structures of ice. Electrical, optical, thermal, and mechanical properties of ice. Growth of ice from the vapor and liquid phases. Physical properties of snow. Offered jointly with ATM S 510. Prerequisite: permission of instructor. (Offered even-numbered years.)

GPHYS 511 Formation of Snow and Ice Masses (3) W *Warren* Snow climatology. Transport of snow by wind. Transfer of radiative, sensible, and latent heat at the surface of snow and ice. Freezing of natural water bodies. Heat and mass budget of ice masses. Remote sensing of snow and ice. Theories of ice ages. Offered jointly with ATM S 511. Prerequisite: permission of instructor. (Offered odd-numbered years.)

GPHYS 512 Dynamics of Snow and Ice Masses (3) Sp *Raymond* Rheology of snow and ice. Sliding and processes at glacier beds. Thermal regime and motion of seasonal snow, glaciers, and ice sheets. Avalanches and glacier surges. Deformation and drift of sea ice. Response of natural ice masses to change in climate. Offered jointly with ATM S 512. Prerequisite: permission of instructor. (Offered odd-numbered years.)

GPHYS 513 Structural Glaciology (3) A *Raymond* Physical and chemical processes of snow stratigraphy and metamorphism. Interpretation of ice sheet stratigraphy in terms of paleoenvironment. Dynamic metamorphism from ice flow. Structures formed at freezing interfaces. Structure of river, lake, and sea ice. Relationship between structures and bulk physical properties. Offered jointly with ATM S 513. Prerequisite: permission of instructor. (Offered odd-numbered years.)

GPHYS 514 Ice and Climate Modeling (3) W *Warren* Principles of global climate modeling. Modeling seasonal cycles of snow cover and sea ice. Ice-sheet mass balance and flow. Solar radiation anomalies due to changes in earth's orbit. Climate/ice-sheet models of Pleistocene ice ages. Offered jointly with ATM S 514. Prerequisite: permission of instructor. (Offered even-numbered years.)

GPHYS 520 Seminar (1-2) AWSp Review of current literature in geophysics and graduate student research with faculty participation.

GPHYS 532 Atmospheric Electrical Dynamics (3) *Holzworth* Global and local dynamical electric field models, including upper atmospheric and tropospheric sources as modified by propagation delays, orographic features, and transient phenomena. Radiation and plasma waves along with microphysics of corona discharge and charge separation mechanisms. Prerequisite: 409 or permission of instructor.

GPHYS 537 Magnetosphere I (3) W *Parks* Formation by interaction of solar wind with geomagnetic field. Trapped particles. Electromagnetic waves in anisotropic plasma. Dynamic disturbances and plasma instabilities. Prerequisite: 407 or permission of instructor.

GPHYS 538 Magnetosphere II (3) Sp *Parks* Plasma waves. Propagation of very-low-frequency and hydromagnetic waves in the magnetosphere. Interactions between plasma waves and particles. Prerequisite: 537.

GPHYS 541 Marine Reflection Seismology (3) Sp Principles of reflection acoustics in the ocean; effect of frequency on reflection coefficient and attenuation; band width and resolution; sound sources; hydrophones, acoustic noise, and tow noise; multichannel techniques; migration of reflectors; physical basis of, and numerical methods for, normal move out and wave-equation. Offered jointly with OCEAN 541. Prerequisite: permission of instructor.

GPHYS 545 Thermomechanics and Mechanisms in Hydrothermal Systems (3) W Thermal balance of hot material injected at a plate divergence; heat transport capability of fluid convection through cracks compared to thermal conduction; theory of hydrothermal penetration into hot rock by thermal contraction cracking; development history of a hydrothermal system; effects of rock/water chemical interaction and mineral deposition; mineral stills. Offered jointly with OCEAN 545. Prerequisite: permission of instructor.

GPHYS 555 Planetary Atmospheres (3) A *Leovy, Warren* Problems of origin, evolution, and structure of planetary atmospheres, emphasizing elements common to all planetary atmospheres; roles of radiation, chemistry, and dynamical processes; new results on the atmospheres of Venus, Mars, Jupiter, and other solar-system objects in the context of comparative planetology. Offered jointly with ASTR 555 and ATM S 555.

GPHYS 556 Planetary Surfaces (3) Sp *Adams* Comparison of surface processes and conditions on Mercury, Venus, earth, moon, Mars, asteroids, and satellites of the great planets. Emphasis on understanding how and why planetary surfaces differ from one another and the implied course of solar-system evolution. Analysis of data from earth-based telescopes and manned and unmanned space missions. Offered jointly with ASTR 556 and GEOL 556.

GPHYS 557 Origin of the Solar System (3) *Brownlee* Nebular and nonnebular theories of solar system origin; collapse from the interstellar medium, grain growth in the solar nebula, formation of planetesimals and planets, early evolution of the planets and other possible planetary systems; the physical and chemical evidence upon which the ideas concerning the origin of the solar system are based. Offered jointly with ASTR 557 and GEOL 557.

GPHYS 560 Mechanics of Erosion and Sediment Transport (3) A Physics of erosion, deposition, and transportation of sediments by turbulent flows. Use of theoretical fluid mechanics to formulate and solve problems of bed load and suspended load transport. Offered jointly with GEOL 560 and OCEAN 560. Prerequisites: 452 and MATH 329. (Offered odd-numbered years.)

GPHYS 561 Seminar in Geological Fluid Mechanics (3) W *J. D. Smith* Reading and discussion of topics of current interest in geological fluid mechanics. Course work includes a report on a specialized topic. Offered jointly with GEOL 561 and OCEAN 561. Prerequisite: permission of instructor.

GPHYS 562 Mechanics of Sediment Transporting Flows (3) A *J. D. Smith* Comprehensive investigation of mechanics of turbulent, near-bottom flows responsible for erosion and transportation of sediment. How bed load and suspended load transport modify characteristics of these flows. Marine, estuarine, and fluvial systems. Offered jointly with GEOL 562 and OCEAN 562. Prerequisites: GEOL 452 and 455. (Offered even-numbered years.)

GPHYS 570 Petroleum Exploration (3) W *Bostrom* The search for sediment basins and reservoirs. Financial and political considerations. Prerequisite: permission of instructor.

GPHYS 571 Gravity and Geomagnetic Interpretation (3) A Power of the numerical Fourier transform to compute potential fields; gravity and magnetic fields of source bodies of arbitrary shape; application of the techniques to a real problem on the computer. Offered jointly with OCEAN 571. Prerequisites: MATH 328, PHYS 323, or equivalent or permission of instructor.

GPHYS 572 Geodynamics (3) W *Lister* Driving forces of plate tectonics and of other large-scale motions. Critical review of measured data, energy balances, and the basic properties of low Reynolds number flow. Emphasis on the qualitative physics of the processes and on order-of-magnitude calculations, rather than on complex mathematic theory. Critiques of some hypotheses. Offered jointly with OCEAN 572. (Offered odd-numbered years.)

GPHYS 573 Terrestrial Magnetism (3) W *Merrill* Advanced aspects of earth magnetism intended for specialists in this field. Extensive discussion of origin theories and their implications; physical basis and theories of magnetism in rocks; paleomagnetic techniques and results. Offered jointly with OCEAN 573. Prerequisite: permission of instructor. (Offered alternate years.)

GPHYS 580 Special Topics in Geophysics (2-6, max. 12) AWSp Intensive treatment of a selected topic in geophysics presented by lectures or seminars for students in geophysics and related special fields. Subject is selected from all areas in geophysics and varies from year to year. Prerequisite: permission of instructor.

GPHYS 594 Waves in Geophysics and Engineering (3) Sp Fundamental concepts and mathematical descriptions of wave propagation; group and phase velocity, dispersion, effects of boundaries, normal mode and progressive wave descriptions; waves in elastic solids, acoustic waves, electromagnetic waves; sources of waves; waves in inhomogeneous media; applications to acoustics, seismology, and earthquake engineering. Offered jointly with CESM 594.

GPHYS 600 Independent Study or Research (*) AWSp

GPHYS 700 Master's Thesis (*) AWSp

GPHYS 800 Doctoral Dissertation (*)

Germanics

340 Denny

The Department of Germanics is concerned with the German language, literature, and civilization, with emphasis on present-day Germany, its history, literature, and philosophy and their role in Western civilization, and with linguistic analysis, especially historic, of the Germanic languages. The department offers in English some courses on well-known authors and topics, designed especially for the nonmajor.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: Traditional major—34 credits in core courses: GERM 301, 302, 303; 310, 311, 312; two from 401, 402, 403; two from 413, 414, 415; 18 credits of electives in upper-division German courses. *German area studies*—25 credits of lower-division college German or equivalent; 25 credits of upper-division German courses, including courses offered in English; 20 credits chosen from one of five interdepartmental areas of specialization; a senior thesis. At least a 2.0 grade must be earned in every upper-division German course; a 2.50 grade-point average must be maintained in these courses.

Graduate Program

Joseph B. Voyles, Graduate Program Coordinator

The Department of Germanics offers a closely integrated program leading to the Master of Arts and to the Doctor of Philosophy degrees. The doctoral curriculum serves the needs of the future professors at universities and colleges, stressing scholarship and research. The master's curriculum requires a minimum of 36 credits, a final comprehensive examination, and a master's thesis or two papers. The study period of the doctoral program is two years (minimum number of post-master's credits is 54). The completion of the necessary course work is followed by general written and oral examinations. A third doctoral year is reserved for the writing of the dissertation.

The M.A. program demands concentration on German literature, civilization, and philosophical traditions, with supplementary course work in at least one of the following three areas: philology and linguistics; methodology and pedagogy; related courses outside the Department of Germanics.

The curriculum for the Ph.D. program during the final two years of graduate study (minimum of 54 credits) allows the choice of one of two areas of concentration: either (1) "Literature and Civilization" and "German Philosophical Traditions," or (2) "Philology and Linguistics" and "Literature and Civilization"—plus supplementary course work in other areas (philology and linguistics; German philosophical traditions; methodology and pedagogy; related courses outside the Department of Germanics). The doctoral dissertation for both doctoral degrees must be an original contribution to scholarship and must demonstrate mastery of the pertinent methods of investigation.

Special Requirements

Aspirants for advanced degrees in German must have the equivalent of an undergraduate major in German. A reading knowledge of one foreign language (usually German) is a prerequisite for the M.A. degree. Reading knowledge of a second language is required before the student is admitted to the Ph.D. General Examination. The languages chosen are subject to approval by the department.

Financial Aid

A limited number of teaching assistantships are available. The teaching load consists of a five-hour course on the first- or second-year level. The teaching assistants are supervised by experienced staff members.

Correspondence and Information

Graduate Program Coordinator
340C Denny, DH-30

Faculty

Chairperson

Diana I. Behler

Professors

Behler, Diana I.,* (Comparative Literature),† Ph.D., 1970, Washington; romanticism, nineteenth century, comparative literature.

Behler, Ernst H.,* (Comparative Literature),† Ph.D., 1951, Munich; history of ideas and comparative literature.

Hertling, Gunter H.,* Ph.D., 1963, California (Berkeley); eighteenth- and nineteenth-century literature.

Hruby, Antonin,* (Comparative Literature),† Ph.D., 1946, Prague; medieval literature.

Rey, William H. (Emeritus), Ph.D., 1937, Frankfurt; nineteenth- and twentieth-century German literature.

Voyles, Joseph B.,* (Linguistics), Ph.D., 1965, Indiana; Germanics and linguistics.

Associate Professors

Ammerlahn, Hellmut H.,* (Comparative Literature),† Ph.D., 1965, Texas; classicism and comparative literature.

Barrack, Charles M.,* Ph.D., 1969, Washington; Germanic linguistics.

Buck, George C.,* Ph.D., 1954, Yale; eighteenth-century and modern German literature.

McLean, Sammy K.,* (Comparative Literature),† Ph.D., 1963, Michigan; twentieth century (poetry, Bertolt Brecht, Franz Kafka) and comparative literature.

Meyer, Herman C. (Emeritus), Ph.D., 1936, Chicago; Germanics.

Rabura, Horst M.,* M.A., 1966, Washington; German language and methodology.

Sauerlander, Annemarie M. (Emeritus), Ph.D., 1936, Cornell; Germanics.

Wilkie, Richard F. (Emeritus), Ph.D., 1953, California (Berkeley); Germanics.

Assistant Professors

Colin, Amy D., Ph.D., 1982, Yale; twentieth-century German literature, poetry, comparative literature.

Peck, Jeffrey M.,* (Comparative Literature),† Ph.D., 1979, California (Berkeley); nineteenth- and twentieth-century German literature, literary theory, comparative literature.

Rieckmann, Jens,* Ph.D., 1975, Harvard; twentieth-century German literature (fiction, turn of the century, Thomas Mann).

Teraoka, Arlene A., Ph.D., 1983, Stanford; German drama, German thought from the Enlightenment to the present, East German literature.

Course Descriptions

Lists of names under various literature courses indicate the kind of material covered but are neither comprehensive nor exclusive of other significant figures. Detailed descriptions of courses are published by the Department of Germanics prior to preregistration.

Courses for Undergraduates

GERM 101, 102, 103 First-Year German (5,5,5) AWS, AWSpS,AWSpS The methods and objectives are primarily audiolingual, with emphasis on speaking and listening. Secondary objectives are reading and writing. (See credit note following 115.)

GERM 104 Individualized First-Year German (1-15) AWSpS Individualized approach to elementary German instruction. Students progress at their own pace. Credits vary. Depending upon amount of material mastered, any number of credits up to 15 may be earned per quarter. Students must register initially for 5 credits and must pay for 5 credits regardless of number of credits earned. (See credit note following 115.)

GERM 111, 112, 113 First-Year German (5,5,5) AW, WSp,ASp Primary emphasis on accelerated acquisition of reading skill. Foundation for proficiency in writing, speaking, and listening is secondary objective. Uses structural and grammatical approach rather than an audiolingual approach. (See credit note following 115.)

GERM 115 Intensive First-Year German (15) S *Barrack, Rabura* Accelerated first-year German. Speaking and listening. Secondary objectives are reading and writing.

These courses are basically equivalent and may not all be taken for credit: 101, 111, and the first 5 credits of 104; 102, 112, and the second 5 credits of 104; 103, 113, and the last 5 credits of 104. Students may take other combinations for credit (e.g., the first 5 credits of 104 followed by 102 and then 113). 115 is the equivalent of 15 credits of any sequence above.

GERM 121, 122 First-Year Reading German (5,5) AS,WS Special beginning course devoted exclusively to the reading objective; 122 continuation of 121. For graduate students only.

GERM 150 Conversational German Through Films (2, max. 6) AWSp Conversational practice in small groups based on films. Because series progresses through the year, beginners may enroll only Autumn Quarter. May be taken concurrently with other Germanics courses.

GERM 201 Basic Second-Year German (5) AWSpS Readings and oral practice in German, plus grammar review. The student may not receive credit for both 201 and 211. Prerequisite: 103 or equivalent.

GERM 202 Intermediate Second-Year German (5) AWSpS Continuation of 201. The student may not receive credit for both 202 and 212. Prerequisite: 201 or equivalent.

GERM 203 Introduction to German Literature and Thought (3) AWSp Introduction to classics of German literature. Majors and minors take concurrently with 207. Prerequisite: 202 or equivalent.

GERM 207 Advanced Second-Year Conversation (2) AWSp Discussion of general topics in order to develop oral fluency. Prerequisite: 202 or equivalent.

GERM 211 Basic Second-Year Reading (5) Primary emphasis on the reading skill. The active reproduction of German is deemphasized. The student may not receive credit for both 201 and 211. Prerequisite: 113 or equivalent.

GERM 212 Intermediate Second-Year Reading (5) Readings in German history and culture. Student may do supervised work in readings relating to his own discipline. The student may not receive credit for both 202 and 212. Prerequisite: 211 or equivalent.

GERM 213 Advanced Second-Year Reading (3) Readings in contemporary German history and culture. Student may do readings relating to his own discipline. Prerequisite: 212 or equivalent.

GERM 230 Conversational German (5) S Intensive conversational German. Prerequisite: 103 or equivalent.

GERM 250 Advanced Conversational German Through Films (2, max. 6) AWSp Conversational practice in small groups based on films. May be taken concurrently with other Germanics courses.

GERM 299 Supervised Study (1-5, max. 10) AWSpS Prerequisite: permission of department adviser.

GERM 300 Studies in Germanics (3 or 5) Topics or figures of German literature or language. German texts. Prerequisite: 15 credits in second-year German or equivalent.

GERM 301, 302, 303 Grammar and Conversation (3,3,3) AW,WSp,Sp Materials used aim not merely at an increase in ability to speak, write, and understand German, but also at broadening the student's understanding of the culture of German-speaking countries. 301 emphasizes phonetics and vocabulary building. 302 and 303 stress conversation and composition. Prerequisite: 15 credits in second-year German or equivalent.

GERM 307 Third-Year Composition (5) S For participants in special summer programs only.

GERM 310 Introduction to Twentieth-Century Literature (3) AS Critical analysis, interpretation, and comparison of individual works by twentieth-century writers. Short stories, poems, and one play by authors such as Kafka, Zweig, Walser, Borchert, Böll, Aichinger, Trakl, Rilke, Heym, Brecht, and Frisch. Prerequisite: 15 credits in second-year German or equivalent or permission of instructor.

GERM 311 Introduction to the German Novella (3) WS Critical analysis, interpretation, and comparison of German novellas, and consideration of the theory and development of the German novella in the nineteenth century. Prerequisite: 15 credits in second-year German or equivalent or permission of instructor.

GERM 312 Introduction to Goethe (3) Sp Critical analysis and interpretation of Goethe's *Faust*, Part I, with consideration of the literary and historical background of the work, and critical analysis and interpretation of selected poems by Goethe. Prerequisite: 15 credits in second-year German or equivalent or permission of instructor.

GERM 330 Conversational German (5) S For participants in special summer programs only.

GERM 393 Proctoring of First-Year German Film Course (1-2, max. 6) AWSp Restricted to upper-division students of German who have demonstrated sufficient proficiency in speaking German to lead discussion groups of participants in 150. Discussion group leaders (proctors) may participate in this program one or two hours per week and receive one credit for each hour in class. 6 credits may be earned by proctors for participating in three quarters of 150, which runs the entire year under a different format each quarter.

GERM 394 Proctoring of Second-Year German Film Course (1-2, max. 6) AWSp Restricted to upper-division students of German who have demonstrated sufficient proficiency in speaking German to lead discussion groups of participants in 250. Discussion group leaders (proctors) may participate in this program one or two hours per week and receive one credit for each hour in class. 6 credits may be earned by proctors for participating in three quarters of 250, which runs the entire year under a different format each quarter.

GERM 401, 402 Grammar and Composition (3,3) A,W Prerequisites: 301, 302, and 303, or permission of instructor.

GERM 403 Grammar and Stylistics (3) Sp Analysis of various writing styles. Prerequisite: 401 or 402 or equivalent or permission of instructor.

GERM 404 History of the German Language (3) From early Germanic to the present. Prerequisite: third-year German, or permission of instructor.

GERM 405 Linguistic Analysis of German (3) Prerequisite: third-year German or permission of instructor.

GERM 407 Advanced Composition (5, max. 10) S For participants in special summer programs only. Not open for credit to those who have had 401, 402, 403.

GERM 410, 411, 412 Survey of Modern German Literature and Culture (3,3,3) A,W,Sp 410: German Romanticism—literature from 1800 to 1830 with esthetic and historical consideration of works by Novalis, Brentano, Eichendorff, Heine, Kleist, Büchner, E. T. A. Hoffmann, Grillparzer, and others. 411: Nineteenth Century Realism—literature from 1830 to 1890, with esthetic and historical consideration of works by Keller, Hebbel, Meyer, Stifter, Fontane, and others. 412: The Twentieth Century—literature from 1890 to 1945, with esthetic and historical consideration of works by Hauptmann, Kaiser, Brecht, Kafka, Mann, Rilke, Trakl, Stadler, Stramm, van Hoddis, and others. Prerequisite: for either 410, 411, or 412, 15 credits in third-year German, or permission of instructor.

GERM 413, 414, 415 Survey of Older German Literature and Culture (5,5,5) A,W,Sp 413: Medieval Literature—German literature from 750 to 1400, with esthetic and historical consideration of works from the Carolingian and Cluniac Periods, the Court Epic, the Heroic Epic, the Spielmannsepik, the Minnesang, the poetry of the epigones who followed the Age of High Chivalry, and the German Mystics. 414: Literature of the Sixteenth, Seventeenth, and Early Eighteenth Centuries—esthetic and historical consideration of authors and works such as the *Ackermann aus Böhmen*, Erasmus, Luther, Hans Sachs, the *Historia von Dr. Faustus*, Baroque poetry and the literature of the early Enlightenment. 415: Literature of the Eighteenth Century—esthetic and historical consideration of works by Lessing, Schiller, and Goethe, with attention to the historical background and development of German Classicism. Prerequisite: for either 413, 414, or 415, 15 credits in third-year German, or permission of instructor.

GERM 430 Advanced Conversational German (5, max. 10) S For participants in special summer programs only. Not open for credit to those who have had 401, 402, 403.

GERM 473 Teaching of College-Level German (1, max. 9) AWSp For teaching assistants only.

GERM 479 Special Topics in the Teaching of Foreign Languages (3, max. 9) S Intensive workshop for in-service and preservice teachers of all foreign languages on some aspect of foreign-language teaching methodology. Prerequisite: foreign-language teaching experience or participation in a previous foreign-language methods course.

GERM 490 Contemporary German Literature (3) Interpretation of selected works by contemporary German authors.

GERM 491 Studies in German Poetry (3) Introduction to various methods of interpretation and to their practical application.

GERM 492 History of Germanic Philology (3) Introduction to the works of outstanding scholars in the field of Germanics.

GERM 495 Proseminar in German Literature (3, max. 15) Special topics, the subject matter and depth of which are not included in other literature courses arranged through consultation between students and faculty. Prerequisite: 15 credits in third-year German or permission of instructor.

GERM 497 Studies in German Literature (1-6, max. 15)

GERM 498 Studies in the German Language (1-6, max. 15)

Courses in English

GERM 240 German Civilization and Literature (5) Development of German civilization, stressing major periods, emphasizing their respective paradoxical nature by a discussion of historical, social, and philosophical aspects as represented in contrasting trends of written work of that period. In English.

GERM 340 Friedrich Nietzsche in English (5) Analysis of Friedrich Nietzsche's chief works and the discussion of his position within modern German literature and thought.

GERM 341 Franz Kafka in English (5) Short stories and novels of Franz Kafka; emphasis on philosophical relevance and esthetic significance.

GERM 342 Thomas Mann in English (5) Some of Thomas Mann's theoretical writings, short stories, and novels, interpreted within the wider context of German literature and philosophy at the turn of the century.

GERM 343 The Theme of God's Death in German Thought in English (5) Discussion of the great controversies about the traditional concept of God, pantheism, atheism, and nihilism, which mark German thought and literature since the late eighteenth century and throughout the nineteenth century.

GERM 344 The Late Hesse in English (5) Major novels of Hermann Hesse discussed within the framework of the European intellectual tradition and with regard to their present popularity in the United States. The crisis of human individuality in a technological world is the major philosophical focus.

GERM 345 Bertolt Brecht in English (5) Brecht's life and work, particularly his plays and writings on theatre, and some poems and short prose pieces to provide additional perspective on his life and work as a whole. The development of his writing and of his ideas and attitudes.

GERM 346 The Contemporary German Novel in English (5) Major novels of the postwar period (1945 to present), discussed in their historical context. Contrasts between West and East German writers, such as Mann, Frisch, Grass, Böll, Lenz, Wolf, and Plenzdorf.

GERM 349 Goethe in English (5) Selected major works (especially Faust) of Goethe, whose literary, philosophical, and scientific achievements are examined as integral parts of his quest for meaning, wholeness, and universality, and whose impact on Western thinking is traced up to Thomas Mann and C. G. Jung.

GERM 350 The German Drama in English (5) German drama from the eighteenth to the twentieth centuries. German history and culture as reflected in the plays. Discussion of major themes.

GERM 351 Vienna 1900 in English (5) Interdisciplinary study of Vienna at the turn of the century. Discussion of literary texts with emphasis on other intellectual and cultural trends of this very rich and complex period.

GERM 352 Literature and Society in Weimar and National Socialist Germany in English (5) Literature, theater, and film, with adjunct consideration of art and architecture, in relation to the German social and cultural situation *circa* 1918 to *circa* 1947.

GERM 353 Germany: East and West—Literature and Culture in English (5) Postwar development and present-day character of the literature and the cultural, social, and political life in the German Democratic Republic and the Federal Republic of Germany. Readings include works by Böll, Grass, Wolf, Plenzdorf and nonliterary texts devoted to culture and everyday life in the two German states.

GERM 370 Man's Quest for Meaning in Contemporary Thought in English (3) Search for meaningful existence in contemporary thought. The main goal is to present this aspect of modern life to a broader community of students and to discuss with them problems that constitute a challenge to an understanding of ourselves.

GERM 390 Germanic Studies in English (3 or 5) Topics or figures of German literature or language.

Courses for Graduates Only

GERM 500 Literary Theory, Methodology, and Bibliography (3) A Historical survey and analysis of criticism (Methodengeschichte) and modern trends in contemporary theory. Methods of research and bibliography, as well as theoretical aspects of practical interpretation.

GERM 503 Contemporary German Literature (3) Seminar analyzing the esthetic movements and thought of contemporary West, as well as East German literature, the social and political problems dealt with in the works of representative authors, and major experimental concepts. Some previous exposure to the German literature and civilization after 1945 is expected.

GERM 504 Special Studies in Literary Criticism and Theory (3, max. 9) Literary criticism and theory, focusing on special topics proposed by the instructor. Taught in English. Prerequisite: 500 or equivalent.

GERM 510 Medieval Literature and Civilization (3) A German literature and civilization from 750 to 1400, with esthetic and historical consideration of works from the Carolingian and Cluniac periods, the Court Epic, the Heroic Epic, the Spielmannsepik, the Minnesang, the poetry of the epigones who followed the Age of High Chivalry, and the German Mystics. Prerequisite: permission of department or departmental coordinator.

GERM 511 Literature and Civilization From 1400 to 1700 (3) W Survey of fifteenth-, sixteenth-, and seventeenth-century culture and literature for students with no previous instruction in this period. Discussion of works by Tepl, Brant, Erasmus, Luther, Sachs, Grimmelshausen, Opitz, Gryphius, and other poets of German Renaissance, humanism, and baroque. Prerequisite: permission of department or departmental coordinator.

GERM 512 Literature and Civilization of the Eighteenth Century (5) A Survey of German literature of the eighteenth century, presented within the context of European civilization during that period. Prerequisite: permission of department or departmental coordinator.

GERM 513 Proseminar in German Literature of the Eighteenth Century (3) A Discussion and critical evaluation of representative topics selected from the German literature of the eighteenth century. Prerequisite: permission of department or departmental coordinator.

GERM 514 Literature and Civilization of the Nineteenth Century (5) W Survey of nineteenth-century German literature. Major contributions from German-speaking countries such as Austria and Switzerland, within the context of European civilization during that period. Prerequisite: permission of department or departmental coordinator.

GERM 515 Proseminar in German Literature of the Nineteenth Century (3) W Discussion and critical evaluation of representative topics selected from the German literature of the nineteenth century. Prerequisite: permission of department or departmental coordinator.

GERM 516 Literature and Civilization of the Twentieth Century (5) Sp Survey of modern German literature from the turn of the century to our own time. Major contributions from German-speaking countries such as Austria and Switzerland, within the context of European civilization during that period. Prerequisite: permission of department or departmental coordinator.

GERM 517 Proseminar in German Literature of the Twentieth Century (3) Sp Discussion and critical evaluation of representative topics selected from the German literature of the twentieth century. Prerequisite: permission of department or departmental coordinator.

GERM 521 Seminar in the Literature of the Reformation and Renaissance (3)

GERM 522 Seminar in Baroque (3)

GERM 525 Seminar in Romanticism (3)

GERM 526 Seminar in Nineteenth-Century Drama (3)

GERM 527 Seminar in Nineteenth-Century Prose (3)

GERM 528 Nineteenth-Century Poetry (3) Representative selections from Hölderlin, the late Goethe, and from prevalent trends in nineteenth-century poetry such as romanticism, "Young Germany," poetic realism, and the experimental poetry of naturalism.

GERM 533 Seminar in Eighteenth-Century Literature (3) Study of one or more of the literary movements: Enlightenment, sentimentalism, anacreontics, storm and stress, classicism, early romanticism, and works by principal authors such as Gottsched, Bodmer, Gellert, Lessing, Wieland, Klopstock, Herder, Lenz, Goethe, Schiller, Jean Paul.

GERM 534 Storm and Stress (3) Extensive investigation of poetological and esthetic concepts advanced by initiators and exponents of German storm and stress. Analyses of narrative and dramatic works of storm and stress reveal reflections and implementations of the new theoretical concepts.

GERM 535 Classicism: Goethe, Schiller (3)

GERM 540 Twentieth-Century Poetry (3) Development of German poetry from Rilke, Hofmannsthal, and George through Trakl, Benn, the Expressionists and the Dadaists, Brecht, and Enzensberger, to such contemporaries as Eich, Heissenbüttel, the concrete poets, Celan, and Bachmann.

GERM 541 Twentieth-Century German Drama (3) Selection from modern German drama representative of the concern with the human condition, of social criticism, and of experimentation with the new dramatic forms.

GERM 542 Twentieth-Century Prose (3) Selected modern German novels, short novels, and short stories by representative authors dealing with the social and political problems of Germany as well as with individual problems of existence and identity.

GERM 550 Gothic (3)

GERM 551 Seminar in Germanic Philology and Linguistics (3) Topics vary. Prerequisites: basic knowledge of German and at least one elementary linguistics course.

GERM 552 Old High German (3)

GERM 555 Old Saxon (3)

GERM 556 Middle High German (3)

GERM 560 Modern Dialects (3)

GERM 565 Seminar in Courtly Epic (3) Aspects and methods of literary analysis pertaining to the study of medieval courtly epics.

GERM 567 Minnesang (3) In-depth study of medieval German lyrics in the context of German and European literary and intellectual development. Poems of the period from Kurenberger through Walther are analyzed with stress on grammatical, formal, stylistic, and ideological interpretation. Prerequisite: adequate knowledge of Middle High German.

GERM 568 Seminar in Heroic Epic (3) Literary and historic problems of the German heroic epic, with special emphasis on the *Nibelungenlied* and the *Dietrichsepik*.

GERM 575 Teaching of German Literature and Civilization (3) Teaching of German language and literature on the advanced level in secondary schools and colleges.

GERM 576 Modern Methods and Materials in Teaching German (3) The audiolingual method and its application; current developments in foreign-language teaching; evaluation of teaching materials.

GERM 580 Seminar in German Literature (3, max. 12) Open topics seminar with varying content.

GERM 581 Seminar in Poetry (3, max. 12) Open topics seminar with varying content.

GERM 582 Seminar in Drama (3, max. 12) Open topics seminar with varying content.

GERM 583 Seminar in Prose (3, max. 12) Open topics seminar with varying content.

GERM 590 German Mysticism of the Late Middle Ages (1-5)

GERM 591 German Idealism and Materialism (3)

GERM 592 German Existentialism and Neomarxism (3)

GERM 600 Independent Study or Research (*) AWSpS

GERM 700 Master's Thesis (*) AWSpS

GERM 800 Doctoral Dissertation (*) AWSpS

History

315 Smith

History undertakes the study of human affairs in a manner that seeks to understand change and development rather than the state of things at a given moment, taking into account societies in diverse parts of the world from the earliest times for which written records exist to the present.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: 55 credits in history with a grade-point average of 2.00 or higher. At least 5 credits each of ancient, medieval, modern European, and United States history (HST 111, 112, 113, and HSTAA 201 or upper-division courses in the same subject areas; adviser must approve substitutions for the basic courses) plus an additional 5 credits in the history of some area or nation outside Europe, the United States, and Canada. At least 25 upper-division credits. One undergraduate seminar or colloquium is required, and each history degree candidate must write at least one major paper in an upper-division course. Beyond the required subjects, the student may or may not specialize, depending upon personal interests and career plans. In addition to all courses with the prefix HST, the history major may include approved courses offered outside the Department of History. A short list of these courses is maintained by undergraduate advisers. Transfer students are required to complete a minimum of 25 upper-division credits in history at the University.

Graduate Program

Thomas L. Hankins, Graduate Program Coordinator

The Department of History offers graduate training leading to the Master of Arts and Doctor of Philosophy degrees in a large number of fields within the discipline. Two pathways, one a general M.A. and the other a preparation for the Ph.D. program are offered. Students in the programs can prepare for careers as college or secondary-school teachers or as members of university faculties who combine teaching with scholarship and professional writing, for positions as archivists, librarians, or editors. A few graduates enter government service, college administration, or publishing. The M.A. program is normally completed in four or five full academic quarters or their equivalent. The Ph.D. program requires at least three years of full-time work beyond the M.A. degree. Graduate training at both levels includes (1) course work or independent study leading to examinations in special historical fields, and (2) sustained investigation and interpretation of historical problems in seminars involving the writing of essays and a thesis.

Special Requirements

Admission to the graduate program requires a sound undergraduate major in history or in one of the basic disciplines related to history completed within a college of liberal arts and sciences. The department also requires evidence of the applicant's ability to write cogently and lucidly and to interpret historical data.

Financial Aid

Beginning graduate students may qualify for a very limited number of readerships. Students with, or who expect to receive, the M.A. degree by the time they begin their duties may apply for an appropriate level of teaching assistantships and may, with continued satisfactory scholarly progress, expect reappointment for a total of three years, provided adequate funds are available.

Correspondence and Information

Graduate Program Coordinator
206 Smith, DP-20

Faculty

Chairperson

Wilton B. Fowler

Professors

Alden, Dauril,* Ph.D., 1959, California (Berkeley); Latin American history, comparative colonial history.

Bacharach, Jere L.,* (Near Eastern Languages and Civilization), Ph.D., 1967, Michigan; history of the Near East.

Bestor, Arthur (Emeritus), Ph.D., 1938, Yale; history

Boba, Imre,* (International Studies), Ph.D., 1962, Washington; medieval history and East European studies.

Bridgman, Jon,* Ph.D., 1960, Stanford; modern German history (especially military), Africa.

Burgess, Charles O.,*‡ (Education), Ph.D., 1962, Wisconsin; history of education.

Burke, Robert E.,* Ph.D., 1950, California; American political and social history in the twentieth century.

Butow, Robert J. C.,* (International Studies),† Ph.D., 1953, Stanford; history of modern Japan, diplomatic history of the Far East.

Bynum, Caroline W.,* Ph.D., 1969, Harvard; medieval history.

Carstensen, Vernon (Emeritus), Ph.D., 1934, State University of Iowa; history.

Chan, Hok-lam,*‡ (International Studies), Ph.D., 1967, Princeton; late traditional China.

Conlon, Frank F.,* (International Studies),† Ph.D., 1969, Minnesota; history of India.

Costigan, Giovanni (Emeritus), Ph.D., 1930, Wisconsin; history.

Ellison, Herbert J.,* (International Studies),† Ph.D., 1955, London; modern Russian history.

Ferrill, Arther L.,* Ph.D., 1964, Illinois; ancient history.

Fowler, Wilton B.,* Ph.D., 1966, Yale; American diplomatic history.

Freidel, Frank B., Ph.D., 1942, Wisconsin; Bullitt Professor of American history.

Griffiths, Gordon (Emeritus), Ph.D., 1942, California (Berkeley); history.

Hankins, Thomas L.,* Ph.D., 1964, Cornell; history of science.

Katz, Solomon (Emeritus), Ph.D., 1933, Cornell; history.

Levy, Fred J.,* Ph.D., 1960, Harvard; history of England in the sixteenth and seventeenth centuries, English historiography.

Pease, Otis A.,* Ph.D., 1954, Yale; United States in the twentieth century.

Pinkney, David H.,* Ph.D., 1941, Harvard; France since 1814.

Pressly, Thomas J.,* Ph.D., 1950, Harvard; American Civil War and Reconstruction, political history of the United States since 1860.

Pyle, Kenneth B.,* (International Studies),† Ph.D., 1965, Johns Hopkins; modern Japanese history.

Saum, Lewis O.,* Ph.D., 1962, Missouri (Columbia); American intellectual history.

Solberg, Carl E.,* Ph.D., 1966, Stanford; Latin America.

Sugar, Peter F.,* (International Studies),† Ph.D., 1959, Princeton; political and economic history of eastern Europe and Near East since the eighteenth century.

Szeftel, Marc M. (Emeritus), Docteur en droit, 1934, Lic. Slav. Phil. Hist., 1939, Université Libre de Bruxelles; history.

Thomas, Carol G.,* Ph.D., 1964, Northwestern; ancient history.

Treadgold, Donald W.,* (International Studies),† D.Phil., 1950, Oxford (England); modern Russia.

Ullman, Joan C.,* Ph.D., 1963, Bryn Mawr; modern Spain.

Associate Professors

Bell, Aldon D.,* Phil., 1961, Oxford (England); modern Britain, empire and commonwealth.

Dull, Jack L.,* (International Studies),† Ph.D., 1966, Washington; early Chinese history.

Emerson, Donald E.,* Ph.D., 1942, Johns Hopkins; history of modern Germany.

Gil, Carlos B.,* Ph.D., 1975, California (Los Angeles); Latin America and history of the Chicano people.

Hanley, Susan B.,*‡ (International Studies), Ph.D., 1971, Yale; premodern Japan.

Johnson, Richard R.,* Ph.D., 1972, California (Berkeley); United States colonial history.

Lytle, Scott H.,* Ph.D., 1948, Cornell; history of France (especially the Revolution).

Palais, James B.,* (International Studies),† Ph.D., 1968, Harvard; modern Korean history.

Rorabaugh, William J.,* Ph.D., 1976, California (Berkeley); United States social history.

Toews, John E.,* Ph.D., 1973, Harvard; modern English history.

Waugh, Daniel C.,* (International Studies),† Ph.D., 1972, Harvard; medieval Russian history.

Assistant Professors

Behlmer, George K.,* Ph.D., 1977, Stanford; modern European intellectual history.

Benin, Stephen D.,‡ Ph.D., 1980, California (Berkeley); medieval Jewish history and thought.

Birt, Michael, ‡ (International Studies), Ph.D., 1983, Princeton; Japanese history.

Blair, Karen J.,‡ Ph.D., 1976, State University of New York (Buffalo); American history.

Guy, R. Kent,* (International Studies),† Ph.D., 1980, Harvard; modern Chinese history.

Leiren, Terje I.,*‡ (Scandinavian Languages and Literature), Ph.D., 1968, North Texas State; Scandinavian history.

O'Neil, Mary R., Ph.D., 1982, Stanford; Renaissance and Reformation history.

Ramet, Pedro,‡ (International Studies), Ph.D., 1981, California (Los Angeles); Soviet and East European studies.

Runte, Alfred,* Ph.D., 1976, California (Santa Barbara); American history, Western and environmental history.

Course Descriptions

Upper-division courses (300 and 400 level) in the Department of History do not generally require prerequisites. Most 400-level courses deal with a single nation during a limited period. The 300-level courses deal with broader subjects at a relatively advanced level. Both are primarily for juniors and seniors, but they are open to freshmen and sophomores with an interest or background in the subject of the course.

Courses for Undergraduates

General History

HST 111 The Ancient World (5) A *Bridgman, Ferrill, C. Thomas* Origins of Western civilization to the fall of Rome.

HST 112 The Medieval World (5) *Bacharach, Boba, Bridgman; Lytle* Political, economic, social, and intellectual history of the Middle Ages. Not open to students who have taken HSTAM 331 or 332 or 333.

HST 113 The Modern World (5) Sp *Bridgman, Pinkney, Sugar* Political, economic, social, and intellectual history of modern Europe. Not open to students who have taken HSTEU 302 or 303.

HST 140 Russia from the Tenth Century to the Present (5) *Waugh* Russian political, social, and economic history from the tenth century to the present. Offered jointly with SISRE 140.

HST 192 The Historian as Detective (5) Examples illustrate how "clues" from the past are used by historians to build inferential "cases"; collection, analysis, and interpretation of evidence as a historical method. Open to all students; recommended for history honors students.

HST 193 Introduction to World History, 1750-Present (5) Sp *Conlon, Johnson, Solberg, Sugar* Tendencies toward uniformity caused by developmental focuses in the face of traditional patterns (e.g., ideology, urbanization, industrialization, nationalism). How the development of the world tended toward uniformity despite survival of traditional forces.

HST 204 Europe and America in the Era of the World Wars (5) *Bridgman, Burke* Declining role of Europe in the world and rise of the United States from 1914 to 1945.

HST 207 Introduction to Intellectual History (5) *Toews* Ideas in historical context. Comparative and developmental analysis of Western conceptions of "community," from Plato to Freud.

HST 215 The History of the Atomic Bomb (5) *Hankins* History of the atomic bomb from the beginning of nuclear physics to the security hearing of J. Robert Oppenheimer. Includes a study of the scientific achievements that made the bomb possible, the decision to deploy the bomb, the moral misgivings of the scientists involved.

HST 242 Europe Discovers the World (5) *Alden, Waugh* Great explorers and their discoveries from Marco Polo to Captain Cook. Impact of the discoveries on Europeans' perceptions of the world and on non-European peoples brought into contact with European civilization.

HST 250 The Jews in Western Civilization (5) *Benin* Jewish historical experience in the Mediterranean and European worlds from ancient Greece to modern-day Israel. Examines the condition of Jewish life in the larger societies of which Jews have always formed a part. Emphasis on the areas of contact between the Jewish and the gentile worlds.

HST 261 Survey of the Muslim Near East (5) *Bacharach* The Middle East (the Arab countries, Israel, Turkey, Iran, and Afghanistan) from the emergence of Islam in A.D. 622 to the present: Culture, economics, politics.

HST 294 Honors Historiography (5) *Levy* Readings in the great historians, from the earliest time to the beginning of the twentieth century. Investigates how perception of the human past has altered our times. Recommended for students in the department's honors program, but also open to nonhonors students.

HST 304 European Expansion Overseas Since 1650 (5) *Bell* Expanding northern European empires (England, Holland, France) of the seventeenth and eighteenth centuries; British naval and economic preeminence in the early nineteenth century; height of European expansion and conflict overseas from 1870 to 1920; imperial disintegration and collapse in the mid-twentieth century; legacy of empires and imperialism. Recommended: survey course in modern European history.

HST 307 History of Christianity (5) *Treadgold* Christian religion, including doctrine, practice, church organization, and culture, from the time of Jesus Christ to the present. No attempt to avoid the controversial aspects of the topic is made, but the necessity of founding argument on knowledge is stressed.

HST 309 Marx and Nietzsche: The Assault on Bourgeois-Christian Civilization (5) *Toews* Major dilemmas and conflicts of modern Western consciousness through historical analysis of Marx, Nietzsche, and the movements they spawned. Emphasis on the relationship between sociocultural change, biography, and ideological innovation. Recommended: 113 or 207.

HST 310 Science and Religion in Historical Perspective (5) *Hankins* Scientific and religious ideas have been two of the major forces shaping our modern view of the world. Often regarded as being in conflict, they can equally well be seen as complementary and interdependent. Study of the relationship between scientific and religious ideas with focus on particular episodes of history from ancient to modern times.

HST 311 Science in Civilization: Antiquity to 1600 (5) *Hankins* From preclassical antiquity to the end of the Middle Ages, stressing the growth of scientific ideas, the cultural context in which they take shape, and their relationship to other movements of thought in the history of civilization.

HST 312 Science in Civilization: Science in Modern Society (5) *Hankins* Growth of modern science since the Renaissance, emphasizing the scientific revolution of the seventeenth century, the development of methodology, and the emergence of new fields of interest and new modes of thought.

HST 314 The Psychoanalytic Revolution in Historical Perspective (5) Genesis and evolution of Freudian theory in context of the crisis of liberal-bourgeois culture in central Europe and parallel developments in philosophy, literature, and social theory. Emergence and division of the psychoanalytic movement. Transformation of psychoanalysis as it was absorbed into British, French, and especially American cultural traditions. Recommended: 207 and 113 or HSTEU 303.

HST 330 The United States in Eastern Asia, 1784-1945 (5) *Butow* The United States in eastern Asia from the arrival of the first American vessel at Canton to the end of the war in the Pacific, with emphasis on the Far Eastern policy of the United States during the first four decades of the twentieth century. Offered jointly with SISEA 330.

HST 345 War and Society (5) *Bridgman* Analysis of the techniques of war from the Renaissance to the present with consideration of the social, political, and economic consequences of war in the Western world.

HST 361 Slavery in History: A Comparative Study (5) *Bacharach* Slavery as a universal historical phenomenon lending itself to a comparative analysis is studied in terms of its philosophical justifications, economic importance, and local practices. The following historical periods are surveyed: the ancient Near East, Greece, Rome, Islam, Africa, Latin America, and North America.

HST 362 U.S. Reconstruction in Comparative Perspective (5) Reconstruction in the southern United States, 1865-77, compared with situations and conditions existing after slavery was formally abolished in the northern United States, Haiti, Jamaica, Canada, Russia, Cuba, Brazil, and Zaria (in northern Nigeria).

HST 363 Wars in the Modern Near East (3) *Bacharach* The Middle East, scene of some of the most significant military events in modern world history, with focus on the repercussions for participants in terms of political and psychological changes. Resident military specialists supplement the historical approach by analyzing the battles and wars on these terms.

HST 370 History of the Expansion of Islam (5) *Bacharach, Conlon* Comparative perspective on the expansion of the religion and community of Islam from its origins to the modern age. Patterns and processes of expansion, conversion, and social and cultural assimilation in a number of world regions (e.g., the Arab World, Iberia, Anatolia, West Africa, Iran, India, and Southeast Asia). Specific case studies of Islam in its regional setting (e.g., South Asia).

HST 391-392 Honors Colloquium in the History of Ideas (5-5) Discussion of selected topics in the history of ideas; writing of an interpretive essay.

HST 395 Modern Historical Writing, Honors Seminar (5) *Levy* New types of problems examined by historians and new techniques that have evolved for solution. Brief historiographical introduction, reaching back to the "scientific" historians of the mid-nineteenth century, then continues by examining the impact on historians of new disciplines such as psychology, sociology, and economics, and of new techniques such as statistics and prosopography. Readings are in the theorists and in those who followed their lead. Admission by departmental invitation only.

HST 411 Origins of Modern Science: The Physical Sciences (5) *Hankins* History of the physical sciences seen through an intensive study of key periods in their development. Emphasis on the nature of scientific revolutions and the role of individual scientists. Prerequisite: one introductory course in a physical science.

HST 412 Science and the Enlightenment (5) *Hankins* The role of science in relation to intellectual, social, economic, and religious forces in the eighteenth century, and growth of the international community in science during the same period.

HST 425 History of the British Empire and Commonwealth Since 1783 (5) *Bell* Britain in the Caribbean, Africa, India, Southeast Asia, and the Pacific; and the settlement, economic development; and political evolution of Canada, Australia, New Zealand, and South Africa.

HST 448 Franklin D. Roosevelt and His World, 1882-1945 (5) Sp *Butow* Life and times of the thirty-second President of the United States, with emphasis on American foreign relations—especially the role he played in the emergence of the United States as a world power. Offered jointly with SIS 448.

HST 461 History of the Middle East: 622-1300 (5) *Bacharach* Political and economic analysis of the period *ca* A.D. 600, preliminary to rise of Islam, to arrival of the Turks. Muhammad's teaching and impact; Islamization and Arabization.

HST 462 History of the Middle East: 1258-1798 (5) *Bacharach* Conquests by successors of Ghengis Khan; creation in Egypt, Syria, and Iran of cavalry-based states; domination of political, social, and economic history by Ottoman and Safavid empires. The Napoleonic invasion.

HST 463 History of the Middle East Since 1789 (5) *Bacharach* Critical issues and themes in the changing Middle East, including Westernization, growth of nationalism, Arab-Israeli dispute, Iranian revolution, and the role of Islam.

HST 464 History of North Africa (5) North Africa (Libya, Tunisia, Algeria, and Morocco) from the time of the Muslim conquest to the establishment of independence from European colonial rule. Economic, social, and cultural developments are emphasized, as is the process by which separate states came into being. Relations with the rest of the Muslim world, with Africa to the south, and with Europe are examined.

HST 467 Nations and States in the Modern World (5) *Treadgold* Development of national consciousness in the "old nations" of Europe before the French Revolution. Replacement by new nationalism, spreading into East Central Europe, Russia, Ibero-America, Asia, and Africa. Offered jointly with SIS 467.

HST 468 History of the Jews From the Spanish Expulsion to the French Revolution (5) Jews in the early-modern period. The Spanish expulsion in 1492 to the onset of political and social emancipation in western Europe and America.

HST 469 Introduction to Modern Jewish History (3 or 5) Selective problems in modern Jewish history, 1789-1948.

HST 470 Medieval Jewish History (5) Social and intellectual history of the Jews in western Europe to the fifteenth century. Jews under Islam and Christianity; the church and the Jews; the Crusades and their legacy; intellectual achievements; conflict and cooperation.

HST 471 History of the Jews in eastern Europe (5) Jews in eastern Europe, from the Khazars to the Holocaust.

HST 481 Economic History of Europe (5) Origins of the modern European economy; historical analysis of economic change and growth from medieval times that stresses the preconditions and consequences of industrialization. Offered jointly with ECON 460. Recommended: ECON 200, 201.

HST 491-492 Honors Historical Method (5-5) W,Sp The purposes, materials, and techniques of historical scholarship. Theory, practice, and criticism.

HST 498 Colloquium in History (3-5, max. 15) Each seminar examines a different subject or problem. A list of the seminars and their instructors is available in the Department of History office. Students must have the permission of the instructor of the seminar in which they plan to enroll.

HST 499 Undergraduate Research (1-5, max. 15) AWSp

History of the Americas

HSTAA 135 The American People and Their Culture in the Modern Era: A History of the United States Since 1940 (5) *Pease* Through study of documents, personal testimony, and other source materials, through written reports on historical problems, and through discussions, lectures, films, and audiovisual presentations, students are encouraged to examine evidence and to think "historically" about persons, events, and movements within the memory of their own generation and that immediately preceding theirs. Primarily for first-year students.

HSTAA 150 Afro-American History (5) Introductory survey of topics and problems in Afro-American history with some attention to Africa as well as to America. Provides some general knowledge and serves as a basic introductory course for a sequence of lecture courses and seminars in Afro-American history.

HSTAA 180 History of the Chicano People to 1848 (5) *Gil* Historical survey of the Chicano people from pre-Hispanic times to the war between the United States and Mexico.

HSTAA 181 History of the Chicano People Since 1848 (5) *Gil* Historical survey of the Chicano people since the war between the United States and Mexico. Recommended: 180.

HSTAA 201 Survey of the History of the United States (5) AWSp Supplies the knowledge of American history that any intelligent and educated American citizen should have. Objective is to make the student aware of his heritage of the past and more intelligently conscious of the present.

HSTAA 202 Makers of American Foreign Policy, 1776 to the Present (5) *W. Fowler* Survey of the history of American foreign relations. Focus on the individuals responsible for initiating new foreign policies or for realigning old ones.

HSTAA 203 American Presidents in the Twentieth Century (3 or 5) *Freidel* American presidents and the presidency in the twentieth century. Problems and policies in domestic and foreign affairs, from the administration of Theodore Roosevelt through that of Richard Nixon.

HSTAA 211 American Indian Wars (5) *Saum* Through lectures and weekly discussions of readings, this course analyzes and describes the course of the Indian wars from the early seventeenth century to the late nineteenth century. Focus on military operations with attention to cultural differences and geopolitical considerations.

HSTAA 218 Americans and Revolutions, Seventeenth-Twentieth Centuries (5) Experiences and attitudes of Americans with respect to revolutions at home and abroad, from the seventeenth century to the present.

HSTAA 281 Introduction to Latin American History: From Columbus to Castro (5) *Solberg* Survey of political, economic, and social history of Latin America from the Iberian conquest to the present. Lectures, discussions, and films focus on developing understanding of Latin America's current problems through study of their historical roots. Designed for the beginning student and the nonspecialist.

HSTAA 301 Foundations of American Civilization (5) *Johnson* Early America from the sixteenth century to the end of the American Revolution: the founding years, social and religious development, race relations, development of the Atlantic world, origins and legacy of American independence.

HSTAA 302 American Civilization: The First Century of Independence (5) *Rorabaugh, Saum* Establishment of the constitutional system; national expansion; intellectual and cultural development; internal conflicts, the Civil War, and Reconstruction.

HSTAA 303 Modern American Civilization From 1877 (5) *Burke, Pease, Pressly* Emergence of modern America, after the Civil War; interrelationships of economic, social, political, and intellectual developments.

HSTAA 333 The American South Since the 1920s (5) *Fowler* Political, social, and economic developments in the eleven states of the former Confederacy. Special attention to the questions of race relations, civil rights, and cultural distinctiveness. Recommended: 201.

HSTAA 351 Formation of the American Constitution to 1840 (3) English constitutionalism and its meaning for the colonies; the American Revolution; constitution making in the states; the Articles of Confederation and the Constitution of 1787; inauguration of the new government and adoption of the Bill of Rights; constitutional decisions of John Marshall; Jacksonian democracy and its constitutional implications.

HSTAA 352 American Constitutional History, 1860 to the Present (3) Sp *Johnson* Modern American constitutional development since the Civil War; the Supreme Court and the shift from economic issues to civil rights; Congress, the presidency, and the Constitution.

HSTAA 377 History of Canada (5) *Solberg* General survey and analysis of political, economic, social, and cultural aspects of Canadian history from the foundation of New France to present; Canadian-American relations, the rise of Quebec nationalism, and the development of the Canadian West.

HSTAA 381 Latin America: The Early Colonial Period (5) *Alden, Solberg* Discovery and founding of Spanish and Portuguese empires in the New World and their development until the eighteenth-century reorganizations.

HSTAA 382 Latin America: Late Colonial and Early National Periods (5) *Alden, Solberg* Imperial reforms, the struggle for independence; the founding of new nations.

HSTAA 383 Modern Latin America (5) *Solberg* Analysis of economic problems, political and social changes, and intellectual trends in major Latin American republics since the late nineteenth century.

HSTAA 384 Latin America: Inter-American and Intra-Continental Relations (5) Inter-American relations, focusing on the United States' diplomatic and military responses to the problems of Latin America since 1776. Intra-Latin American relations and regional organizations (e.g., the Organization of American States).

HSTAA 401 American Revolution and Confederation (5) *Johnson* Causes of separation of the United States from the British empire; political theory of the Revolution; its military history; diplomacy of the Revolution; the Revolution as a social movement; intellectual aspects; readjustment after independence; the formation of the American union; the Constitution.

HSTAA 404 New England: From the Foundings to the Civil War (5) *Johnson* New England from colonial beginnings to the region's emergence to national leadership in the mid-nineteenth century. Emphasis on Puritanism, the New England town, adjustment to empire, revolution and constitution making, the growth of party, abolitionism, the flowering of a regional culture, and the personalities who embodied these key themes and periods.

HSTAA 405 The South From 1600 to 1830 (5) *Johnson* The South from the founding of the plantation society to its emergence as a self-conscious section in the early nineteenth century. Emphasis on patterns of settlement, labor systems, the influences of trade and empire, regional politics, a provincial culture, and the South's role in the Revolution and the new nation, together with the personalities through which these themes were expressed.

HSTAA 407 Andrew Jackson's United States (5) *Rorabaugh* United States from 1820 to 1850, a period of unprecedented change in politics, society, and culture. Cities grew, factories were built, more people voted, and reformers advocated abolition, temperance, and women's rights. A basic knowledge of United States history is assumed.

HSTAA 409 American Social History: The Early Years (5) *Rorabaugh* Survey of American society and institutions from the colonial era through the Civil War, with special attention to reform, labor, immigration, education, law enforcement and the city.

HSTAA 410 American Social History: The Modern Era (5) *Rorabaugh* Survey of American society and institutions from Reconstruction to the present with special attention to reform, poverty, social mobility, immigrant and ethnic groups, the city and law enforcement.

HSTAA 411 The United States During the Era of Civil War and Reconstruction (5) *Pressly* Conflicting interests, ideologies, and ways of life in the United States from the 1840s to the 1870s.

HSTAA 412 The Westward Movement, 1700-1850 (5) *Runte* Anglo-American advance into interior of continental United States culminating in occupation of Far West. Rivalry with New France and New Spain in colonial period; role of federal government in westward expansion; land policy and land distribution; migration, settlement, and the pioneering experience; federal Indian policies and implementation; political evolution, urbanization, and economic development of trans-Appalachian West; shaping of national character and institutions.

HSTAA 413 History of the Trans-Mississippi West (5) *Runte* Anglo-American exploration, conquest, occupation, and exploitation of the trans-Mississippi West, with emphasis on economic development into the twentieth century. Considers wide range of developmental themes (social, political, cultural) in historiography of American West. Recommended: 412.

HSTAA 415 History of Indian-White Relations in Anglo-America (5) Indian-White contact, conflict, and accommodation from the Atlantic colonies in the seventeenth century to the American nation in the twentieth century.

HSTAA 421 American Environmental History (5) *Runte* American attitudes toward the natural environment. Impact of settlement on the major natural regions of the United States. Evolution of the conservation movement, including development of the national park system, national forest system, and emergence of the ecological perspective. Recommended: courses in forestry, environmental studies, geography, history, and related disciplines.

HSTAA 425 American Urban History Before 1870 (3 or 5) Early development of American cities.

HSTAA 426 American Urban History Since 1870 (3 or 5) Development of American cities for the past century. Topics include physical development, immigration, politics, and changes in society and culture.

HSTAA 431 American Politics and Society Since 1920 (5) *Burke, Pease* Political, social, economic, and intellectual developments in the United States from 1920 to the present.

HSTAA 432 History of Washington and the Pacific Northwest (5) *Runte, Saum* Exploration and settlement; economic development; growth of government and social institutions; statehood.

HSTAA 436 American Jewish History Since 1885 (5) Political, social, economic, and religious history of the American Jewish community from the period of the great eastern European migration until the present. The integration of the immigrant community into the general American community; the rise of nativism; the development of American socialism; World War I and World War II; and the reactions of the American Jews to these events.

HSTAA 450 American Labor History (5) *Burke* American workers and their efforts to organize and bargain collectively with their employers. Post-Civil War period. Radical movements and trade unions.

HSTAA 451 Constitution Making in America,1776-89 (5) Intensive study of the framing of the Articles of Confederation, the state constitutions, the territorial ordinances, the U.S. Constitution of 1787, and the Bill of Rights. Class discussions and term paper, in addition to required attendance at lectures offered in 351, which cover the English and colonial backgrounds and developments to 1840. Credit cannot be received for both 351 and 451.

HSTAA 454 The Intellectual History of the United States (5) *Saum* Lectures and discussions devoted to the development of the American mind, from historical beginnings to the present.

HSTAA 455 History of American Liberalism Since 1789 (5) *Burke, Pease, Pressly, Saum* Comparative study of aims and accomplishments of four major reform movements in the United States: Jeffersonian democracy, Jacksonian democracy, Progressivism, the New Deal.

HSTAA 456 The American Character (5) *Pease* Explores prevailing explanations for the American character and tries to assess its historical consequences. Lectures, discussion, reading, reports. Recommended: two college-level courses in history, including study of the American people and of the people of at least one other modern nation or society.

HSTAA 458 History of American Education to 1865 (3) *Burgess* Development of American education in cultural context: colonial period, influence of enlightenment, and common school movement. Offered jointly with EDEPS 458.

HSTAA 459 History of American Education Since 1865 (3) *Burgess* Development of American education in cultural context: progressive education, recent criticism, continuing issues and trends. Offered jointly with EDEPS 459.

HSTAA 461 Diplomatic History of the United States, 1776-1901 (5) *Fowler* Foreign policy of the United States government prior to the twentieth century. Emphasis on international wars, territorial expansion, and the peculiarities of the American position in world politics. Prerequisite: 202 or graduate standing.

HSTAA 462 Diplomatic History of the United States, 1901-Present (5) *Fowler* Foreign policy of the United States government during the twentieth century. International wars and the other major episodes in diplomacy are emphasized. Prerequisite: 202 or graduate standing.

HSTAA 470 Colloquium in American History: the Progressive Era, 1900-1917 (5) *Burke, Freidel* The principal problems and themes of the Progressive Era, emphasizing political, economic, social, and cultural aspects.

HSTAA 471 Colloquium in American History: the 1920s in America (5) *Burke, Freidel* Achievements and issues of the New Era; causes and consequences of the stock-market crash and Great Depression, with emphasis on political, economic, social, and cultural analysis.

HSTAA 472 Colloquium in American History: Franklin D. Roosevelt and the New Deal (5) *Burke, Freidel* Analysis of the key political, economic, social, and cultural factors in the New Deal, including the role played by President Roosevelt. Prerequisite: permission of instructor.

HSTAA 473 Colloquium in American History: Franklin D. Roosevelt and World War II (5) *Burke, Freidel* Problems and policies of the United States in World War II, covering the home front, diplomacy, and strategy, with emphasis on the role of President Roosevelt. Prerequisite: permission of instructor.

HSTAA 482 The History of Brazil: Colonial Period to the Present (5) *Alden* Colonial foundations; the first and second empires; the old and new republics; current problems; prospects for the future.

HSTAA 483 Southern South America (5) AWSpS *Solberg* History of the four countries that form southern South America: Argentina, Uruguay, Paraguay, and Chile, focusing on economic, social, and political change in the nineteenth and twentieth centuries. Governments of Juan Perón in Argentina and Salvador Allende in Chile. Relations of the four countries with Europe and the United States.

HSTAA 485 Social Revolution in Twentieth-Century Latin America: A Comparative Approach (3) *Solberg* Analyzes and compares major Latin American social revolutions, including Mexico (1910-20) and Cuba (since 1959). Backgrounds and causes; the impact of revolutionary change; relationships between United States and revolutionary and postrevolutionary governments.

HSTAA 486 History of Mexico: Colonial Origins to 1822 (5) *Gil* Political, social, and economic history of Mexico from its discovery by the Spanish to its independence from Spain.

HSTAA 487 History of Mexico: 1822 to the Present (5) *Gil* Political, social, and economic history of Mexico from its independence from Spain to the present. Recommended: 486.

HSTAA 488 History of the Caribbean and Central America (5) *Gil* Political, social, and economic history of principal countries in the Caribbean and Central America from their discovery to the present.

Ancient and Medieval History, Including Byzantine

HSTAM 201 Ancient History (5) *Ferrill, Thomas* Development and characteristics of ancient Greek civilization from the Bronze Age to the Roman conquest. Emphasizes interaction of cultures of the eastern Mediterranean.

HSTAM 202 Ancient History (5) *Ferrill, Thomas* Political, social, economic, and cultural development of Rome from the beginnings in the eighth century B.C. to the beginning of the Middle Ages.

HSTAM 203 Introduction to the Middle Ages: Medieval People (5) *Bynum* Introduction to the Western Middle Ages through a study of social roles and statuses as seen through documents and imaginative literature. The groups studied are rulers, aristocracy, peasants, townspeople, clergy, outcasts, and outsiders.

HSTAM 205 Military History of the Ancient World (5) *Ferrill* Military history from prehistoric times to the fall of the Roman Empire, with special emphasis on the Greco-Roman period and the campaigns of Alexander the Great, Hannibal, Scipio Africanus, and Julius Caesar.

HSTAM 331 Early Middle Ages (5) The Dark Ages, feudalism, emergence of the medieval order of civilization, and the development of Romanesque culture.

HSTAM 332 Central Middle Ages (5) Europe in the central Middle Ages: culture of cathedrals and universities, formation of national states, development of urban society.

HSTAM 333 Late Middle Ages (5) Disintegration of the medieval order under the impact of the national state, the secularization of society, and the decline of the church. Movements of reform and revolution. The culture of late gothic Europe.

HSTAM 336 The Humanist Ideal: From the Greeks to the Renaissance (3) *Ferrill, Griffiths, O'Neil, C. Thomas* Students read certain ancient, medieval, and Renaissance texts, selected to show the continuity and the transformations of the humanistic tradition, and write periodic essays on their reading as well as a term paper. Intended to supplement courses on the history of the respective periods.

HSTAM 351 Medieval Italy (5) Italy, from the barbarian invasions to the Renaissance, considered in the framework of European and Mediterranean cultures.

HSTAM 401 Early Greece (5) *Ferrill, Thomas* Bronze and Dark Age Greece: realities of the heroic age of ancient Greece.

HSTAM 402 Classical Greece (5) *Ferrill, Thomas* The classical civilization of ancient Greece, with special emphasis on the legacy of Greece to western civilization.

HSTAM 403 Alexander the Great and the Hellenistic Age (5) *Ferrill, Thomas* Rise of Macedonia, conquest of Near East by Alexander, and division into lesser kingdoms after Alexander's death. Special emphasis on fusion of cultures and change from city-state to world-state.

HSTAM 405 Topics in Ancient History (3, max. 6) *Ferrill, Thomas* An umbrella course that makes it possible to treat a special topic in the history of the ancient world during the period from the Bronze Age to the fall of the Roman Empire. One topic is studied in depth during the quarter. Prerequisite: permission of instructor.

HSTAM 411 The Early Roman Republic (3) *Ferrill* Political, social, economic, and cultural history, with emphasis on the development of the constitution and territorial expansions.

HSTAM 412 The Late Roman Republic (3) *Ferrill* Political, social, and cultural history, with special emphasis on the period of Cicero and Caesar.

HSTAM 413 The Early Roman Empire (3) *Ferrill* Political, social, economic, and cultural history, with emphasis on the Julio-Claudians.

HSTAM 414 The Late Roman Empire (3) *Ferrill* Political, social, economic, and cultural history, with emphasis on the decline of ancient civilization.

HSTAM 421 The Byzantine Empire (5) *Waugh* Political, social, economic, and cultural history of the Eastern Roman Empire from the fourth to fifteenth centuries.

HSTAM 426 Origins of European States (5) *Boba* From tribe to nation. Analysis of political, social, and cultural developments leading to the formation of territorial states in Europe. Prerequisite: some courses in medieval history or permission of instructor.

HSTAM 431 Topics in Medieval History, 500-1000 (5) *Boba, Bynum* Study in depth of one or more topics in the history of Europe during the early Middle Ages. Prerequisite: a course in medieval history.

HSTAM 432 Topics in Medieval History, 1000-1250 (5) *Boba* Study in depth of one or more topics in the history of Europe during the High Middle Ages. Prerequisite: a course in medieval history.

HSTAM 441 Church and State in the Middle Ages (5) *Boba* Changing theories and realities of relationship between religious and secular elements of medieval civilization.

HSTAM 442 Central Europe in the Middle Ages (5) *Boba* Origins and medieval history of Germany, Austria, Bohemia, and Poland, considered as a region within the sphere of Western European civilization.

HSTAM 443 Kievan and Muscovite Russia: 850-1700 (5) *Waugh* Development of Russia from earliest times to the reign of Peter the Great.

HSTAM 445 Russian Culture to the Era of Peter the Great (5) *Waugh* Development of Kievan and Muscovite "high" culture (to the beginning of the eighteenth century): religion, political ideas, the arts in a broad sense; questions of cultural influences. Extensive use of audiovisual materials. Prerequisite: 443 or permission of instructor.

HSTAM 446 Medieval Russian Chronicles (5) *Waugh* History of Russian chronicle writing; study of the chronicles as literature and as historical sources, with emphasis on the latter. Prerequisites: reading knowledge of Russian and permission; recommended: 443.

HSTAM 470 Intellectual and Religious History of the Later Roman Empire and Early Middle Ages (5) A *Bynum* Selected topics in intellectual and religious history A.D. 200 to 1000: the Apologists; Christian Platonism. The Latin Fathers with special attention to Augustine, Boethius, and Gregory the Great; the development of monasticism; the Carolingian and Ottonian revivals. Most reading in original sources in translation. Prerequisite: appropriate background in medieval history or intellectual history.

HSTAM 471 Intellectual and Religious History of the High Middle Ages (5) W *Bynum* Selected topics in intellectual and religious history A.D. 1000 to 1300: the religious revival of the eleventh and twelfth centuries; early scholasticism with special attention to Anselm's and Abelard's sacred and secular theories of love; heresy and popular religion; the friars, the women's religious movement of thirteenth century, and mysticism; high scholasticism with special attention to Thomas Aquinas and Bonaventure. Most reading in original sources in translation. Prerequisite: appropriate background in medieval history or intellectual history.

HSTAM 472 Intellectual and Religious History of the Later Middle Ages (5) Sp *Bynum* Selected topics in intellectual and religious history A.D. 1250 to 1550. Concentration on Europe north of the Alps and on philosophical and theological issues rather than on "humanism" and the history of scholarship. Most reading in original sources in translation. Prerequisite: appropriate background in medieval history or intellectual history.

History of Asia

HSTAS 201 Ancient Indian Civilization (5) *Conlon* Religions, literature, philosophy, politics, arts, and history of India from earliest times to the Mughal empire.

HSTAS 202 Modern Indian Civilization (5) *Conlon* The Islamic impact, British conquest, and contemporary India. Emphasis on the rise of nationalism, social organization, and contemporary life and history.

HSTAS 211 History of Chinese Civilization (5) *Dull* Intensive survey of Chinese civilization from earliest times to today. Introduces all students, including East Asian history majors, to the general sweep of Chinese history. Social, cultural, and intellectual developments.

HSTAS 212 History of Korean Civilization (5) *Palais* Korean civilization from earliest times to the present. Various aspects of the development of Korean society and culture in terms of government organization, social and economic change, literature, and art.

HSTAS 213 History of Japanese Civilization (5) *Hanley* Japanese civilization from prehistory to modern times. A survey of the most important developments in Japan's political, economic, and social history and Japanese literary, artistic, and religious traditions.

HSTAS 348 Alternative Routes to Modernity (3) A *Guy* Routes to modernity followed by non-Western societies between 1600 and 1900. Historical experiences of non-Western societies seen in the contexts of European history and of development theory. Primary sources and techniques for posing theoretical questions of historical data. Offered jointly with SIS 348.

HSTAS 401 History of Ancient India (5) *Conlon* India in ancient times; emphasis on forms of political organizations and economic life, social organizations, and cultural developments.

HSTAS 402 History of Medieval and Mughal India (5) *Conlon* Medieval India; emphasis on forms of political organizations and economic life, social organizations, and cultural developments.

HSTAS 403 History of Modern India to 1900 (5) *Conlon* Modern India; emphasis on forms of political organizations and economic life, social organizations, and cultural developments.

HSTAS 404 History of Twentieth-Century India (5) *Conlon* Analysis of the problems in the fields of social life, international and domestic politics, education, economics, and other areas that confront India today.

HSTAS 405 Maharashtra in Indian History (5) *Conlon* Regional approach to medieval and modern Indian history through examination of the history of Maharashtra in western India. The rise of the Marathas; British rule; political and economic modernization; religious and social life; problems of contemporary society.

HSTAS 421 History of Early Japan (5) Political, social, economic, and cultural development of Japan to the beginning of the Tokugawa period (seventeenth century).

HSTAS 422 History of Tokugawa Japan (5) *Hanley* Background to the unification of Japan in 1600; establishment of the Tokugawa political structure; and the social, economic, and cultural history of the period 1600-1868.

HSTAS 423 History of Modern Japan (5) *Pyle* Political, social, economic, and cultural development of Japan from the late Tokugawa period to the present with special emphasis on the cultural impact of the West.

HSTAS 431 Tibetan History (3) *Wylie* Tibet from earliest times to the present. Emphasis on the status and relations of Tibet in Asian affairs and on the evolution of the political institutions of a lama-ruler state. Recommended background: 211 or equivalent. (Offered alternate years.)

HSTAS 451 Chinese History: Earliest Times to 221 B.C. (5) *Dull* Preimperial China.

HSTAS 452 Chinese History: 221 B.C. to A.D. 906 (5) *Dull* Development of the imperial Chinese state.

HSTAS 453 Chinese History: A.D. 906 to 1840 (5) *Chan, Dull* The Wu, Tai, Sung, Yuan, Ming, and early Ch'ing periods.

HSTAS 454 History of Modern China (5) *Guy* Political, economic, social, and intellectual history of China from 1800 to the present. Processes of modernization and revolution and relationship between them.

HSTAS 476 Western Influences in Russian and Chinese Intellectual History (4) *Treadgold* Comparative analysis of stages of Western impact on Russian (1462-1917) and Chinese (1582-1949) thought previous to the proclamation of Marxism-Leninism as the official ideology.

HSTAS 481 History of Traditional Korea: Earliest Times to the Nineteenth Century (5) *Palais* Korean history from earliest times to the modern period.

HSTAS 482 History of Modern Korea: 1860 to the Present (5) *Palais* Traditional institutions and society, Japanese colonial rule, liberation and the Korean War, early Korean communist movement, and North Korea and South Korea since 1945.

See also HST 443.

Modern European History

HSTEU 275 Life in England (5) AW *Behlmer, Bell, Levy* Social history of England from the Norman conquest to the present, seen through letters, autobiographies, novels, and plays of the time. Life of the ordinary inhabitant—in the village and the manor house.

HSTEU 301 Early Modern European History: 1450-1648 (5) *Bridgman, Emerson, Griffiths, Levy* Political, social, economic, and cultural history from the late Renaissance to the Peace of Westphalia.

HSTEU 302 Modern European History: 1648-1815 (5) *Bridgman, Emerson, Hankins, Lytle, Sugar* Political, social, economic, and cultural history from the Peace of Westphalia to the fall of Napoleon.

HSTEU 303 Contemporary European History Since 1815 (5) *Bridgman, Ellison, Emerson, Pinkney, Sugar* Political, social, economic, and cultural history from the fall of Napoleon to the present.

HSTEU 305 European Witchcraft (5) Witchcraft and magical beliefs in Europe considered as a problem in intellectual, social, and legal history. Medieval background, systematization of witchcraft theory in fifteenth century; comparison of learned and popular beliefs; mechanisms of witch trials and inquisitorial procedure; the Faust legend; growth of skepticism and decline of witchcraft in seventeenth century.

HSTEU 369 The Destruction of European Jewry, 1932-45 (3 or 5) W History of anti-Semitism; dimensions of the Holocaust; the Holocaust organization and the victims' responses; reaction of world to events in Europe, Allied policies, refugee policy, and American actions. Legal, historical, and sociological questions raised by these events.

HSTEU 370 The Vikings (3) *Boba, Leiren* The Vikings at home in Scandinavia and abroad, with particular emphasis on their activities as revealed in archaeological finds and in historical and literary sources. Offered jointly with SCAND 370.

HSTEU 372 Social History of Early Modern Europe (5) Central issues in the social history of western Europe between the fourteenth and eighteenth centuries: changes in the family, childhood, sex, and marriage; hierarchical social structures and social change; attitudes toward world wealth and poverty; organization of poor relief and social services; relationship between cultural levels and social milieux (rural, urban, clerical, and courtly).

HSTEU 378 The Making of Contemporary France (5) *Nostrand, Pinkney* Historical origins and subsequent development of nine contemporary problems and characteristics of French government and politics, economy, and society. Prerequisite: FREN 203 or 222 or equivalent.

HSTEU 380 History of Scandinavia to 1521 (3) *Leiren* Survey of Scandinavian history from the Viking Age to 1521, with emphasis on the efforts at unification between Iceland, Denmark, Norway, and Sweden, and their relationship to the European continent. Offered jointly with SCAND 380.

HSTEU 381 History of Scandinavia to 1809 (3) *Leiren* Scandinavian history from 1521 to 1809, with special emphasis on the Lutheran Reformation, the Thirty Years War, and the Napoleonic Wars. Offered jointly with SCAND 381.

HSTEU 382 History of Scandinavia From 1809 to the Present (3) *Leiren* Scandinavian history from 1809 to the present, with major emphasis on the political, social, cultural, and economic development of the Scandinavian countries. Offered jointly with SCAND 382.

HSTEU 401 The Reformation (5) *Griffiths* Origins of the disunity of Europe in the crisis of the sixteenth century with emphasis on the relations between religion and politics.

HSTEU 403 Seventeenth-Century Europe (5) Social, political, and intellectual changes in early modern Europe; corporate society and the "general crisis" of the seventeenth century; decline of Spain; mercantilism and the rise of Dutch republic; political/religious conflicts, Thirty Years War and English civil war; absolutism in France under Richilieu, Mazarin, and Louis XIV; effects of warfare on society; scientific revolution and the new philosophies.

HSTEU 405 European Intellectual History: Eighteenth Century (5) *Toews* Development of the social sciences, moral theory, political theory, and religious thought in eighteenth-century Europe. Rationalism, empiricism, utilitarianism, and the sources of idealism.

HSTEU 406 European Intellectual History: Nineteenth Century (5) *Toews* Selected topics in intellectual history up to 1890. The philosophical consequences of the French Revolution, the development of idealism, conservatism, romanticism, and early socialist theory; positivism, the problems of historicism, new forms of Christian apologetics, utilitarianism in decline, liberalism as philosophy, the early Marx.

HSTEU 407 European Intellectual History: Twentieth Century (5) *Toews* Selected topics in the intellectual history of the late nineteenth and early twentieth centuries. The aftermath of Darwinism, the problems of methodology in modern social science, historicism and moral relativism, irrationalism in philosophy and social theory, revisionism in secular and orthodox religions.

HSTEU 410 The Renaissance (1300-1560) (5) *Griffiths* Conditions of Renaissance culture: Italian republics and despots, humanism, the classical ideal of the arts, Machiavelli and the foundations of modern political thought; the end of an era. Prerequisite: HST 112 or 301.

HSTEU 411 Europe: 1814-70 (5) *Bridgman, Emerson, Lytle, Pinkney, Sugar* Development of Europe during the age of Metternich, the revolutions of 1848, and the emergence of new national states.

HSTEU 412 Europe: 1870-1914 (5) *Bridgman, Emerson, Sugar* Impact of population increase and technological change on European society; stresses and strains in European life and outlook.

HSTEU 413 Europe: 1914-45 (5) *Bridgman, Emerson* Politics and society of Europe in the age of the concentration camp.

HSTEU 414 Europe Since 1945 (5) *Ullman* Political, economic, and military developments in Europe under the impact of the Cold War.

HSTEU 415 Europe in the Six Years' War (1939-45) (5) *Emerson* Inquiry to discover what the war of 1939-45 was about and what it did to the more than five hundred million Europeans.

HSTEU 421 France: 1429-1789 (5) *Lytle, Pinkney* Political and cultural history, from Joan of Arc to the eve of the French Revolution. Villon, Rabelais, Montaigne, Moliere, Voltaire, Rousseau, de Tocqueville.

HSTEU 422 The French Revolution and Napoleon: 1789-1815 (5) *Lytle, Pinkney* Transformation of France under the Revolution of 1789; the Reign of Terror and Napoleon; the impact of the revolution and Napoleon upon Europe.

HSTEU 423 France Since 1814 (5) *Lytle, Pinkney* Political, economic, and social history since the Congress of Vienna. Special emphasis upon the continuity of the revolutionary tradition.

HSTEU 431 Germany: 1648-1914 (5) *Bridgman, Emerson* Society, economy, and political problems of central Europe from the Thirty Years War to World War I, with particular emphasis on the nineteenth century.

HSTEU 432 Germany: 1914-45 (5) *Bridgman, Emerson* Politics and society from the collapse of the Bismarckian empire to the collapse of Hitler's empire.

HSTEU 435 World War I (5) *Bridgman, Emerson* Political, institutional, cultural, and military history of World War I, with emphasis on the impact of the war on European society.

HSTEU 438 Modern Russian Intellectual History (5) *Ellison, Treadgold* Development of Russian social and political thought and philosophy from the seventeenth century to the Revolution of 1917.

HSTEU 439 Soviet Union Since World War II (5) *Ellison* Domestic and foreign policy; political, economic, social, and cultural developments.

HSTEU 440 History of Communism (5) *Ellison* Communism from its origins in the Bolshevik faction of Russian social democracy to the present, treating the development of the ideology, the various communist parties, and the communist states. Offered jointly with SIS 440. Prerequisites: two courses in modern European history or politics.

HSTEU 444 Imperial Russia: 1700-1900 (5) *Treadgold, Waugh* Development of Russia from Peter the Great to Nicholas II.

HSTEU 445 Twentieth-Century Russia (5) *Ellison, Treadgold.* Russia and the USSR from Nicholas II to the present.

HSTEU 447 Russian and East European Bibliography (5) *Boba* Analysis of bibliographical problems in the social sciences and the humanities. For seniors and graduate students. Prerequisite: one East European language or German.

HSTEU 450 Ethnic History of Russia and East Europe (5) *Boba* Survey of races and ethnic groups in stages of acquiring national identity and political consciousness. Emphasis on processes of assimilation and alienation.

HSTEU 451 East-Central Europe Since 1342 (5) *Sugar* Focus on the lands of today's Poland, Czechoslovakia, Hungary, and East Germany from the time they were great powers to the present. Traces the major changes in the fortunes of these lands in both local and international settings.

HSTEU 452 Eastern Europe Since 1918 (5) *Sugar* Poland, Czechoslovakia, Hungary, Rumania, Yugoslavia, Bulgaria, and Albania, from the end of World War I to the present. Prerequisite: 451 or permission of instructor.

HSTEU 453 History of the Balkans, 1400 to the Present (5) *Sugar* Centuries of Ottoman rule that produced a new basis for the reemergence of independent states in the nineteenth and twentieth centuries; history of these new states until the present.

HSTEU 461 Formation of the Spanish Nation: to 1700 (5) *Ullman* Major political, economic, and cultural events leading to the creation of the Spanish nation under Ferdinand and Isabel.

HSTEU 462 Spain: 1700 to the Present (5) *Ullman* Political, economic, and cultural attempts of Spain to adjust to capitalism, liberalism, and secularism.

HSTEU 464 The Jews in Spanish History (3 or 5) *Ullman* Sephardic Jews in Spanish politics, economy, and culture, emphasizing the medieval Golden Age and the Inquisition.

HSTEU 470 The Jacobethan Age: England, 1580-1630 (5) *Levy* Emphasis on arts and society instead of the traditional kings, battles, and politics; the way people at all levels of society lived, in towns and in the countryside, within the bounds of the royal court or outside in the political wilderness. Classes on poetry, drama, music, architecture, painting, interior decoration, and some of the minor arts, as well as on demography and some of the traditional historical subjects. Not open for credit to students who have taken 471 or 472.

HSTEU 471 England in the Sixteenth Century (5) *Levy* Political, administrative, and social history from Henry VII to Elizabeth I, with emphasis on the Reformation and its effects and on conditions of life in Elizabethan England. Not open to students who have taken 470.

HSTEU 472 England in the Seventeenth Century (5) *Levy* Political, administrative, and social history from the accession of James I to the Glorious Revolution. Not open to students who have taken 470.

HSTEU 474 England in the Nineteenth Century (5) *Behlmer, Bell* Political, social, and cultural development; the agrarian, industrial, and French revolutions; the rise of parliamentary democracy; the Victorian age; political thought from utilitarianism to Fabianism; Irish home rule.

HSTEU 475 England in the Twentieth Century (5) *Behlmer, Bell* From the Boer War to the present; conservatism, liberalism, and socialism; England in two world wars; the decline of British imperialism.

HSTEU 476 Modern Irish History (5) Political and social history from 1800 to the present; the Irish Question after the Act of Union; development of Irish nationalism in the Home Rule and Sinn Fein periods; the Irish Free State and Northern Ireland since 1921; current problems in Northern Ireland.

Courses for Graduates Only

General History

HST 501 Ancient Greece and Rome: Writings and Interpretations (3-6) *Thomas* Study of historians, development of historical study as a distinct pursuit, focus of attention in historical

scholarship in the ancient world and comparison with modern interpretation of antiquity.

HST 502 Medieval Europe: Writings and Interpretations (3-6) *Bynum, O'Neil, Waugh* Study of historians, schools of history, and interpretations of medieval European history.

HST 503 Modern Europe: Writings and Interpretations (3-6) Sp *Pinkney* Study of historians, schools of history, and interpretations of modern European history.

HST 511 History of Science (3-6) *Hankins*

HST 512-513-514 Seminar in the History of Science (3-6)-(3-6)-(3-6) A,W,Sp *Hankins*

HST 524 British Empire History (3-6) *Bell*

HST 543 American Diplomacy and the Far Eastern Crisis, 1931-41 (3-6) *Butow* Field course in the diplomacy of the decade preceding American entry into World War II, with emphasis on the Far Eastern crisis. Prerequisite: permission of instructor.

HST 544, 545 Seminar in American Diplomacy and the Far Eastern Crisis, 1931-41 (3-6, max. 12, 3-6, max. 12) *Butow* Diplomacy of the decade preceding American entry into World War II, with emphasis on the Far Eastern crisis. Prerequisite: permission of instructor.

HST 551 Field Course in African History (3-6) Systematic examination of key historical writings and interpretive controversies in African history, with special attention to the growth of multidisciplinary approaches to historical reconstruction and the evaluation and use of oral historical data. Prerequisites: reading knowledge of one of the following: French, German, Portuguese, Arabic, or other African language.

HST 561 Islamic History (3-6) *Bacharach*., Field course. Introduction to advanced study in the major periods and problems of Islam. Bibliographical guidance is stressed.

HST 562 Ottoman History (3-6) *Sugar* Field course. Introduction to the major periods and problems of Ottoman history, 1300-1914, by acquainting the student with the major works in at least two languages. An attempt is made to teach some use of Ottoman materials. A minor problem is investigated in detail by every student. Prerequisite: knowledge of at least one major language besides English (French, German, Russian, or other).

HST 563 Modern Near East (3-6) *Bacharach* Field course introducing the student to the major periods and problems of Near Eastern history, 1798 to the present. Prerequisite: permission of instructor.

HST 571 Orientation to an Academic Career in History (3) AS *Sugar* Course for prospective college and university history instructors, preparing them for the nonacademic aspects of their duties. Prerequisite: Master of Arts degree in history or permission of instructor.

HST 598 Methods of Historical Research (5) Practical instruction in the scholarly techniques employed in historical research. A professional level of competence is inculcated through written exercises involving the actual searching out of historical sources, the critical evaluation of documents, the utilization of historical evidence in writing papers and theses, and the proper forms of documentation. Field trips to various archival establishments supplement the lectures and written exercises.

HST 600 Independent Study or Research (*) AWSpS

HST 700 Master's Thesis (*) AWSpS

HST 800 Doctoral Dissertation (*) AWSpS

History of the Americas

HSTAA 501 American History: Early (3-6) *Johnson*

HSTAA 503 Seminar in American History: Early (3-6, max. 12) *Johnson*

HSTAA 512 American History: Western (3-6) *Runte*

HSTAA 516 Hispanics of the United States (3-6) *Gil* Major periods and problems in the historiography of the Hispanic people of the United States. Emphasis on Chicanos or Mexican-Americans. Reading knowledge of Spanish is recommended.

HSTAA 521 American History: Writings and Interpretations, 1770-1870 (4-6) A *Burke, Fowler, Pease, Pressly*

HSTAA 522 American History: Writings and Interpretations Since 1870 (4-6) W *Burke, Fowler, Pease, Pressly*

HSTAA 524 American Social History Before 1860 (3-6) Field course. Survey of major problems and literature in American social history before 1860.

HSTAA 525 American Social History After 1860 (3-6) Field course. Survey of major problems and literature in American social history after 1860.

HSTAA 532-533-534 Seminar in American History: Recent Period (3-6, max. 12)-(3-6, max. 12)-(3-6, max. 12) A,W,Sp *Burke, Pease*

HSTAA 554 American History: Intellectual (3-6) *Saum*

HSTAA 555-556 Seminar: American Intellectual History (3-6)-(3-6) *Saum* Develops research and writing competence in American intellectual history. Prerequisite: permission of instructor or graduate program coordinator.

HSTAA 561 History of American Foreign Policy (3-6) *Fowler*

HSTAA 562-563 Seminar in American Diplomatic History (3-6)-(3-6) *Fowler*

HSTAA 577 History of Canada (3-6) *Solberg* Canadian historiography and bibliography from the foundation of New France to the present.

HSTAA 581 Latin American History: Colonial Period (3-6) *Alden*

HSTAA 582 Latin American History: National Period (3-6) *Alden, Gil, Solberg*

HSTAA 583-584-585 Seminar in Latin American History (3-6, max. 12)-(3-6, max. 12)-(3-6, max. 12) *Alden, Gil, Solberg* Problems of historical research in the history of Latin America from colonial beginnings to the present.

Ancient and Medieval History, Including Byzantine

HSTAM 501 Greek History (3-6) *Thomas* Problems in the history of the Athenian constitution.

HSTAM 511 Roman History (3-6) *Ferrill* Roman history, 31 B.C.-A.D. 37.

HSTAM 512-513 Seminar in Ancient History (3-6)-(3-6) *Ferrill, Thomas* Detailed study of special topics in ancient history. Prerequisite: permission of instructor or graduate program coordinator.

HSTAM 521 Byzantine History (3-6) *Boba*

HSTAM 530 Early Middle Ages (3-6) *Boba* Field course. Survey of early European history through the times of tribal migrations and invasions from Asia. Problems and methods of research. Prerequisite: permission of instructor or graduate program coordinator.

HSTAM 531 Medieval European History (3-6)

HSTAM 532, 533 Medieval European Seminar (3-6,3-6) AWSp Prerequisite: reading knowledge of French or German or Latin.

HSTAM 540 Medieval Russian Documents (3-6) *Waugh* Introduction to the study of documentary sources for medieval Russian history; the methods and application of diplomatics, with an introduction to paleography and codicology. Prerequisites: reading knowledge of Russian and 443 or permission of instructor. Recommended: 441.

HSTAM 541 Medieval Russian History (3-6) *Waugh* Prerequisites: 443 or permission of instructor and reading knowledge of Russian.

HSTAM 543 Seminar in Medieval Russian History (3-6, max. 12) *Waugh* Prerequisite: reading knowledge of Russian.

HSTAM 591, 592, 593 Advanced Medieval and Renaissance Seminar (3-6,3-6,3-6) *Bacharach, Boba, Bynum, Griffiths, Levy* A continuing seminar, running three quarters of every year. Provides a forum in which all students of medieval and Renaissance history who are writing their theses, dissertations; or any research projects may submit their work in progress to peer and faculty evaluation.

History of Asia

HSTAS 501 Indian History (3-6) *Conlon* Prerequisite: permission of instructor.

HSTAS 502, 503 Seminar: History of India (3-6, max. 12; 3-6, max. 12) *Conlon* Seminar on selected topics and problems in the history of medieval and modern India. Prerequisites: 501 and permission of instructor.

HSTAS 521 Modern Japanese History (3-6) *Pyle* Field course. Prerequisites: 422, 423, or permission of instructor.

HSTAS 523 Seminar in Modern Japanese History (3-6) *Pyle* Prerequisite: permission of instructor.

HSTAS 525 Japan in the Twentieth Century (3-6) Problems in the political, economic, and social history of Japan, 1890-1952.

HSTAS 551 Field Course in Chinese History: Pre-Sung Period (3-6) *Dull* Introduces Western language materials on traditional China in order to give the students bibliographical and other assistance in preparing for examinations in this field of history.

HSTAS 552-553-554 Seminar in Chinese History: Pre-Sung Period (3-6, max. 12)-(3-6, max. 12)-(3-6, max. 12) A,W,Sp *Dull* Prerequisite: reading knowledge of Chinese.

HSTAS 561 Field Course in Chinese History: Sung to Modern (3-6) *Chan* Introduces Western language materials on Chinese history from the Sung dynasty to the modern period in order to give students bibliographical and other assistance in preparing for examinations in this field of history.

HSTAS 562-563-564 Seminar in Chinese History: Sung to Modern (3-6)-(3-6)-(3-6) A,W,Sp *Chan* Professional writing seminar in Chinese history from Sung to modern times. Prerequisite: reading knowledge of Chinese.

HSTAS 571-572 Chinese History: Modern Period (3-6)-(3-6) W,Sp Field course in modern Chinese history, emphasizing extensive reading in the secondary literature on modern China..

HSTAS 573-574-575 Seminar in Chinese History: Modern Period (3-6, max. 12)-(3-6, max. 12)-(3-6, max. 12) A,W,Sp Research seminar in modern Chinese history. Training in the materials and methods of research, and preparation of extended research papers. Prerequisites: 571-572 or permission of instructor and reading knowledge of Chinese.

HSTAS 581 Modern Korean History (3-6) Sp *Palais* Field course. Prerequisite: permission of instructor.

HSTAS 582-583-584 Seminar in Korean History (3-6)-(3-6)-(3-6) A,W,Sp *Palais* Selected topics in Korean history and historiography.

HSTAS 585 Research Seminar: Modern Korea (3-6) *Palais* Advanced instruction in problems and methods of research in Korean history. No foreign language required. Prerequisite: permission of instructor.

See also HST 543, 544, 545.

Modern European History

HSTEU 501 Renaissance and Reformation (3-6) *Griffiths*

HSTEU 502-503-504 Seminar in the Renaissance and Reformation (3-6, max. 12)-(3-6, max. 12)-(3-6, max. 12) A,W,Sp *Griffiths*

HSTEU 515 Modern European Intellectual History (3-6)

HSTEU 516-517 Seminar: European Intellectual History (3-6)-(3-6)

HSTEU 521 Modern European History: France (3-6) *Lytle, Pinkney*

HSTEU 522-523-524 Seminar in French History (3-6)-(3-6)-(3-6) A,W,Sp *Lytle, Pinkney*

HSTEU 531 Modern European History: Germany (3-6) *Bridgman, Emerson*

HSTEU 532-533-534 Seminar in Modern European History: Germany (3-6)-(3-6)-(3-6) A,W,Sp *Bridgman, Emerson*

HSTEU 544 Modern Russian History (3-6) *Treadgold*

HSTEU 545-546-547 Seminar in Modern Russian History (3-6)-(3-6)-(3-6) A,W,Sp *Ellison, Treadgold* Seminar in modern Russian history. Prerequisite: reading knowledge of Russian and either French or German.

HSTEU 548 Field Course in Soviet History (3-6) *Ellison* Specialized course for graduate history students in the scholarly literature of Russian history since 1917. Intended for graduate students preparing for M.A. or Ph.D. field examination in Russian history of the Soviet period.

HSTEU 551 History of Eastern Europe: 1772-1939 (5) *Sugar* Study of the east-central European region: Poland, Czechoslovakia, Hungary, Rumania, and the Balkan countries, from their rebirth to World War II. Prerequisite: reading knowledge of German, French, Russian, or one East European language.

HSTEU 552 History of Eastern Europe: 1939 to the Present (5) *Sugar* Prerequisite: reading knowledge of one major European or one East European language.

HSTEU 553-554-555 Seminar in Modern East European History (3-6)-(3-6)-(3-6) A,W,Sp *Sugar* Study and research involving special methods dealing with the histories of the East European countries in the modern period.

HSTEU 562 Early Spanish History (3-6) *Ullman* Problems in the history of Spain, antiquity through the Middle Ages.

HSTEU 563 Modern Spanish History (3-6) *Ullman* Problems in the history of Spain, 1500 to the present.

HSTEU 571 English History: Tudor and Stuart (3-6) *Levy*

HSTEU 572 English History (3-6) *Bell*

HSTEU 573-574 Seminar in Modern English History (3-6)-(3-6) *Bell*

HSTEU 575-576 Seminar in Tudor-Stuart History (3-6)-(3-6) *Levy* Seminar in the history of England under the Tudors and the Stuarts. Prerequisite: 571 or permission of instructor.

Honors—Arts and Sciences

B10 Padelford

The honors program offers outstanding students a special curriculum featuring small classes, challenging instruction, and close contact with faculty and other honors students. An emphasis on writing is incorporated into the honors core curriculum and honors seminars. Directed and independent study are particularly encouraged for upper-division students, commonly leading to a senior honors thesis or project.

Undergraduate Program

Admission Requirements: To be considered for admission to the College Honors Program at entrance, students must apply during their final high school semester to the Director of Honors. Selection is based on high school records, test scores, and recommendations from the secondary school. Students also may seek admission based on superior academic performance during their freshman year at the University.

Graduation Requirements: A college honors student will be counseled by honors associates and will satisfy the distribution requirement through a specially designed honors general education curriculum.

A student becomes a candidate for an honors degree upon acceptance, usually during the junior year, by a department that offers an honors curriculum. Such a student is graduated "With College Honors" in the appropriate discipline. A student who is not a member of the college honors program but who demonstrates superior abilities in a particular field of study may, at the invitation of that department, participate in a departmental honors curriculum and receive a degree "With Distinction" in the major field.

Course Descriptions

Courses for Undergraduates

H A&S 210, 211, 212 Humanities for Honors Students I, II, III (4,4,4) Evolution of an art form, an idea, or a discipline central to the humanities. Content varies from year to year. For college honors students only.

H A&S 220, 221, 222 Science for Honors Students I, II, III (4,4,4) Evolution of an idea or concept central to the natural sciences. Intended for non-science majors. Content varies from year to year. For college honors students only.

H A&S 230, 231, 232 Social Science for Honors Students I, II, III (4,4,4) Development of an idea, concept, or institution central to the social sciences. Content varies from year to year. For college honors students only.

H A&S 350 Honors Seminar (2, max. 20) Discussion of selected topics in a variety of subject-matter fields. Topics and reading material vary from year to year. For honors students only. Prerequisite: permission of honors office.

H A&S 398 Interdisciplinary Special Topics (2-5, max. 15) Special interdisciplinary course for honors students. Subjects vary.

International Studies

406 Thomson

The Henry M. Jackson School of International Studies organizes and supports interdisciplinary teaching and research in international affairs. The school consists of a group of interdisciplinary language and area studies programs on major world regions. It also incorporates topical and comparative programs for the purpose of studies that transcend national and regional boundaries.

Undergraduate Program

Students may concentrate on a major world area within the context of the humanities and social sciences, specialize in topical studies, or pursue a more general course of study within the major in International Studies. For all the programs listed below except Comparative Religion, the student receives a Bachelor of Arts degree with a major in International Studies.

Chinese Regional Studies

Jack L. Dull, Chairperson

The Chinese program provides students a sound foundation in one or more aspects of the study of China. The program has particular strength in history, both modern and premodern, as well as in the social sciences.

Bachelor of Arts Degree

Major Requirements: 30 credits or equivalent Chinese language training; additional training recommended. HSTAS 211, 212; 213 or SISEA 241, SISEA 455; 25 credits in 300- and 400-level courses on China, including HSTAS 454, one course in premodern China, and one course in Chinese arts and literature. Specialization (at least three courses) in one of the three fields of modern China, premodern China, and Chinese arts and literature.

Comparative Religion

Eugene Webb, Chairperson

Comparative Religion programs are offered in History of Religions, Western Emphasis; History of Religions, Eastern Emphasis; Religion and Society; and Religion in Symbolic Expression.

Bachelor of Arts Degree

Major Requirements: RELIG 201, 202, 380; 35 credits in additional courses appropriate to each of the four tracks.

International Studies

Joel Migdal, Chairperson

The major in International Studies gives students a comprehensive and interdisciplinary perspective on world problems, plus an ability to analyze the subtle interactions of politics, economics, and culture within the global system.

Bachelor of Arts Degree

Admission Requirements: ECON 200, 201 (may be taken first year in program). Sophomore standing preferred. Admission is competitive. Applications must be submitted April 1-12 for Autumn Quarter admission or October 1-21 for Winter Quarter admission.

Major Requirements: Foreign-language competency through end of second-year college level; SIS 200, 201, 202, 401, 495, 498; three or four upper-division courses in an approved track; three interdisciplinary courses in International Studies. Majors are required to maintain a grade-point average of at least 2.50, both overall and in the program.

Japanese Regional Studies

Kozo Yamamura, Chairperson

The Japanese program combines language training with interdisciplinary study. Courses to an advanced level are offered in interdisciplinary studies, economics, business, political science, geography, all periods of Japanese history, art, literature, and language.

Bachelor of Arts Degree

Major Requirements: 30 credits or equivalent Japanese language training; additional training recommended. HSTAS 211, 212 (or a 5-credit course dealing with East Asia that must not be entirely on Japan); 213 or SISEA 241; 25 credits in 300- or 400-level courses on East Asia, of which 15 must deal with Japan; SISEA 451.

Jewish Studies

Stephen Benin, Chairperson

Jewish Studies brings the major disciplines of humanistic learning and the social sciences to bear on the historical entity known as the Jewish people. Courses in history, both modern and premodern, comparative religion, and Near Eastern languages and civilizations enable the student to study the history of the Jewish people, their rich and varied culture, and the influence of this culture upon world civilizations.

Bachelor of Arts Degree

Major Requirements: Language competence in Hebrew through second year; 50 credits, including two courses each in Jewish religion and Jewish history; plus a senior thesis.

Korean Regional Studies

James B. Palais, Chairperson

The Korean program combines language instruction with history and interdisciplinary area training for students interested in the culture and history of Korea. The program focuses on Korea within the broader context of East Asia.

Bachelor of Arts Degree

Major Requirements: 30 credits or equivalent Korean language training; additional training recommended. HSTAS 211, 212; 213 or SISEA 241; HSTAS 481, 482; 25 credits in 300- and 400-level courses on East Asia.

Russian and East European Regional Studies

Donald W. Treadgold, Chairperson

The Russian and East European regional program is designed for students who wish to pursue concentrated study of these regions within an interdisciplinary framework. The curriculum reflects current problems and interests, as indicated by the inclusion of classes in communist films, ethnic minorities, East-West trade, and assent and dissent.

Bachelor of Arts Degree

Major Requirements: Russian Option: 30 credits or equivalent Russian language; SISRE 243, 324, 343, 457; 15 credits in 300- and 400-level courses in a selected discipline of the area; 15 credits in 300- and 400-level courses on Russia in social sciences and humanities, approved by the program adviser. *East European Option:* 30 credits or equivalent in one East European language (Bulgarian, Czech, Hungarian, Polish, Romanian, or Serbo-Croatian), SISRE 220, 344, 458; 15 credits in 300- and 400-level courses in a selected discipline in the area; 15 credits in 300- and 400-level courses on eastern Europe in social sciences and humanities as approved by the program adviser.

South Asian Studies

Karl H. Potter, Chairperson

The South Asian Studies program combines language instruction with history and interdisciplinary area training for students interested in Bangladesh, India, Nepal, Pakistan, Sri Lanka, or Tibet.

Bachelor of Arts Degree

Major Requirements: 30 credits or equivalent in one of the languages of South Asia (Hindi, Sanskrit, Tamil, or Tibetan); HSTAS 201, 202; SISSA 498; 30 credits in the area in one of the following disciplines—anthropology, comparative religion, economics, history, linguistics, philosophy, or political science

Graduate Program

School of International Studies

The Jackson School offers four specialization tracks that lead to a Master of Arts in International Studies. These specialization tracks are East Asian Studies, Middle Eastern Studies, Russian and East European Studies, and South Asian Studies. Specific requirements vary from one program to another, but all stress interdisciplinary study within the context of the historical cultures, contemporary situations, and languages of the four world areas.

The Jackson School also offers a general International Studies track in the Master of Arts degree, which concentrates on the interaction of international economic, political, and cultural processes with states and societies around the world.

Admission Requirements: Applicants must meet the requirements of the Graduate School. An undergraduate grade-point average of 3.00 in the junior and senior years is normally a prerequisite for admission. Submission of the scores of the aptitude section (verbal and quantitative) of the Graduate Record Examination is required for the East Asian and South Asian programs and is strongly recommended for the Russian and East European program.

Financial Aid: Financial support is available in the form of Title VI National Resource Fellowships. Graduate students are also eligible for a limited number of teaching or research assistantships and readerships through discipline departments.

East Asian Studies

Jack L. Dull, Chairperson, Chinese Regional Studies

Kozo Yamamura, Chairperson, Japanese Regional Studies

James B. Palais, Graduate Program Coordinator, and Chairperson, Korean Regional Studies

The East Asian Studies program is offered by faculty members from a number of disciplines cooperating within the Jackson School. Two-year regional programs in China, Japan, and Korea lead to the Master of Arts degree in International Studies. These programs are designed for students with Bachelor of Arts degrees in a discipline (1) as a terminal degree in preparation for careers in government, journalism, business, or teaching, and (2) as a transitional degree for a Doctor of Philosophy program in a discipline. Programs are structured to permit each student a maximum of individual faculty guidance plus group participation with other graduates.

Admission Requirements

See above under School of International Studies.

Graduation Requirements

Chinese Regional: Chinese language training through the third year; 26 credits, of which 8 must be at the 500 level or above; SISEA 521-522; two seminar papers or a thesis; comprehensive oral examination.

Japanese Regional: Japanese language training through the third year (15 credits minimum training at this university); 26 credits, of which 8 must be at the 500 level or above; SISEA 555 and 559; essay of distinction; comprehensive oral examination.

Korean Regional: Korean language through the second year of instruction; 36 credits, of which 18 must be at the 500 level or above, including HSTAS 481, 482, POL S 544, and one graduate seminar in Korean history (either HSTAS 585 or HSTAS 582-583-584); essay of distinction or two seminar papers; comprehensive oral examination.

Financial Aid

In addition to teaching assistantships, a few research assistantships may be available through the Chinese, Japanese, and Korean Regional Studies programs of the Jackson School. Scholarships are also available through the Chester Fritz Endowment (Chinese Studies) and the Japan Foundation Endowment Grant (Japanese Studies).

Research Facilities

Research and training facilities include the East Asia Library with a comprehensive collection of manuscripts, books, and serials on China, Japan, and Korea. The University is affiliated with the Inter-University Program for Chinese Language Studies in Taipei and the Inter-University Center for Japanese Language Studies in Tokyo, both of which provide intensive language training to advanced undergraduate and graduate students. The school has ongoing projects on China, Japan, and Korea in which advanced graduate students and recognized scholars from the United States and foreign institutions regularly participate.

Correspondence and Information

Graduate Program Coordinator
405 Thomson, DR-05

International Studies

Joel S. Migdal, Chairperson and Graduate Program Coordinator

The Master of Arts in International Studies degree program provides students with broad knowledge and skills in analyzing international affairs. Designed for students entering a variety of professional fields, the program trains them in international and comparative studies in a multi-disciplinary setting. Students are prepared to undertake sophisticated analyses of international affairs and typically will hold positions after graduation with the international divisions of federal and state governments, international divisions of banks, trading companies, policy study institutes, corporations with international operations, and international development and educational organizations. The program usually entails concurrent enrollment in a graduate professional degree program and adds approximately one year to the student's course of study (see admission requirements below).

Admission Requirements

In addition to meeting the requirements of the Jackson School of International Studies, candidates are preferred who demonstrate previous professional experience and education or who enroll concurrently in a graduate professional degree program. Arrangements have been made with the Graduate School of Business Administration, the Graduate School of Public Affairs, the Institute for Marine Studies, the College of Forest Resources, and the School of Law for such concurrent degrees. Applicants must have completed introductory level micro- and macro-economics courses. Prior foreign language study is highly recommended.

Graduation Requirements

36 credits, of which 18 must be at the 500 level or above. Students are required to take a series of core courses (SIS 500, 501, and 502—9 credits total), and complete two other fields (9 credits each) from the following areas: a regional studies field, a functional field, a topical series field, or a special topics field. A practicum course in international studies (6 credits), which involves writing formats, document location and analysis, and methodologies in the study of international affairs, also is required, as is a graduate course in economic theory (3 credits). Students take an oral examination emphasizing the three fields of specialization; each student also must submit two seminar papers in program courses, which will be presented to the Master of Arts examining committee. All students must demonstrate a practical proficiency in a relevant modern language. Depending on the choice of language, this constitutes two to three years of college-level course work. Credit in language courses is not counted toward satisfaction of degree requirements.

Correspondence and Information

Graduate Program Coordinator
405 Thomson, DR-05

Middle Eastern Studies

Jere L. Bacharach, Chairperson

The Middle East program is designed for students who wish to study the region within an interdisciplinary framework, focusing especially on the social, political, economic, and legal structure of the Middle East. A student is normally expected to complete the program in two years and one summer. Students interested in the M.A. in International Studies degree emphasizing literature and other humanistic aspects of the Middle East should inquire about the program in the Department of Near Eastern Languages and Literature.

Admission Requirements

Admission requirements include a statement of purpose; a sample of written work; three letters of recommendation, of which at least two must attest to scholarly ability. Although knowledge of a Near Eastern language is not a prerequisite for admission, applicants are generally expected to have had at least the equivalent of one year's study of the language in which they plan to concentrate. Students with no language training may wish to begin their language program in an intensive summer program.

Graduation Requirements

In addition to fulfilling the Graduate School requirements for the Master of Arts degree, each aspirant must fulfill the following graduation requirements: Training through the third year or its equivalent in one Middle East language; SIS 500, 501, 502, or SIS 200, 401; three of the following: HST 463; N E 430; RELIG 430,• N E 432; POL S 538, SISME 430; 15 credits in other courses on the Middle East or approved by the graduate program coordinator. A thesis and an oral examination.

Correspondence and Information

Chairperson
318 Thomson, DR-05

Russian and East European Studies

Donald W. Treadgold, Chairperson and Graduate Program Coordinator

The Russian and East European Studies programs may be completed in two years. Designed primarily for students with B.A. degrees in a discipline, the programs offer a background for professional pursuits in government, journalism, business, or teaching, or for those who plan to take advanced graduate study leading to the Ph.D. degree in a discipline. The program includes language training, a concentration of study in a chosen discipline, and a combination of courses in other disciplines that focus on the region.

Admission Requirements

See above under School of International Studies. Also *Russian Studies*—six quarters in Russian language (the equivalent of 30 credits); *East European Studies*—six quarters (equivalent of 30 credits) in one foreign language, either an East European language or one appropriate to the student's area interest (Russian, German, Ottoman Turkic, or French).

Graduation Requirements

39 credits in interdisciplinary course work (other than language) as follows: 15 or 20 credits in area-oriented courses in the discipline(s) or topic of concentration (at least 9 credits at the 500 level or above); 10 or 15 credits in at least two additional disciplines; 9 credits of thesis. Written examination; oral interdisciplinary examination on the area of specialization; thesis. *Russian Regional Option.* Instruction in Russian through the fourth year (30 credits required for admission). *East European Option*—Knowledge of two languages, one of which must be a language of the area (exclusive of French, German, or Russian); the second language may be either an additional language of the area or a nonarea language that is useful to the area of concentration. Language competence in two languages may be satisfied either by passing the Language Proficiency Test or by the equivalent of two years' training (30 credits for each language).

Research Facilities

The University of Washington is one of the major centers for research in Russia and eastern Europe. In addition to extensive holdings in Russian language materials, the library has works in all major languages of eastern Europe.

Correspondence and Information

Graduate Program Coordinator
503 Thomson, DR-05

South Asian Studies

Karl H. Potter, Chairperson and Graduate Program Coordinator

The South Asian Studies program has been designed for (1) students who have completed the Bachelor of Arts degree and are qualified to pursue graduate study, whose career objectives involve teaching and research, who plan to specialize in a traditional discipline but whose geographical area of interest lies within South Asia (i.e., India, Pakistan, Sri Lanka (Ceylon), Bangladesh, Nepal, and Tibet); (2) students planning to enter certain professional training programs at the graduate level (e.g., education, business administration, journalism, law, or public affairs) and whose career objectives are oriented toward South Asia; (3) students planning a career in government service (e.g., the diplomatic corps) and who wish to acquire a special understanding of the South Asia area. Through a cooperative program with the University of British Columbia, students may participate in South Asia courses offered by the UBC graduate faculty.

Admission Requirements

See above under School of International Studies.

Graduation Requirements

A South Asian language through the third year of instruction; SISSA 510, 511; 28 credits in disciplines, 10 of which must be at the 500 level or above. At least 18 of these 28 credits must be in courses directly related to the study of South Asia. Two seminar papers in lieu of a master's thesis. Comprehensive oral examination.

Research Facilities

The University of Washington library holds an extensive collection of books and serials relating to South Asia. The library is a full participant in the U.S. Library of Congress Public Law 480 program, which supplies current publications from India, Pakistan, and Sri Lanka (Ceylon). The library is also a member of the South Asian Microfilm Program of the Center for Research Libraries, which provides access to a large collection of microfilm newspapers, journals, and documents on South Asia.

Correspondence and Information

Graduate Program Coordinator
303 Thomson, DR-05

Faculty

Director

Kenneth B. Pyle

Professors

Alexander, Edward,* (English), Ph.D., 1963, Minnesota; romantic and Victorian literature.

Bacharach, Jere L.,* (History, Near Eastern Languages and Civilization), Ph.D., 1967, Michigan; Middle East.

Beckmann, George M.,* Ph.D., 1952, Stanford; modern East Asian history.

Boba, Imre,* (History),† Ph.D., 1962, Washington; Russian and East European history.

Brass, Paul R.,* (Political Science),† Ph.D., 1964, Chicago; South Asia.

Butow, Robert J. C.,* (History),† Ph.D., 1953, Stanford; East Asian diplomatic history.

Bynum, Caroline W.,* (History), Ph.D., 1969, Harvard; medieval history.

Chan, Hok-lam,* (Asian Languages and Literature, History), Ph.D., 1967, Princeton; late imperial Chinese history.

Chirot, Daniel,* (Sociology),† Ph.D., 1973, Columbia; modernization, political sociology, peasant societies.

Conlon, Frank F.,* (History),† Ph.D., 1969, Minnesota; South Asia.

Ellison, Herbert J.,* (History),† Ph.D., 1955, London; modern Russian history.

Fowler, David C.,* (English), Ph.D., 1949, Chicago; medieval literature.

Haley, John O.,* (Law), LL.M., 1971, Washington; Japanese law.

Haney, Jack A. V.,* (Slavic Languages and Literature),† Ph.D., 1970, Oxford; medieval Russian literature.

Heilmann, Donald C.,* (Political Science),† Ph.D., 1964, California (Berkeley); Japanese politics and international relations.

Henderson, Dan F.,* (Law), Ph.D., 1955, California (Berkeley); Japanese law.

Heer, Nicholas L.,* (Near Eastern Languages and Civilization), Ph.D., 1955, Princeton; Arabic language and literature; Islamic theology and philosophy.

Jackson, W. A. Douglas,* (Geography),† Ph.D., 1953, Maryland; Russian geography.

Kapetanic, Davor,* (Slavic Languages and Literature),† Ph.D., 1954, Yugoslav Academy of Science; Serbo-Croatian language and literature.

Kartiganer, Donald,* (English), Ph.D., 1964, Brown; American Jewish writers.

Keyes, Charles F.,* (Anthropology), Ph.D., 1967, Cornell; social structure, religion, peasant society ethnic group relations; mainland Southeast Asia.

Knechtges, David R.,* (Asian Languages and Literature), Ph.D., 1968, Washington; early Chinese literature.

Legters, Lyman H.,* (Education), Ph.D., 1958, Free University (Berlin); Russian and East European Studies.

MacKay, Pierre A.,* (Classics, Comparative Literature, Near Eastern Languages and Civilization), Ph.D., 1964, California (Berkeley); topography of the Near East, Ottoman Turkish and classical Arabic literatures.

Mah, Feng-hwa,* (Economics),† Ph.D., 1959, Michigan; Chinese economy and foreign trade.

McKinnon, Richard N.,* (Asian Languages and Literature, Comparative Literature), Ph.D., 1951, Harvard; Japanese language and literature.

Mickiesen, Lew R.,* (Slavic Languages and Literature),† Ph.D., 1951, Harvard; Slavic linguistics.

Migdal, Joel S.,* Ph.D., 1972, Harvard; political science, international political economy.

Miller, Roy A.,* (Asian Languages and Literature), Ph.D., 1953, Columbia; Japanese language and linguistics.

Modelski, George,* (Political Science), Ph.D., 1954, London; world politics, international relations.

Norman, Jerry,* (Asian Languages and Literature), Ph.D., 1969, California (Berkeley); Chinese language and linguistics.

Palais, James B.,* (History),† Ph.D., 1968, Harvard; modern Korean history.

Poppe, Nicholas N. (Emeritus), (Asian Languages and Literature), Ph.D., 1934, Leningrad; Mongolian specialist.

Potter, Karl H.,* (Philosophy),† Ph.D., 1955, Harvard; South Asia.

Pyle, Kenneth B.,* (History),† Ph.D., 1965, Johns Hopkins; modern Japanese history.

Reshetar, John S.,* (Political Science), Ph.D., 1950, Harvard; USSR and East European politics.

Roth, Guenther,* (Sociology), Ph.D., 1967, California (Los Angeles); theory, political sociology.

Ruegg, David S.,* (Asian Languages and Literature), D.Litt., 1969, Paris; South Asia

Schiffman, Harold F.,* (Asian Languages and Literature), Ph.D., 1969, Chicago; South Asia.

Spector, Ivar (Emeritus), Ph.D., 1928, Chicago; Russian civilization.

Stark, Rodney,* (Sociology), Ph.D., 1971, California (Berkeley); scientific methods in theory and research, religion, prejudice, police.

Sugar, Peter,* (History),† Ph.D., 1959, Princeton; political and economic history of eastern Europe and Near East since the eighteenth century.

Szeftel, Marc M. (Emeritus), (History), Docteur en droit, 1934, Lic.Slav.Phil.Hist., 1939, Université Libre de Bruxelles; history.

Taylor, George E.(Emeritus), D.Litt., 1957, Birmingham (England); East Asian studies.

Thornton, Judith A.,* (Economics),† Ph.D., 1960, Radcliffe; Soviet and comparative economics.

Townsend, James R.,* (Political Science),† Ph.D., 1965, California (Berkeley); Chinese government and politics.

Treadgold, Donald W.,* (History),† D.Phil., 1950, Oxford; modern Russian and Chinese history.

Ullman, Joan C.,* (History),† Ph.D., 1963, Bryn Mawr; Jews in Spanish history.

Velikonja, Joseph,* (Geography), Ph.D., 1948, Rome (Italy); East European geography.

Wang, Ching-hsien,* (Asian Languages and Literature, Comparative Literature),† Ph.D., 1971, California (Berkeley); Chinese literature and poetry.

Webb, Eugene,* (Comparative Literature),† Ph.D., 1965, Columbia; comparative literature, comparative religion.

Wittfogel, Karl A. (Emeritus), Ph.D., 1928, Frankfurt (Germany); Chinese history.

Yamamura, Kozo,* (Economics), Ph.D., 1964, Northwestern; economic development and economic history of Japan, comparative economic history.

Ziadeh, Farhat J.,* (Near Eastern Languages and Civilization, Comparative Literature), LL.B., 1940, London; Arabic language and literature, Islamic law and institutions.

Associate Professors

Andrews, Walter G.,* (Comparative Literature, Near Eastern Languages and Civilization), Ph.D., 1970, Michigan; Turkish language and literature, Ottoman Turkish.

Augerot, James E.,* (Slavic Languages and Literature),† Ph.D., 1968, Washington; Slavic linguistics, Romanian, Bulgarian.

Brandauer, Frederick P.,* (Asian Languages and Literature), Ph.D., 1973, Stanford; Chinese language and literature.

Butwin, Joseph M.,* (English), Ph.D., 1971, Harvard; Victorian literature.

Chang, Kuei-sheng,* (Geography),† Ph.D., 1955, Michigan; geography of China.

Cirtautas, Ilse D.,* (Asian Languages and Literature), Ph.D., 1958, Hamburg; Turkic language and literature.

Coats, Herbert S.,* (Slavic Languages and Literature),† Ph.D., 1970, Illinois; Russian phonology and syntax, Slavic accentuation.

Cumings, Bruce G.,* (Political Science), Ph.D., 1975, Columbia; Korean politics, East Asian international relations.

Curtis, J. William,* (Architecture), M.A., 1969, Washington; South Asia.

Dale, Phillips S.,* (Psychology), Ph.D., 1968, Michigan; psychology, psycholinguistics.

Dull, Jack L.,* (History),† Ph.D., 1966, Washington; early imperial Chinese history.

Dumont, Jean-Paul,* (Anthropology), Ph.D., 1972, Pittsburgh; cultural and social anthropology, symbolism, structuralism, South America, France.

Hanley, Susan B.,* (History), Ph.D., 1971, Yale; premodern Japanese history.

Harmon, Daniel P.,* (Classics), Ph.D., 1968, Northwestern; Greek and Roman religion, Latin poetry, Greek tragedy.

Harrell, Stevan,* (Anthropology),† Ph.D., 1974, Stanford; Chinese anthropology and society.

Hawley, John S., * (Asian Languages and Literature), Ph.D., 1977, Harvard; Hindi language and comparative religion.

Kakiuchi, George H.,* (Geography),† Ph.D., 1957, Michigan; geography of Japan.

Keating, John P.,* (Psychology), Ph.D., 1972, Ohio State; communication media and attitude change, value formation and systems, environmental psychology, relation of psychology to religion.

Kochin, Levis W.,* (Economics), Ph.D., 1975, Chicago; money and banking.

Konick, Willis A.,* (Slavic Languages and Literature),† Ph.D., 1964, Washington; modern Russian literature and language.

Kramer, Karl D.,* (Comparative Literature, Slavic Languages and Literature),† Ph.D., 1964, Washington; late nineteenth-century Russian prose.

Lardy, Nicholas R., Ph.D., 1975, Michigan; economics, Chinese economy.

Lieberman, Fredric,* (Music), M.A., 1965, Hawaii; ethnomusicology.

Loraine, Michael B.,* (Comparative Literature, Near Eastern Languages and Civilization), Ph.D., 1968, Cambridge; Persian language and literature.

Lukoff, Fred,* (Asian Languages and Literature),† Ph.D., 1954, Pennsylvania; Korean language and linguistics.

Neuman, Daniel,* (Music), Ph.D., 1974, Illinois; ethnomusicology.

Perry, Elizabeth J.,* (Political Science), Ph.D., 1978, Michigan; peasants and politics of China.

Rubin, Jay,* (Asian Languages and Literature), Ph.D., 1970, Chicago; Japanese literature.

Sakata, H. Lorraine,* (Music), Ph.D., 1976, Washington; ethnomusicology.

Shapiro, Michael C.,* (Asian Languages and Literature), Ph.D., 1974, Chicago; South Asia.

Silbergeld, Jerome L.,* (Art History), Ph.D., 1974, Stanford; Chinese art history.

Swayze, Harold E.,* (Slavic Languages and Literature),† Ph.D., 1959, Harvard; Soviet literature.

Toews, John E.,* (History), Ph.D., 1973, Harvard; intellectual history.

Waugh, Daniel C.,* (History),† Ph.D., 1972, Harvard; medieval Russian history.

Webb, Glenn T.,* (Art History), Ph.D., 1970, Chicago; Asian art history.

Wenke, Robert J.,* (Anthropology),† Ph.D., 1975, Michigan; archaeology, quantitative analysis, Near East, Mesoamerica.

West, James D.,* (Slavic Languages and Literature),† Ph.D., 1970, Cambridge; Russian and Soviet poetry and prose, Russian translation.

Williams, Michael A., Ph.D., 1977, Harvard; early Christianity and religions of antiquity.

Yue-Hashimoto, Anne O.,* (Asian Languages and Literature), Ph.D., 1966, Ohio State; Chinese language and linguistics.

Zumbrunnen, Craig,* (Geography), Ph.D., 1973, California (Berkeley); Soviet population and natural resource problems.

Assistant Professors

Benin, Stephen D., Ph.D., 1980, California (Berkeley); medieval Jewish history and thought.

Boltz, William G.,* (Asian Languages and Literature), Ph.D., 1974, California (Berkeley); classical Chinese literature.

Colin, Amy D., (Germanics), Ph.D., 1982, Yale; comparative literature.

Daniel, E. Valentine,* (Anthropology), Ph.D., 1979, Chicago; cultural anthropology and religion.

Guy, R. Kent,* (History),† Ph.D., 1981, Harvard; modern Chinese history.

Jacobi, Ruth I., (Near Eastern Languages and Civilization),† Ph.D., 1975, Washington; modern Hebrew language and literature.

Jones, Christopher R., Ph.D., 1975, Harvard; political science, Soviet foreign policy.

Kavoussi, Rostam M., (Economics), Ph.D., 1976, Harvard; Middle East economics.

Keeler, John T. S.,* (Political Science), Ph.D., 1978, Harvard; West European politics.

Lerner, Lawrence W. (Acting), Ph.D., 1976, Washington; Russian history.

O'Neil, Mary R., (History), Ph.D., 1982, Stanford; history of the Renaissance and Reformation.

Ramet, Pedro, Ph.D., 1981, California (Los Angeles); political science, Soviet and East European studies.

Ranney, Susan, (Economics), Ph.D., 1978, Wisconsin (Madison); international economics.

Roehl, Thomas W., (Marketing and International Business), Ph.D., 1983, Washington; Japanese business.

Siddiq, Muhammad,* (Near Eastern Languages and Civilization), Ph.D., 1981, California (Berkeley); Arabic language and literature.

Salomon, Richard G.,* (Asian Languages and Literature), Ph.D., 1975, Pennsylvania; Sanskrit language.

Sheikholeslami, Ali Reza, (Political Science), Ph.D., 1975, California (Los Angeles); politics of the Middle East.

Lecturer

Hiraga, Noboru, (Asian Languages and Literature), M.A., 1955, Washington; Japanese language.

Course Descriptions

Courses for Undergraduates

General

SIS 200 States and Capitalism: The Origins of the Modern Global System (5) *Chirot, Migdal* Origins of the modern state system and of the world market in Europe. Interacting forces of politics and economics around the globe from the sixteenth century until World War II.

SIS 201 Introduction to International Political Economy (5) *Cumings, Migdal* International political economy through the examination of major facets of the post-World War II era. Analyzes the new postwar economic order and its crises in the 1970s and 1980s, North-South relations, the postwar political order and its East-West rivalry.

SIS 202 Cultural Interactions in an Interdependent World (5) Cultural interaction among societies and civilizations, particularly Western versus non-Western. Intellectual, cultural, social, and artistic aspects; historical factors.

SIS 301 War (5) *Chirot* Origins and conduct of war; readings from anthropology, political science, economics, and history, as well as novels and some recent works on the arms-control controversy. Modern forms of warfare, including guerrilla war, world war, and nuclear war. Offered jointly with SOC 301.

SIS 302 Intercultural Relations (5) *Webb* Perspectives on foreign cultures through literary example. Interdisciplinary approaches to the study of culture as such and problems of intercultural relations. Prerequisite: 202 or ANTH 202.

SIS 330 Political Economy of Development (5) *Ranney* Growth, income distribution, and economic development in less developed countries today. Policies concerning trade, industrialization, the agricultural sector, human resources, and financing of development. Prerequisites: ECON 200, 201.

SIS 332 Political Economy of International Trade and Finance (5) *Kavoussi* Theoretical and historical analysis to explore the causes and effects of the rise and decline of four major international trade and monetary regimes. Foundations and emerging features of the new international trade and monetary regime and its implications for the world economy.

SIS 342 Social Theory in International Context (5) *Toews* Comparative, historical introduction to the foundations of modern social theory in the work of Max Weber, Sigmund Freud, and Claude Levi-Strauss. Focus on tensions between universalist claims, European origins, and non-European applications of models of cultural formation and development.

SIS 348 Alternative Routes to Modernity (5) A *Guy* Routes to modernity followed by non-Western societies between 1600 and 1900. Historical experiences of non-Western societies seen in the context of European history and of development theory. Emphasizes primary sources and techniques for posing theoretical questions of historical data. Offered jointly with HSTAS 348.

SIS 355 Social Change in Latin America (5) *Van Den Berghe* Problems of development and dependency in Latin America. Relations of power and production between social classes and ethnic groups, with special emphasis on Meso-America (Mexico, Guatemala) and the Andes (Peru, Bolivia). Offered jointly with SOC 355. Prerequisite: introductory course in sociology, anthropology, political science, or economics.

SIS 375 Geopolitics (5) *Jackson* Spatial aspects of international politics, with attention to perceptions of national space, the way states organize territory, and the strategic use of geography to advance state goals. Offered jointly with GEOG 375. Prerequisite: GEOG 100 or equivalent.

SIS 390 Political Economy of Industrialized Nations (5) Theoretical bases of various political-economic systems of industrialized nations. Several major issues these political economies currently face; usefulness and limits of economic analyses within broader perspective of political economy. Prerequisites: ECON 200 and 201.

SIS 397 Junior Honors Seminar (5) Intensive consideration of major works in international studies, with emphasis on the development of critical reading and writing skills. Required of honors candidates. Prerequisite: admission to honors program in International Studies.

SIS 401 International Political Economy (5) *Lardy* Establishment, maintenance, and decay of the post-1945 international economic order. Political economy of international trade, monetary relations, inflation, and North-South relations. Prerequisites: 201, ECON 200, 201.

SIS 421 National Security and International Affairs (5) *Jones* Major military aspects of contemporary international politics. Uses and limitations of military capabilities for sustaining a stable international order and national security. Processes by which states detect and assess threats to their security; practice of deterrence; transfer of arms among states; pursuit of arms control. Recommended: course work in international relations.

SIS 422 The United States in the Contemporary International System (5) *Hellmann* United States in the world: ways in which international circumstances shape the political-strategic, economic, and cultural dimensions of America's policy. Case studies from post-1945 period. Recommended: background course work in international relations or American foreign policy.

SIS 426 World Politics (5) *Modelski* Nation-state system and its alternatives; world distributions of preferences and power; structures of international authority; historical world societies and their politics. Offered jointly with POL S 426.

SIS 440 History of Communism (5) *Ellison* Communism from its origins in Bolshevik faction of Russian social democracy to the present, treating the development of the ideology, the various communist parties, and the communist status. Offered jointly with HSTEU 440. Prerequisites: two courses in modern European history or politics. (Formerly SISRE 440.)

SIS 444 Peasants in Politics (5) Interdisciplinary study of peasants, with special attention to questions of rural transformation. Peasant involvement in an increasingly independent world. Rebellion and revolution, impact of the international market, agricultural development. Offered jointly with POL S 446.

SIS 448 Franklin D. Roosevelt and His World, 1882-1945 (5) *Butow* Life and times of the thirty-second President of the United States, with emphasis on American foreign relations—especially the role he played in the emergence of the United States as a world power. Offered jointly with HST 448.

SIS 455 Industry and the State (5) *Cumings* Builds on states and markets approach of 200 and 201 through specific examination of effects of industry and industrial structure on political outcomes and roles of state. Emphasis on late-developing and newly developing economies: Japan, the two Koreas, Taiwan, China, Brazil, Mexico. Prerequisites: 200, 201.

SIS 456 State-Society Relations in Third World Countries (5) *Migdal* Relationships among political, social, and economic changes in Asia, Africa, and Latin America. Problems of economic and political development, revolution and reform, state-society relations, imperialism and dependency. Offered jointly with POL S 450.

SIS 467 Nations and States in the Modern World (5) *Sugar, Treadgold* Development of national consciousness in the "old nations" of Europe before the French Revolution. Replacement by the new nationalism and its spread into East Central Europe, Russia, Ibero-America, Asia, and Africa. Offered jointly with HST 467.

SIS 475 Geography of International Relations (5) *Jackson* Selected problems of spatial patterns and dynamic relationships. Geographical problems of regional, national, and international organization. Offered jointly with GEOG 475. Prerequisite: GEOG 375 or permission of instructor.

SIS 490 Special Topics (1-5, max. 15) AWSp Content varies from quarter to quarter. Prerequisite: permission of instructor.

SIS 491- Senior Honors Seminar (5-) A Study of issues related to students thesis topics. Develops thesis-writing skills. Open only to International Studies honors students.

SIS -492 Senior Honors Seminar (-5) W Students write a senior thesis working with their individual writing advisers.

SIS 495 Task Force (5) W Small-group seminars address current problems in international affairs, each focusing on one specific policy question and producing a joint task force report. Restricted to senior majors in international studies. Prerequisites: 200, 201, 202, 401.

SIS 498 Senior Seminar (5) Reading and discussion of selected works of major importance in interdisciplinary international studies. A major paper based on individual interests is required. Prerequisites: 200, 201, 202, and 401 and acceptance as a major in International Studies.

SIS 499 Undergraduate Research (3-5, max. 15) AWSp Prerequisite: permission of instructor.

African Studies

SISAF 265 Introduction to African Civilizations (5) A Historical framework within which African social, economic, and political systems developed. Art, musical, and religious traditions. Geographical focus on Africa south of the Sahara Desert.

SISAF 444 African Studies Seminar (3, max. 9) W or Sp Interdisciplinary seminar focusing upon one particular aspect of the African continent. Emphasis may be humanistic, social scientific, or historical. African Studies faculty and visiting scholars lecture on areas of their own expertise.

SISAF 450 African Oral Tradition (3) *Eastman, Williams* Range of oral tradition used in Africa from South African heroic poetry through Yoruba divinations to Berber music. Use of oral tradition as both historical method and expressive culture in its geographical, cultural, and religious context. Guest lecturers and audiovisual materials. Prerequisites: AFRAM 303 or 306 or equivalents and either 265 or ANTH 202.

SISAF 490 Special Topics (1-5, max. 15) AWSp Content varies. Prerequisites: three courses in the area.

SISAF 499 Undergraduate Research (3-5, max. 15) AWSp *Eastman, Spain, Williams* Prerequisite: permission of instructor.

Chinese Regional Studies

SISEA 101 Contemporary China (5) Sp *Perry, Townsend* Concentrates on the post-1949 evolution of Chinese government, economy, society, and culture.

SISEA 210 The Far East in the Modern World (5) Social, economic, and political problems of China, Japan, Korea, and Southeast Asia. Development of Russia as an Asiatic power as well as the role of Western powers in the Far East.

SISEA 234 Man, Morality, and the State in Chinese History (5) Concepts of Chinese civilization in its various stages from Confucius's time to the present. Morally based political philosophy of Confucianism with other conflicting or complementary views of man and state (e.g., Taoism, Chinese Marxism).

SISEA 235 Southeast Asian Civilization: Buddhist and Vietnamese (5) *Keyes* Civilizations of Theravada Buddhist societies in Burma, Thailand, Cambodia, and Laos, and Vietnamese societies of Southeast Asia. Culture of tribal peoples who live on peripheries of these societies. Cultural transformations consequent upon the war in Indochina and resettlement of Indochinese refugees in United States. Offered jointly with ANTH 235.

SISEA 240 Chinese Civilization (5) Sp. *Dull* China's material civilization—including fine arts, literature, religion, and thought—in relation to general development of Chinese society.

SISEA 330 The United States in Eastern Asia,1784-1945 (5) A *Butow* The United States in eastern Asia from the arrival of the first American vessel at Canton to the end of the war in the Pacific, with emphasis on the Far Eastern policy of the United States during the first four decades of the twentieth century. Offered jointly with HST 330.

SISEA 419 Asian Marxist Thought (3) Theory and practice of Marxist-Leninism in Asia from 1920 to present. Emphasizes the relation of Asian Marxist thought to the specific domestic and international conditions of the time and to the classical ideas of Marx and Lenin. Offered jointly with POL S 419. Prerequisite: one course from either the nineteenth- or twentieth-century Marxism series or a course in modern Asian politics or history.

SISEA 424 Perspectives on East Asia for Teachers (3, max. 6) Substantive concepts, resources, and materials employed in teaching about East Asia. Requirements may vary in relation to the background of participants.

SISEA 443 Traditional Chinese Society (5) A *Harrell* Late traditional (Ming-Qing) China as a social system. Systematic analysis of temporal and spatial variation in family, kinship, local organization, social class, government, and antigovernment activity. Offered jointly with ANTH 443. Prerequisite: ANTH 202, HSTAS 454, graduate standing or permission of instructor.

SISEA 444 Contemporary Chinese Society (5) W *Harrell* Society in the People's Republic of China as a product of traditional Chinese society and the changes wrought upon it by the impact of the West and by the revolutionary policies and practices of the Chinese Communist Party. Offered jointly with ANTH 444. Prerequisite: 443 or ANTH 403 or permission of instructor.

SISEA 445 Religion in China (5) Sp *Harrell* Religion in Chinese society, doctrines, practices, and social consequences of the eclectic folk religion, the elite Confucian, Taoist, and Buddhist traditions, syncretistic sects, and imported Christianity. Offered jointly with ANTH 447. Prerequisite: one course in Chinese society, politics, or history, or permission of instructor.

SISEA 446 Political Development in East Asia (5) *Perry* Comparative examination of political development in Japan and China from the nineteenth century to the present. Emphasis on theories of development and their applicability to the East Asian context. Prerequisite: one course in Chinese or Japanese history or in political development, or permission of instructor.

SISEA 455 Undergraduate Colloquium on China (5) Interdisciplinary study of China, with emphasis on the modern period. Prerequisite: permission of instructor.

SISEA 465 Postwar Economic Development of Taiwan (5) *Mah* Analytical survey of economic development of Taiwan since 1950. Rapid growth and successful transition from traditional to modern economy. Role of government and foreign trade, income distribution, and standard of living. Prerequisites: ECON 200, 201, or equivalent.

SISEA 490 Special Topics (1-5, max. 15) AWSp Course content varies. Prerequisites: three courses in the area.

SISEA 499 Undergraduate Research (3-5, max. 15)

Comparative Religion

RELIG 201 Introduction to World Religions: Western Traditions (5) AW *Benin, Webb, Williams* History of religions, concentrating on religious traditions that have developed west of the Indus. Primary attention to the Semitic religions (Judaism, Christianity, Islam) and to their ancient world background with emphasis on basic conceptual and symbolic structures.

RELIG 202 Introduction to World Religions: Eastern Traditions (5) W *Conlon, Hawley* History of religions, concentrating on religions that have developed in South Asia and East Asia. Primary attention to Hinduism and Buddhism; other important Asian religions are discussed in relation to them, with emphasis on basic conceptual and symbolic structures.

RELIG 203 Comparing Religions (5) *Hawley* The world's major religious traditions. Major points of comparison: scripture, doctrine, ritual, religious community, the individual. Detailed investigation of a single theme in comparative perspective.

RELIG 210 Introduction to Judaism (5) W *Benin* Basic ideas and motifs of Judaism: God, Covenant, Law, Life Cycle (birth, marriage, family life, sexual laws, role of women, death); Cycle of the Year (Sabbath, holidays, festivals); Holy Land, prayer, Messianism.

RELIG 220 Introduction to the New Testament (5) *Williams* Modern scholarly methods of research and analysis in dealing with New Testament books and their interpretation. Genres of various books (gospel, epistle, sacred history, apocalypse); problems of the relationships among author, material, and intended audience; relationships between theme and image.

RELIG 301 Religious Thought Since the Middle Ages (5) W *Webb* Development of religious thought in the West from the Middle Ages to the twentieth century. History of focal ideas: God, man, knowledge, and authority during this period and the relation of changes in these ideas to the ways in which basic issues in religious thought have been conceived. Recommended: 201.

RELIG 310 Judaism From the Babylonian Exile to the Dead Sea Scrolls (5) *Benin* Religion of Israel from Babylonian exile to the normative religion of the rabbis and transition from Israelite religion to Judaism. Includes revelation and covenant; prophets and authority; priests and the temple; emergence of "sacred scripture," wisdom literature; Hellenism; apocalyptic and Messianic sects; the Dead Sea Scrolls; Roman rule and exile.

RELIG 311 Jewish Religious Thought From Philo to Maimonides (5) WSp *Benin* Jewish religious thought—legal and philosophic—first to thirteenth centuries of the Christian era. Evolution and consolidation of rabbinic Judaism; emergence and flowering of Jewish philosophy, including the contributions of Philo, Saadia, Judah ha-Levi, and Maimonides. Continuity and change within the tradition. Recommended: 201 or 210.

RELIG 313 Jewish Mystical Traditions: Kabbalah and Its Influence (5) *Benin* Jewish esoteric thought from Rabbi Moses Cordovero. Emergence of Safed as a center of this thought. The thought of Isaac Luria and its immense influence in Jewish history through other movements—specifically the mystical messiah, Sabbetai Sevi, and the rise of Hasidism. Recommended: 201 or 210.

RELIG 315 Modern Jewish Thought (5) Jewish thought since the mid-eighteenth century, focusing on major intellectual encounters between Judaism and the modern world. Includes impact of the European enlightenment; reform, conservatism, and neoorthodoxy; Jewish nationalism; and responses to the Holocaust in postwar Jewish thought. Recommended: 201 or 210.

RELIG 320 The World of the Early Church (5) *Williams* Early Christian church within the context of the Greco-Roman sociopolitical, philosophical, and religious environment. Covers the period from about A.D. 100-300. Christian thinkers and documents studied include both the classical "orthodox" and the "heretical." Recommended background: 201 or 220, or HST 307.

RELIG 321 The Age of St. Augustine (5) Sp *Williams* Christian church in the fourth and fifth centuries as a major institution in the Roman Empire. Great figures of patristic theology, such as Athansius, Gregory Nazianzus, Gregory of Nyssa, and Augustine. Recommended: 201 or 320, or HST 307.

RELIG 322 The Gospels and Jesus of Nazareth (5) *Williams* Gospel material from early Christianity, including both canonical and noncanonical gospels. Relation of gospels to analogous literature from the Hellenistic-Roman period. Recommended: 220 or ENGL 309.

RELIG 325 American Religious Thought (5) Sp *Simonson* Main theological ideas and events in American church history. Selected historically important religious movements and themes in America from the time of the Puritans to the twentieth century. Pertinent American social, political, and cultural concerns. Recommended: a course in Western religious traditions, American history, or American literature.

RELIG 326 Gnosticism and Early Christianity (5) W or Sp *Williams* Impact of Gnosticism on the development of Christianity and several other religious groups of that period. Readings dating from the first through the third centuries A.D. Recommended: 201 or 220, or HST 307.

RELIG 327 Eastern Christian Traditions (5) *Webb* Eastern Christian traditions, with principal focus on Eastern Orthodox tradition in Byzantium and Russia from time of the Council of Nicea to the twentieth century. Considers significant differences between eastern and western Christianity and their doctrinal and cultural origins; explores distinctive features of eastern tradition. Prerequisite: 201 or HST 307.

RELIG 349 Religious Movements: The Sociology of Cults and Sects (3) Sp *Stark* Understanding religion, what it is and what it does. Examines the formation of new religious movements, cults, and sects and the conditions under which they succeed or fail. Offered jointly with SOC 349. Prerequisite: SOC 110.

RELIG 350 Buddhism and Society: The Theravada Buddhist Tradition in South and Southeast Asia (5) A *Keyes* Religious tradition of Theravada Buddhism (as practiced in Sri Lanka, Burma, Thailand, Laos, and Cambodia). Variations in ethical orientations developed through Theravada Buddhist ideas. Offered jointly with ANTH 352. Recommended: 202 or knowledge of one Eastern religious tradition.

RELIG 352 Hinduism (5) Sp *Hawley* Varieties of Hindu religious practice; the diverse patterns of religious thought and action among contemporary Hindus. Includes ritual behavior, village Hinduism, tantrism, sadhus, yoga, sects, the major gods and their mythologies, religious art, and the adjustments of Hinduism to modernity. Recommended: 202 or other study of South Asian culture.

RELIG 354 Buddhism (3) *Ruegg* Buddhism as a religious way and as a way of thinking; the forms of Buddhism known in South Asia (India, Sri Lanka, etc.) and those introduced from there to Tibet and other parts of Central Asia. Includes the "Three Jewels" (i.e., the Buddha or Awakened Person, the Teaching [Dharma], and Community [Sangha]) around which Buddhism is traditionally articulated. Recommended: 202 or other study of Asian culture.

RELIG 380 The Nature of Religion and Its Study (5) Sp *Webb* Study of religion as a general human phenomenon. Manner in which different methods of inquiry (phenomenology, anthropology, sociology, psychology, literary criticism, archaeology, philosophy, theology, etc.) illuminate different aspects of religion and help to shape our conceptions of its nature. Recommended: 201 or 202 or other course in the history of religious traditions.

RELIG 410 Religion and Personality (5) Sp *Willeford* Religion's role in the development of the personality, in its dealing with the major events of life in its search for meaning and value. Recommended: 201 or 202 and 380.

RELIG 430 Islam (5) *Ziadeh* Religious and cultural milieu of Arabia before Muhammad; Muhammad's call and struggles to establish the new faith; Qur'anic content and style; Western and Muslim scholarship and the Qur'an; place of traditions in the Islamic edifice; Muslim political and religious thought; sources of Muslim religious law; and modern Muslim movements. In English. Offered jointly with N E 430.

RELIG 445 Greek and Roman Religion (3) Religion in social life of Greeks and Romans; emphasis on their public rituals and festivals. Priesthoods, personal piety, rituals of purification and healing, and the conflict of religions in the early Roman Empire. Offered jointly with CLAS 445. Prerequisite: one course in ancient history, classics, or religious studies; 201 preferred.

RELIG 450 Tibetan Buddhism (3) W *Wylie* Development of Buddhist philosophy and its amalgamation with the teaching of *Bon*, the pre-Buddhism shamanism in Tibet. The resulting doctrines and phenomenology of Tibetan Buddhism. Prerequisite: 202 or equivalent. (Offered alternate years.)

RELIG 490 Special Topics (1-5, max. 15) Topics vary with each offering. Prerequisites: 380 and permission of instructor.

RELIG 491 Seminar: Topics and Issues in Judaism (3-5, max. 15) A *Benin* Includes free will, women, death, mysticism, communal structure, civil law, religious law, prophecy, Jewish medical ethics, etc. Emphasis on how the topic is dealt with in the Bible (e.g., Mishna, Gemara, Rabbinic Responsa). Recommended: 210 or 311.

RELIG 492 Seminar: Topics in Early Christianity (1-5, max. 15) A *Williams* Development of Christian religious thought during its classical formative period. Topics include Apocalypticism, Gnosticism, the figure of the "wise man" or "divine man," the relation between Christian thought and Hellenistic-Roman philosophy. Recommended: one course in early Christian thought or literature.

RELIG 499 Undergraduate Research (1-5, max. 15) AWSp Primarily for comparative religion majors and majors in the School of International Studies. Prerequisite: permission of instructor.

Japanese Regional Studies

SISEA 210 The Far East in the Modern World (5) Social, economic, and political problems of China, Japan, Korea, and Southeast Asia. Development of Russia as an Asiatic power as well as the role of Western powers in the Far East.

SISEA 241 Japanese Civilization (5) *Hanley* Japan's civilization, including fine arts, literature, economic institutions, legal system, material culture, social organization, religions, and government, in relation to the development of Japan as a society and nation.

SISEA 330 The United States in Eastern Asia, 1784-1945 (5) A *Butow* The United States in eastern Asia from the arrival of the first American vessel at Canton to the end of the war in the Pacific, with emphasis on the Far Eastern policy of the United States during the first four decades of the twentieth century. Offered jointly with HST 330.

SISEA 414 Law and Society in Japan (5) *Haley* Role of law in Japan. Particular focus on inherent contrasts between traditional values and Western legal forms, the function and limits of law in governmental processes, and the nature of the criminal process. Recommended: HSTAS 213.

SISEA 419 Asian Marxist Thought (3) (See Chinese Regional Studies for course description.)

SISEA 424 Perspectives on East Asia for Teachers (3, max. 6) Substantive concepts, resources, and materials employed in teaching about East Asia. Requirements may vary in relation to the background of participants.

SISEA 440 The Emergence of Postwar Japan (5) A *Hellmann, Pyle, Yamamura* The making of modern Japan; World War II and surrender; American occupation; postoccupation rebuilding; emergence as an industrial power.

SISEA 441 Economic and Social History of Japan to 1900 (5) A *Hanley, Yamamura* Lecture-seminar on Japanese economic and social history from 700 to 1900. Analyses of the rise and disintegration of the *shoen* system, the rise of commerce, the development of the monetary system, changes in the living standard, demographic changes, and the early phases of industrialization. Political and cultural developments as related to economic and social change. (Taught with 541.)

SISEA 442 Political Economy of Postwar Japan (5) Political and economic problems of Japan since 1945. Utility of competing theoretical approaches to analysis of government and economy of Japan. Policy-making processes and effects of policies adopted. Some knowledge of postwar Japan desirable. Recommended: 440.

SISEA 446 Political Development in East Asia (5) *Perry* Comparative examination of political development in Japan and China from the nineteenth century to the present. Theories of development and their applicability to the East Asian context. Prerequisite: one course in Chinese or Japanese history or in political development, or permission of instructor.

SISEA 451 Undergraduate Colloquium on Japan (5) Interdisciplinary study of Japan with emphasis on the modern period.

SISEA 475 Japanese Society (5) *Hanley* Discusses rapidly changing Japanese society and history of its unique aspects. Readings and lectures in sociology, anthropology, economics, and politics; emphasis on Japanese search for cultural identity and prevalent interpretations of Japanese society and behavior. Prerequisite: 241, HSTAS 213, or background in Japan studies.

SISEA 490 Special Topics (1-5, max. 15) AWSp Topics vary.

SISEA 499 Undergraduate Research (3-5, max. 15) AWSp

Jewish Studies

SISJE 490 Special Topics (1-5, max. 15) AWSp Content varies.

SISJE 499 Undergraduate Research (3-5, max. 15) AWSp Prerequisite: permission of instructor.

Korean Regional Studies

SISEA 210 The Far East in the Modern World (5) Social, economic, and political problems of China, Japan, Korea, and Southeast Asia. Development of Russia as an Asiatic power as well as the role of Western powers in the Far East.

SISEA 330 The United States in Eastern Asia, 1784-1945 (5) A *Butow* The United States in eastern Asia from the arrival of the first American vessel at Canton to the end of the war in the Pacific, with emphasis on the Far Eastern policy of the United States during the first four decades of the twentieth century. Offered jointly with HST 330.

SISEA 419 Asian Marxist Thought (3) (See Chinese Regional Studies for course description.)

SISEA 424 Perspectives on East Asia for Teachers (3, max. 6) Examination and evaluation of substantive concepts, resources, and materials employed in teaching about East Asia. Requirements may vary in relation to the background of participants.

SISEA 439 Politics of Korea (5) AW *Cumings, Palais* Korean politics in the twentieth century, treating political legacy of ancient regime, colonial period, Korean War, and the politics of North and South Korea. Comparative treatment of both Koreas in light of the Chinese and Japanese experience. Includes the America-Korea relationship. Offered jointly with POL S 439. Recommended: 210 or equivalent.

SISEA 446 Political Development in East Asia (5) *Perry* Comparative examination of political development in Japan and China from the nineteenth century to the present. Theories of development and their applicability to the East Asian context. Prerequisite: one course in Chinese or Japanese history or in political development, or permission of instructor.

SISEA 490 Special Topics (1-5, max. 15) Topics vary. Prerequisites: three courses in the area.

SISEA 499 Undergraduate Research (3-5, max. 15)

Middle Eastern Studies

SISME 210 Studies in Islamic Culture (5) A *Siddiq* Fundamentals of Islamic culture presented in selected texts in translation. Selections from the Koran, Islamic law, poetry, theology, and philosophy. Offered jointly with N E 210.

SISME 430 Economic Development of the Middle East (5) *Kavoussi* Comparative examination of economic development in the Middle East. Includes population growth, agrarian change, industrialization, foreign trade, capital flows, and fiscal and monetary policies.

SISME 431 Political Economy of Middle Eastern Petroleum (5) *Kavoussi* Role of Middle Eastern oil-exporting countries, international oil companies, and major oil-consuming nations in determination of supply and demand in the world petroleum market. Impact of oil upon economies of oil-exporting countries and the world economy.

Russian and East European Regional Studies

RUSSIAN PROGRAM

SISRE 140 Russia From the Tenth Century to the Present (5) *Waugh* Russian political, social, and economic history from the tenth century to the present. Offered jointly with HST 140.

SISRE 243 Russian Civilization (5) *Lerner, Waugh* Russia's civilization, including fine arts, literature, religion, and history; political, social, and legal institutions and thought in relation to the general development of Russian society from early times to 1917.

SISRE 244 Soviet Dissent: Yesterday, Today, and Tomorrow (5) *Legters* Survival of dissent in tsarist and modern Russia. Emphasis on scientific knowledge, religion, history, ethnic destiny, and other beliefs as bases for dissent in the Soviet Union.

SISRE 248 Multiethnic States in the Soviet Union and Eastern Europe (5) *Boba* Nationality and multiethnic problems in the Soviet Union and East European states. Relevance and irrelevance of Marxist theory as applied to this problem.

SISRE 324 Soviet Society (5) *Lerner* Political, economic, and social institutions, and the literature and fine arts of the Soviet Union.

SISRE 343 Interdisciplinary Seminar on Russia (5) Bridges the two basic requirements of the Russian Regional Studies baccalaureate program. Study in depth of two short periods in Russian history. Prerequisites: 243, two years of Russian language, and permission of Russian and East European undergraduate adviser.

SISRE 375 Turkic Peoples of the Soviet Union (3) *Cirtautas* History of the Turkic peoples, A.D. 552 to present. Emphasis on current status of Turkic peoples in USSR. Geographical distribution, demographic data, reactions and adaptations to changes resulting from the 1917 revolution. Turkic viewpoint on past and present developments.

SISRE 378 Russia and Asia (3) *Waugh* Russian expansion into Central Asia. Russian and Soviet policies toward nationalities and relations with adjacent Asian countries.

SISRE 401, 402, 403 History of Marxist Thought (5,5,5) A,W,Sp *Legters* 401, 402: teachings of Marx and Engels in the nineteenth century. Analysis of Marxism as a doctrine. 403: Developments in Marxist thought since 1917. Emphasis on neo-Marxist theory in Europe. Prerequisite: permission of instructor.

SISRE 410 Writers and Intellectuals of Soviet Central Asia (3) Covers modern native writers and intellectuals of Soviet central Asia and compares them with writers educated before the revolution. Prerequisite: 375 or permission of instructor.

SISRE 415 Soviet Marxism (5) *Legters* Social and intellectual process leading to a Soviet variant of Marxism; reception of Marxism in Russia and the revolutionary movement formed in its wake. Relationship between the revolution and the major spokesmen for Soviet Marxism. Prerequisite: 401, 402, or 403.

SISRE 450 Survey of the Cultures of the Turkic Peoples of the Soviet Union (3) A *Cirtautas* The nomadic and sedentary cultures of the Turkic peoples' cultural life (language, literature, adherence to traditional modes of life) under Soviet Russia's dominance.

SISRE 455 Marine Resource Policy of the Soviet Bloc (3) A *Kaczynski* Criteria applied by communist states in developing a strategy of ocean resource use and management. Problems and choices influencing communist ocean policy; areas of conflict with other ocean interests, including those of the West and developing countries. Offered jointly with IMS 455. Prerequisites: understanding of communist bloc economic and political systems and approval of instructor.

SISRE 457 Undergraduate Colloquium on Russia (5) Interdisciplinary study of Russia, with emphasis on the historical period. Required of all undergraduate Russian Regional Studies majors. Prerequisite: permission of instructor.

SISRE 490 Special Topics (1-5, max. 15) AWSp Topics vary. Prerequisites: three courses in the area.

SISRE 499 Undergraduate Research (3-5, max. 15) AWSp

EAST EUROPEAN PROGRAM

SISRE 220 Introduction to East European Studies (5) *Velikonja* Geographic setting, ethnic composition, religions, cultural pattern, economic problems, social and political institutions of eastern Europe in the past and present.

SISRE 246 Assent and Dissent in Eastern Europe (5) Art and literature of assent and dissent as used to analyze political problems in Bulgaria, Czechoslovakia, Hungary, Poland, Rumania, and Yugoslavia.

SISRE 248 Multiethnic States in the Soviet Union and Eastern Europe (5) *Boba* Nationality and multiethnic problems in the Soviet Union and East European states. Relevance and irrelevance of Marxist theory as applied to this problem.

SISRE 344 Interdisciplinary Seminar on Eastern Europe Today (5) Development of eastern Europe since 1948, responses of an economically and culturally diverse group of states to the imposition of the Soviet political and social system.

SISRE 458 Undergraduate Colloquium on East Europe (5) Interdisciplinary study of eastern Europe with emphasis on the historical period. Prerequisite: permission of instructor.

SISRE 490 Special Topics (1-5, max. 15) Topics vary. Prerequisites: three courses in the area.

SISRE 499 Undergraduate Research (3-5, max. 15) AWSp

South Asian Studies

SISSA 210 Introduction to Indian Thought (5) *Hawley* Three major themes in Indian thought—time, truth, and temptation—as expressed in classical Hindu and Buddhist texts, and in traditional and modern art and drama. Field trips, films.

SISSA 386 Introduction to the Philosophical Systems of India (5) A *Potter* Fundamental views of classical Indian philosophical schools on epistemology and metaphysics through readings in translation of basic works. Nyaya, Vaisesika, Samkhya, Yoga, Jain philosophy, Vijnanavada and Madhyamika Buddhism, Advaita Vedanta, and later developments. Offered jointly with PHIL 386. Prerequisite: 210 or one course in philosophy.

SISSA 417 Political Economy of India (5) *Brass* Analysis of relationships among processes of economic change, political institutions, and structures of political power in contemporary India. Includes contrasting approaches to Indian economic development, land reform, radical and agrarian political movements, and role of foreign aid.

SISSA 490 Special Topics (1-5, max. 15) AWSp Topics vary. Prerequisites: three courses in the area.

SISSA 498 Undergraduate Colloquium on South Asia (5) Interrelationship of the various social science disciplines in the study of South Asian history and culture. Prerequisite: permission of instructor.

SISSA 499 Undergraduate Research (3-5, max. 15) AWSp

Courses for Graduates Only

General

SIS 500 Seminar: Origins of the Modern Global System (3) Development of global interdependence from the fifteenth century to World War II. Interrelationship of politics and economics. International political economy from contextual, institutional, and historical perspectives.

SIS 501 Seminar: International Political Economy (3) Institutional and historical perspective on the international political economy, focusing on the developing interrelationship of politics and economics. Prerequisites: ECON 200, 201.

SIS 502 Seminar: Change and Stability in International Affairs (3) Sp *Chirot, Jones* Examines major differences in the nature of cultural and economic adaptation to the challenge of the West, as well as the tensions these differences have generated within particular societies. Regional phenomena in the context of powerful international forces.

SIS 590 Special Topics (2-5, max. 10) AWSp Seminar. Course content varies. Offered occasionally by visiting or resident faculty.

SIS 600 Independent Study or Research (*) AWSpS

Chinese Regional Studies

SISEA 521-522 Seminar: Introduction to the Interdisciplinary Study of China (5-5) WSp *Harrell, Perry, Townsend*

SISEA 530 Seminar on China (3, max. 6) AWSp *Chan, Dull, Harrell* Problems of Chinese history. Prerequisite: permission of instructor.

SISEA 531 Chinese History: Research Methods and Bibliographic Guides (3, max. 6) *Chan* Introductory research seminar dealing with the methodological and bibliographical problems concerning all periods and aspects of Chinese history from the earliest times to the nineteenth century. Prerequisite: two years of classical or modern Chinese.

SISEA 553 Chinese Legal Tradition (3) A *Chan, Haley* Concepts and principles of the legal tradition in China. Drawing on primary and secondary sources in English and, for students with Chinese language competence, traces the concept and development of Chinese law as well as legal institutions in Chinese society. Offered jointly with LAW B 553.

SISEA 590 Special Topics (5, max. 10) AWSp Seminar. Course content varies. Offered occasionally by visiting or resident faculty.

SISEA 600 Independent Study or Research (*) AWSp

SISEA 700 Master's Thesis (*) AWSp

Comparative Religion

RELIG 600 Independent Study or Research (*)

Japanese Regional Studies

SISEA 541 Economic and Social History of Japan to 1900 (5) A *Hanley, Yamamura* Analyses of the rise and disintegration of the *shoen* landholding system, the rise of commerce and industrialization, the development of the monetary system, demographic changes, urbanization. Economic and social change through empirical examination and social science techniques. Prerequisite: previous course work in Japanese history or economic history, or permission of instructor. Not open to students who have taken 441.

SISEA 555 Introduction to Modern Japanese Studies (5) A *Hanley* Interdisciplinary introduction to the study of Japan.

SISEA 559 Interdisciplinary Seminar on Japan (5) W *Yamamura* Research seminar, with emphasis on Japan's modern development and contemporary problems.

SISEA 590 Special Topics (5, max. 10) AWSp Seminar. Course content varies. Offered occasionally by visiting or resident faculty.

SISEA 600 Independent Study or Research (*) AWSp

SISEA 700 Master's Thesis (*) AWSp

Korean Regional Studies

SISEA 600 Independent Study or Research (*) AWSp

SISEA 700 Master's Thesis (*) AWSp

Middle Eastern Studies

SISME 600 Independent Study or Research (*)

SISME 700 Master's Thesis (*)

Russian and East European Regional Studies

RUSSIAN PROGRAM

SISRE 500 Interdisciplinary Research Seminar (*) AWSp Contemporary problems in the societal, political, and economic development of Russia and East Europe. Seminars are devoted to specific topics, such as comparative cultures and ethnic minorities; economic development and environmental degradation; comparative communism; and problems of a similar interdisciplinary nature. Prerequisite: permission of instructor.

SISRE 508 Seminar: Problems in the Study of Marxism (3-5, max. 15) AWSp *Legters* Investigation of the deeper and more complex historical and philosophical problems encountered in understanding Marxist thought of the nineteenth and twentieth centuries. Prerequisites: 401, 402, 403, or equivalent in other departments.

SISRE 555 Soviet Ocean Policy (3) W *Kaczynski* Problems of Soviet ocean policy and challenge of Soviet ocean expansion. How Soviet navy, fishing fleet, merchant marine, ocean research capability, and network of overseas land support bases have put USSR in front rank of military powers. Offered jointly with IMS 555. Prerequisite: permission of instructor.

SISRE 590 Special Topics (5, max. 10) AWSp Course content varies. Offered occasionally by visitors or resident faculty.

SISRE 600 Independent Study or Research (*) AWSp

SISRE 700 Master's Thesis (*) AWSp

EAST EUROPEAN PROGRAM

SISRE 500 Interdisciplinary Research Seminar (*) AWSp *Jackson, Thornton* Contemporary problems in the societal, political, and economic development of Russia and East Europe. Seminars are devoted to specific topics, such as comparative cultures and ethnic minorities; economic development and environmental degradation; comparative communism; and problems of a similar interdisciplinary nature. Prerequisite: permission of instructor.

SISRE 504 Approaches to East European Politics (3-5) W *Paul* Selected concepts and methodologies useful for the analysis of politics and social structure in the socialist countries of east-central and southeastern Europe. Offered jointly with POL S 537. Prerequisite: permission of instructor.

SISRE 505 Seminar: Problems of Social and Political Development in Eastern Europe (3-6) Research seminar dealing with selected problems of continuity and change in eastern Europe. Prerequisite: some previous course work on eastern Europe.

SISRE 555 Soviet Ocean Policy (3) W *Kaczynski* Problems of Soviet ocean policy and challenge of Soviet ocean expansion. How Soviet navy, fishing fleet, merchant marine, ocean research capability, and network of overseas land support bases have put USSR in front rank of military powers. Offered jointly with IMS 555. Prerequisite: permission of instructor.

SISRE 600 Independent Study or Research (*) AWSp

SISRE 700 Master's Thesis (*) AWSp

South Asian Studies

SISSA 510 Introduction to Interdisciplinary Study of South Asia (5) Introduction to work done in the various disciplines focusing on South Asia.

SISSA 511 Seminar on South Asia (5) Interdisciplinary seminar for graduate students in which research and writing on individual research topics is critically developed. Designed to provide each student with an opportunity to synthesize his or her studies on South Asia. Prerequisite: 510 or permission of graduate program coordinator.

SISSA 590 Special Topics (5, max. 10) AWSp Seminar. Course content varies. Offered occasionally by visitors or resident faculty.

SISSA 600 Independent Study or Research (*) AWSp

SISSA 700 Master's Thesis (*) AWSp

Japanese Regional Studies

See International Studies.

Jewish Studies

See International Studies.

Korean Regional Studies

See International Studies.

Linguistics

A210 Padelford

Linguistics is the scientific study of language, which is one of the most characteristic human attributes. In contrast with other disciplines concerned with languages, linguistics deals with languages from the point of view of their internal structure as cognitive systems. Courses provide training in the method and theory of language analysis and description, as well as studies of language change and genetic relationships.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: LING 200 or 400; 451, 452, 453; 461, 462, 463; at least one year of a non-Indo-European language; at least one year of an Indo-European language; 20 credits of courses in linguistics or of related courses in other departments as listed in the Department of Linguistics office.

Graduate Program

The Department of Linguistics offers programs of studies for graduate students leading to the degrees of Master of Arts and Doctor of Philosophy. The program is administered by the departmental faculty.

In addition to syntax, phonology, and historical linguistics, some course work is available in various cooperating departments. Among those fields represented outside the department are anthropological linguistics, applied linguistics, Chinese, formal grammars, English, Germanic linguistics, Japanese, Korean, linguistics and society, linguistic philosophy, psycholinguistics, Romance linguistics, Scandinavian linguistics, Semitic linguistics, Slavic linguistics, Southeast Asian linguistics, speech and phonetics.

The major interest of the core faculty, however, lies in theoretical linguistics: syntax, semantics, and phonology. One of the core faculty members is the Supervisory Committee chairperson for each doctoral candidate.

Admission Requirements: At least one previous course in linguistics is highly recommended, as is proficiency in one language other than the student's native language.

Master of Arts Degree

Familiarity with one foreign language, usually a non-Indo-European language. 27 credits of course work are recommended in syntax, phonology, and historical linguistics. At least 9 of these credits must be at the 500 level; 9 credits in LING 700; total credits, 36. In each of three core areas of linguistics and a specialized area, candidates must pass an examination question, do a research paper, or receive a 3.60 grade-point average in three courses numbered 401 or above; thesis.

Doctor of Philosophy Degree

Direct admission to the Ph.D. program will be considered on an individual basis for applicants holding an M.A. in linguistics or a closely related field. In addition to fulfilling the normal Ph.D. requirements, those admitted directly to the Ph.D. program must also, in each of three core areas of linguistics, either pass an examination question, do a research paper, or receive a 3.60 grade-point average in three courses numbered 401 or above.

Requirements for the Ph.D. degree include those for the M.A. degree plus the following: 27 additional credits of course work, including two units in LING 599. Students who receive high pass on the M.A. examination or papers and who are exempted from writing an M.A. thesis will substitute 9 additional credits of course work in lieu of the M.A. thesis credits. 27 credits in LING 800; total credits, 54; supervised teaching; oral General Examination; Final Examination and a dissertation.

Faculty

Chairperson

Joseph E. Emonds

Professors

Brame, Michael K.,* Ph.D., 1970, Massachusetts Institute of Technology; syntax, phonology, structure of Arabic and English.

Contreras, Heles,*‡ (Romance Languages and Literature), Ph.D., 1961, Indiana; Spanish linguistics, syntax, semantics.

Emonds, Joseph E.,* Ph.D., 1970, Massachusetts Institute of Technology; syntax, structure of English and French.

Newmeyer, Frederick J.,* Ph.D., 1969, Illinois; syntax, structure of English, language and society, history of linguistics.

Saporta, Sol,* (Romance Languages and Literature),† Ph.D., 1955, Illinois; language and society, sociology of science, Spanish linguistics.

Voyles, Joseph B.,‡ (Germanics), Ph.D., 1965, Indiana; general and historical Germanic linguistics.

Associate Professors

Augerot, James E.,*‡ (Slavic Languages and Literature, International Studies), Ph.D., 1968, Washington; Slavic linguistics, Romanian, Bulgarian.

Cooke, Joseph R., *‡ (Asian Languages and Literature, Anthropology), Ph.D., 1965, California (Berkeley); Thai languages and literature.

Kaisse, Ellen M.,* Ph.D., 1977, Harvard; phonology, historical linguistics, ancient and modern Greek, syntax-phonology interface.

Assistant Professor

ter Meulen, Alice, Ph.D., 1980, Stanford; formal semantics.

Lecturer

Williams, Wayne R.,*‡ (Afro-American Studies), Ph.D., 1976, Indiana; Afro-American studies/linguistics.

Course Descriptions

Courses for Undergraduates

LING 200 Introduction to Linguistics (5) AWSpS *Brame, Contreras, Emonds, Kaisse, Newmeyer, Saporta* Introduction to the scientific study of language; language and writing; phonological and grammatical analysis; language change; related disciplines.

LING 201 Language and Human Behavior (5) Elements of the biological basis of human language, the differences between animal and human communication, and the function of language in society. Prerequisite: 200.

LING 333 Linguistics and Society (3) *Newmeyer, Saporta, Williams* Interaction of language, culture, and society, and the relationship of linguistic theory to societal problems. Ethical and political considerations involved in the application of linguistic theory.

LING 400 Survey of Linguistic Method and Theory (3) AWSpS *Brame, Contreras, Emonds, Kaisse, Newmeyer, Saporta* Background and scope of modern linguistics; syntax, phonology; languages of the world; language analysis; relation to other disciplines. Not open to students who have had 200.

LING 401 Linguistics and Related Disciplines (3) *Newmeyer, Saporta* Relation of current work in linguistic theory to philosophical, psychological, political, and educational thought.

LING 402 Survey of the History of Linguistics (3) *Shapiro* Survey of the main trends in linguistic theory from ancient times until the advent of transformational-generative grammar. Includes Greek and Roman grammar, non-Western theories of grammar, nineteenth-century comparative and historical grammar, Prague School grammar, and American structuralist grammar. Prerequisite: 400 or equivalent or permission of instructor.

LING 404, 405, 406 Indo-European (3,3,3) *Voyles* Overview of the Indo-European languages, of comparative method, and of the phonology, morphology, and syntax of reconstructed Indo-European. Grammatical analyses and texts from various attested ancient and modern Indo-European languages, selected according to the interests of the students.

LING 433 Language Policy and Cultural Identity (3) *Eastman, Schiffman* Decision-making regarding language in sociopolitical contexts. Language and ethnicity, educational policy, use of language in developing nations. Plans to modernize, purify, standardize, reform, and revive language. Language loyalty and motives for second-language acquisition. Offered jointly with ANTH 464. Prerequisite: 200 or 400.

LING 441 Linguistics and Poetic Language (3) Relationship between linguistic structures, linguistic universals, and the poetic uses of language; linguistic description in the analysis of literature. Prerequisite: 400 or permission of instructor.

LING 443 Philosophy and Linguistics (3) Philosophical problems that arise in the attempt to understand current linguistic theories and the implications of linguistics for philosophy. Offered jointly with PHIL 443.

LING 445 Theoretical Aspects of Teaching English as a Foreign Language (3) W Linguistic analysis as a basis for the teaching of English as a foreign language; language as rule-governed behavior. Prerequisite: 200 or 400 or permission of instructor.

LING 447 Language Development (4) A *Dale* First-language acquisition and use by children. Emphasis on theoretical issues and research techniques. Offered jointly with PSYCH 457. Prerequisites: 400 or PSYCH 306, and senior or graduate standing.

LING 449 Second-Language Learning (3) Sp Issues related to the psychological aspects of second-language learning. Prerequisite: 200 or 400 or permission of instructor.

LING 451, 452, 453 Phonology (3,3,3) A,W,Sp *Brame, Contreras, Kaisse, Saporta* Speech sounds, mechanism of their production, and structuring of sounds in languages; generative view of phonology. Offered jointly with ANTH 451, 452, 453. Prerequisite: 200 or 400, either of which may be taken concurrently.

LING 454 Methods in Comparative Linguistics (3) *Klausenburger, Shapiro, Voyles* Method and theory of historical and comparative linguistics. Problems of phonological, morphological, syntactic, and semantic change and reconstruction. Prerequisite: 400 or permission of instructor, undergraduate adviser, or graduate program coordinator.

LING 455 Areal Linguistics (3, max. 6) *Eastman* Issues involved in classification of languages. Systems of classification based on structure, word order, areal features. Ways in which languages may be classified for different purposes. Processes such as borrowing, vocabulary specialization, lexical change, language death and revival. Offered jointly with ANTH 455.

LING 461, 462, 463 Syntax (3,3,3) A,W,Sp *Brame, Contreras, Emonds, Newmeyer* Study of the structural properties of language; introduction to generative transformational syntax. Offered jointly with ANTH 461, 462, 463. Prerequisite: 200 or 400 or permission of instructor.

LING 476 Philosophy of Language (5) Current theories of meaning, reference, predication, and related concepts. Offered jointly with PHIL 453. Recommended: PHIL 120.

LING 479 Formal Semantics and Natural Language (3) Formal characterization of linguistic meaning. Emphasis on nature and purpose of formal semantics and on its relation to formal syntax. Typical topics: Tarskian definitions of truth; "truth theory" and theory of meaning; possible world semantics; Montague semantics; generative semantics; Chomsky on syntax and semantics. Offered jointly with PHIL 479. Recommended: PHIL 120 or 370.

LING 499 Undergraduate Research (1-5) AWSpS

Courses for Graduates Only

LING 500 Proseminar (3) Introduction to bibliography and research in linguistics.

LING 501, 502, 503 Linguistic Analysis Laboratory (3,3,3) Guided analysis of a language unfamiliar to all students of the class; construction of a grammar based on material elicited from native informant. Prerequisites: 453, 463, or permission of instructor.

LING 504 Indo-European Comparative Phonology (2) *Kaisse* Sound systems of the principal families of Indo-European and the relation of these to a hypothetical parent tongue. Prerequisite: 406 or permission of instructor. (Offered alternate years.)

LING 505 Indo-European Comparative Grammar (2) Systematic treatment, with extensive surveys of individual language groups. Prerequisite: 504.

LING 514 Seminar in Comparative Linguistics (3) *Kaisse* Nineteenth- and twentieth-century theories of phonological change. Prerequisite: 404 or permission of instructor.

LING 519 Mathematical Models of Grammar (3) *Brame* Study of some mathematical models of language recognition, emphasizing context-free and context-sensitive grammars. Prerequisite: graduate standing in mathematics, linguistics, or psychology, or permission of instructor.

LING 524 Seminar in Theoretical Linguistics (3, max. 6) Individual and joint research on selected topics in theoretical linguistics. Topics change each quarter. Typical topics are semantics, generative grammar, phonological theories. Prerequisites: 453, 463.

LING 530 Dialectology (3) *Schiffman, Williams* The principles of dialect deviation as related to linguistic structure and usage. Offered jointly with ANTH 530. Prerequisite: 452 or permission of instructor.

LING 550, 551, 552 Advanced Phonology (3,3,3) AWSp *Brame, Kaisse* Problems in phonological theory, generative phonology, phonological change. Theories of prosody. Prerequisites: 451, 452, 453.

LING 553 Analysis of Linguistic Structures (3, max. 6) Syntactic and/or phonological analysis. Language varies. Offered jointly with ANTH 553. Prerequisite: permission of instructor.

LING 561, 562, 563 Advanced Syntax (3,3,3) A,W,Sp *Brame, Contreras, Emonds, Newmeyer* Intensive investigation of the historical background of, and recent developments in, transformational syntax. Prerequisites: 461, 462, 463.

LING 565 Contrastive Linguistics (3) The attempt to look across linguistic systems for comparable and contrastive classes and subclasses. Problems of subcategorization and universal grammar. Three conceptually distinct models: structural, transfer grammar, generative. Prerequisites: 452, 463.

LING 567 Syntactic and Semantic Development (3) A *Dale* Selected topics in the study of child language (e.g., cognitive basis of language, early semantic systems, development in language-handicapped children). Topics vary. Offered jointly with PSYCH 567. Prerequisites: one course in child language development and permission of instructor.

LING 579 Comparative Altaic Linguistics (3) Comparative phonology and morphology of Mongolian, Turkic, and other Altaic languages. Offered jointly with ALTAI 579. Prerequisite: permission of instructor.

LING 580 Problems in Linguistics (3, max. 12) AWSp *Brame, Contreras, Kaisse, Newmeyer, Saporta, Williams* For advanced students of linguistics, dealing with significant movements, techniques, skills, and theories in the field. Prerequisite: permission of instructor.

LING 599 Linguistics Colloquium (1, max. 6) AWSp Seminar attended by faculty and graduate students to discuss research in progress and topics of general interest. Attendance is required for a minimum of two quarters during the student's residence. Prerequisite: permission of instructor.

LING 600 Independent Study or Research (*) AWSpS

LING 700 Master's Thesis (*) AWSpS

LING 800 Doctoral Dissertation (*) AWSpS

Mathematics

C138 Padelford

Mathematics is the basic language of physical science, with applications in engineering and business as well as the natural and social sciences. The department has introduced a Mathematical Sciences option in its Bachelor of Science degree program for those students who want to prepare for careers in industry, business, or graduate study in applied mathematics or natural science. For students who want to study mathematics as a discipline in its own right, the department continues to offer the Pure Mathematics option of the B.S. degree. The Bachelor of Arts degree is intended for those students who do not wish to continue studies in either mathematics or a mathematical science.

Undergraduate Program

In all options, 2.0 or higher grades must be obtained in all mathematics courses presented to satisfy the mathematics requirement, and a grade-point average of 2.00 or higher must be obtained in all mathematics courses taken.

Bachelor of Arts Degree

Admission: Four years of high school mathematics recommended.

LIBERAL ARTS OPTION

Major Requirements: 50 approved credits in mathematics, including MATH 124, 125, 126, 302, 303, 327, 328, and 9 credits in mathematics courses numbered 400 or above.

TEACHER PREPARATION OPTION

Major Requirements: 50 approved credits in mathematics, including MATH 124, 125, 126, 205 or 302, 327, 411, 412, 444, 445; STAT 341, 342; either QMETH 200, ENGR 141 or C SCI 241 or equivalent programming experience.

Bachelor of Science Degree

Admission: Same as for the Bachelor of Arts degree.

MATHEMATICAL SCIENCES OPTION

Major Requirements: (1) A minimum of 58 credits in mathematics. Courses must include MATH 124, 125, 126 (or 134, 135, 136); 238, 239; 302, 303; 327, 328 (or 334, 335); 394, 395, 396; and two sequences chosen from 407, 408; 424, 425, 426; 427, 428, 429; 464, 465, 466. (2) PHYS 121, 122, 123. (3) Either C SCI 241 or ENGR 141. (4) 15 additional credits in a designated area of concentration. Suggested areas include: astronomy, atmospheric sciences, computer science, economics, geophysical sciences, physics, physical chemistry, and statistics. Students contemplating this option normally should apply during their sophomore year.

MATHEMATICS OPTION

Major Requirements: (1) A minimum of 70 credits in mathematics. Courses must include MATH 124, 125, 126 (or 134, 135, 136); 238, 239; 302, 303, 304; 327, 328, 329 (or 334, 335, 336); 402, 403, 404; 424, 425, 426; at least one three-quarter or two two-quarter sequences chosen from 405, 406; 407, 408; 414, 415; 427, 428, 429; 441, 442, 443; 461, 462. (2) PHYS 121, 122, 123. (3) Either C SCI 241 or ENGR 141.

Graduate Program

James A. Morrow, Graduate Program Coordinator

The degrees of Master of Arts, Master of Science, and Doctor of Philosophy are offered. Opportunities are available within the department for study of pure and applied mathematics for each of these degree programs. The two master's degrees are equivalent in rigor and quality, but they serve students with different needs. The Master of Arts degree is appropriate for students who need a broad background in advanced mathematics and who expect to continue working with mathematics of approximately the same level in their careers. A teacher preparation option is offered. The Master of Science degree is appropriate for students who expect to be working with more specialized mathematics of increasing order of complexity in their careers. The Doctor of Philosophy degree is the highest professional degree in mathematics. It is appropriate for students who plan on a career of research and/or teaching of mathematics at the highest levels.

Master of Arts Degree

MATHEMATICS OPTION

Admission Requirement: Bachelor of Arts degree with major in mathematics or equivalent background (minimum of 45 quarter credits, or 30 semester credits of mathematics beyond college algebra).

Graduation Requirements: With Thesis—36 credits in courses at the 400 level or above, of which 18 must be in courses at the 500 level or above, including 9 credits for thesis. At least 6 credits each in algebra, analysis, and one other field. Demonstration of proficiency in one of three languages—French, German, or Russian. Thesis is largely expository.

Without Thesis—36 credits in courses at the 400 level or above, of which 18 must be in courses at the 500 level or above. At least 6 credits each in algebra, analysis, and one other field. The 18 credits in courses numbered 500 or above should be distributed over no more than three sequences. Language requirement same as the thesis option.

TEACHER PREPARATION OPTION

Admission Requirement: Baccalaureate degree with background in mathematics.

Graduation Requirements: 36 credits; 33 at the 400 level or above, remaining 3 at the 400 level or above in mathematics or at the 300 level or above in another field; 18 credits must be at the 500 level or above, and at least 15 of these credits must be in mathematics courses; 9 credits must be in thesis. A foreign language is not required.

Master of Science Degree

Admission Requirement: Bachelor of Science degree with major in mathematics, Bachelor of Arts degree with strong major in mathematics or equivalent background.

Graduation Requirements: With Thesis—36 credits, including 9 credits of thesis; a minimum of 27 approved credits in courses numbered 400 or above, with at least 18 credits in courses numbered 500 or above. The courses must include at least 6 credits each in analysis, algebra, and one other field. Demonstration of proficiency in one of three languages—French, German, or Russian. Thesis should contain original research. *Without Thesis*—Formal admission to candidacy for the Doctor of Philosophy degree. Also see the Department of Statistics listing in this section of the catalog.

Doctor of Philosophy Degree

Admission Requirement: Mathematical training equivalent to a master's degree in mathematics.

Graduation Requirements: Satisfactory performance in MATH 504, 505; 524, 525; 534, 535; a set of preliminary exams on basic graduate material; General Examination on a special topic; demonstration of proficiency in one of the following languages: French, German, Russian; dissertation that is an original piece of work; and Final Examination.

Research Facilities

An excellent library and access to computing facilities are located in the same building as the department. The mathematics research library has an outstanding collection of monographs and subscribes to nearly all journals of significance to the mathematics community. The department shares with statistics and biostatistics a research-oriented UNIX-based VAX 11/750. Other accessible computers include a CDC Cyber 170/750, VAX 11/780, and numerous other project-dedicated systems.

Financial Support

More than half of the graduate students in mathematics are supported by teaching assistantships. The workload allows ample time for graduate courses and thesis work.

Correspondence and Information

Graduate Program Adviser
C36 Padelford, GN-50

Faculty

Chairperson

Ramesh A. Gangolli

Professors

Arsove, Maynard G.,* Ph.D., 1950, Brown; potential theory, complex function theory, theory of bases.

Beaumont, Ross A.,* Ph.D., 1940, Illinois; algebra (group theory).

Birnbaum, Z. William (Emeritus), Ph.D., 1929, John Casimir (Lwow, Poland); statistics.

Blumenthal, Robert M.,* Ph.D., 1956, Cornell; probability.

Brownell, Francis H.,* Ph.D., 1949, Princeton; differential equations, applied mathematics.

Corson, Harry H.,* Ph.D., 1957, Duke; topology, functional analysis.

Curjel, Caspar R.,* Dr.Sc., Math., 1960, Eidg. Techn. Hochschule, Zurich (Switzerland); algebraic topology, algebra.

Curtis, Edward B.,* Ph.D., 1962, Harvard; algebraic topology.

Dubisch, Roy, Ph.D., 1943, Chicago; mathematical education.

Erickson, K. Bruce,* Ph.D., 1970, Wisconsin; probability theory.

Folland, Gerald B.,* Ph.D., 1971, Princeton; partial differential equations.

Gangolli, Ramesh A.,* Ph.D., 1961, Massachusetts Institute of Technology; probability.

Glicksberg, Irving,* Ph.D., 1951, California (Los Angeles); harmonic analysis.

Goldstein, Allen A.,* Ph.D., 1954, Georgetown; approximation theory, nonlinear programming, control theory, calculus of variations.

Greenberg, Ralph,* Ph.D., 1970, Princeton; number theory.

Grunbaum, Branko,* Ph.D., 1957, Hebrew University; geometry.

Hewitt, Edwin,* Ph.D., 1942, Harvard; harmonic analysis on groups, measure theory functional analysis.

Jans, James P.,* Ph.D., 1955, Michigan; ring structure and homological algebra.

Klee, Victor L.,* (Computer Science), Ph.D., 1949, Virginia; convex sets, analysis of algorithms, linear programming, combinatorics, functional analysis.

Lind, Douglas A.,* Ph.D., 1973, Stanford; ergodic theory.

McFarlan, Lee H. (Emeritus), Ph.D., 1924, Missouri; calculus of variations.

Michael, Ernest A.,* Ph.D., 1951, Chicago; topology.

Miller, Haynes R.,* Ph.D., 1975, Princeton; algebraic topology.

Morel, Anne C.,* Ph.D., 1953, California (Berkeley); logic, general algebra, ordered groups.

Morrow, James A.,* Ph.D., 1967, Stanford; complex analysis.

Namioka, Isaac,* Ph.D., 1956, California (Berkeley); algebraic topology, functional analysis.

Nunke, Ronald J.,* Ph.D., 1955, Chicago; category theory, Abelian groups.

Phelps, Robert R.,* Ph.D., 1958, Washington; convexity, functional analysis, geometry of Banach spaces.

Pyke, Ronald,‡ Ph.D., 1956, Washington; statistics (nonparametric inference).

Ravenel, Douglas C.,* Ph.D., 1972, Brandeis; algebraic topology.

Rockafellar, Ralph T.,* Ph.D., 1963, Harvard; convexity, linear programming.

Sarason, Leonard,* Ph.D., 1961, New York; partial differential equations.

Segal, Jack,* Ph.D., 1960, Georgia; topology.

Shorack, Galen R.,*‡ (Statistics), Ph.D., 1965, Stanford; mathematical statistics (distribution-free statistics).

Stout, Edgar L.,* Ph.D., 1964, Wisconsin; complex analysis.

Warfield, Robert B.,* Ph.D., 1967, Harvard; algebra.

Warner, Garth W.,* Ph.D., 1966, Michigan; analysis.

Westwater, Michael J.,* Ph.D., 1967, Cambridge; mathematical physics.

Associate Professors

Avann, Sherwin P. (Emeritus), Ph.D., 1942, California Institute of Technology; lattice theory.

Bass, Richard F.,* Ph.D., 1977, California (Berkeley); probability theory (Markov processes) and statistics.

Bungart, Lutz,* Ph.D., 1962, Princeton; several complex variables.

Dekker, David B. (Emeritus), (Computer Science),† Ph.D., 1948, California (Berkeley); computers.

Irving, Ronald,* Ph.D., 1977, Massachusetts Institute of Technology; ring theory.

King, James R.,* Ph.D., 1969, California (Berkeley); several complex variables.

Kingston, J. Maurice,* Ph.D., 1939, Toronto; mathematical education.

Koblitz, Neal I.,* Ph.D., 1974, Princeton; algebraic number theory.

Marshall, Donald E.,* Ph.D., 1976, California (Los Angeles); functional analysis.

Monk, George S.,* Ph.D., 1964, Minnesota; algebra.

Moore, Robert T.,* Ph.D., 1964, Princeton; operator theory and group representation.

Osborne, Mason S.,* Ph.D., 1972, Yale; representation theory.

Ragozin, David L.,* Ph.D., 1967, Harvard; approximation theory, analysis on Lie groups.

Sullivan, John B.,* Ph.D., 1971, Cornell; algebraic groups.

Zafran, Misha,* Ph.D., 1972, California (Riverside); harmonic analysis.

Assistant Professors

Arms, Judith M.,* Ph.D., 1977, California (Berkeley); mathematical physics.

Ballard, John W.,* Ph.D., 1974, Wisconsin; algebraic representation theory.

Doty, Stephen (Acting), Ph.D., 1982, Notre Dame; representation theory.

DuChamp, Thomas E.,* Ph.D., 1976, Illinois; differential geometry, foliations, characteristic classes, calculus of variations.

Fernando, Suren L. (Acting), Ph.D., 1983, Wisconsin; abstract algebra.

Graham, Robin, Ph.D., 1981, Princeton; several complex variables, partial differential equations.

Griffin, Philip S. (Acting), Ph.D., 1982, Minnesota; probability theory.

Kottwitz, Robert E.,* Ph.D., 1977, Harvard; representation theory.

Merrill, Kathy (Acting), Ph.D., 1983, Colorado; ergodic theory, number theory.

Messer, Thomas C. (Acting), Ph.D., 1983, Duke; nonlinear partial differential equations.

Ozols, Vilnis,* Ph.D., 1967, California (Berkeley); Lie groups, Riemannian geometry.

Riedtmann, Christine,* Ph.D., 1978, Switzerland; representation theory of artin algebras.

Wegmann, Steven A. (Acting), Ph.D., 1983, Warwick; algebraic topology.

Lecturers

Baxter, Kathleen, Ph.D., 1959, California (Berkeley); biostatistics, teacher education.

Warfield, Virginia M., Ph.D., 1971, Brown; probability and remedial mathematics.

Zuckerman, Helen C. (Emeritus), M.S., 1935, Washington; mathematics.

Course Descriptions

Courses for Undergraduates

Mathematics

MATH 100, 102 Algebra (5,5) AWSp,AWSp Similar to the first three terms of high school algebra. Assumes no previous experience in algebra. Open only to specially admitted students (i.e., [1] Educational Opportunity Program students, or [2] students admitted with an entrance deficiency in mathematics; not open to regularly admissible students).

MATH 103 Introduction to Elementary Functions (3) AWSp Continues the study of algebra begun in 100 and 102 with emphasis on functions (polynomial, rational, logarithmic, exponential, and trigonometric). Open only to specially admitted students (see definition under 100) who have completed 102.

MATH 105 Elementary Functions (5) AWSpS Elementary functions with emphasis on the general nature of function, polynomial, rational, exponential, logarithmic, and trigonometric functions. Not open for credit to students who have taken 156. Prerequisites: 1½ years of high school algebra and qualifying test, or equivalent.

MATH 106 Introduction to Finite Mathematics (3) AWSp Brief introduction to logic, set theory, and probability theory. Intended primarily for students in the biological and social sciences and in business administration. Ordinarily, credit may not apply toward a major in mathematics. Prerequisite: 1½ years of high school algebra, or X101 or equivalent.

MATH 124, 125, 126 Calculus With Analytic Geometry (5,5,5) AWSpS,AWSpS,AWSpS Plane analytic geometry, differentiation of algebraic and transcendental functions, definite and indefinite integrals, technique of integration, vectors, vector-valued functions, infinite series. Applications. Credit not allowed for both 124 and 134, or 125 and 135, or 126 and 136. Prerequisites: 105 or qualifying test, and trigonometry for 124; 124 or 134 for 125; 125 or 135 for 126.

MATH 134, 135, 136 Honors Calculus With Analytic Geometry (5,5,5) A,W,Sp See credit restrictions under 124, 125, 126 above. Prerequisites: four years of high school mathematics, including one year of calculus, and permission of departmental adviser.

MATH 156 Application of Algebra to Business and Economics (5) AWSpS Use of graphs and algebraic functions as found in business and economics. Algebraic and graphical manipulations to solve problems. Exponential and logarithm functions; various applications to growth of money. Not open for credit to students who have taken 105. Prerequisite: 1½ years of high school algebra.

MATH 157 Application of Calculus to Business and Economics (5) AWSpS Rates of change, tangent, derivative, accumulation, area, integral in specific contexts, particularly economics. Techniques of differentiation and integration. Application to problem solving. Optimization. Credit does not apply toward a mathematics major. Prerequisite: 156 or equivalent.

MATH 170, 171 Mathematics for Elementary School Teachers (3,3) AWSpS,Sp Development of the systems of whole numbers, integers, and rational numbers; measurement; basic geometric concepts; functions; elementary probability and statistics. Ordinarily, credit may not apply toward a major in mathematics. Prospective elementary education students are required to take 170. Prerequisites: one year of high school algebra and one year of geometry for 170; 170 for 171.

MATH 205 Elementary Linear Algebra (3) AWSpS Systems of equations, vector spaces, matrices, linear transformations, characteristic vectors. Not open for credit to students who have taken 302. Prerequisite: 124 or 157.

MATH 238, 239 Elements of Differential Equations (3,3) AWSpS,AWSp Elementary methods of solution of first-order equations, linear equations of second and higher order, power series solutions. Laplace transforms, linear systems, stability theory. Prerequisite: 126 or 136 for 238; 238 and either 205 or 302 for 239.

MATH 301 Elementary Number Theory (3) AWS Brief introduction to some of the fundamental ideas of elementary number theory. Prerequisite: 126 or 136.

MATH 302, 303, 304 Linear Algebra (4,3,3) AWSpS, AWSpS,Sp Systems of linear equations. Vector spaces, equations, equivalence and similarity of matrices. Characteristic values and vectors. Jordan canonical form. Inner product spaces, linear functionals, application to linear programming and differential equations. Prerequisites: 126 or 136 for 302; 302 for 303; 303 for 304.

MATH 305 Introduction to Mathematical Logic (3) AS Induction, relations, partial ordering, lattice ordering, linear ordering, equivalence relations. Propositional calculus; relationship between propositional calculus and Boolean algebras. Predicate logic. Prerequisites: 126 or 205, or 105 and PHIL 120.

MATH 327, 328, 329 Advanced Calculus (3,3,3) AWSpS, AWSpS,AWSpS Functions of several variables, partial derivatives, gradients, extremal problems, line integrals, Green's theorem. Lagrange multipliers, surface integrals, vector analysis in three dimensions, theorems of Gauss and Stokes. Infinite series, uniform convergence, improper integrals. Prerequisite: 126 or 136 for 327; 327 for 328; 328 for 329.

MATH 334, 335, 336 Honors Advanced Calculus (3,3,3) A,W,Sp Honors courses covering the material of 327, 328, 329 from a more advanced standpoint. Also cover material from 238 and selected other topics. Prerequisites: 136 or permission for 334; 334 for 335; 335 for 336. (Formerly 234, 235, 236.)

MATH 381, 382, 383 Introduction to Mathematical Modeling (3,3,3) A,W,Sp Simple discrete and continuous models of diverse natural and social phenomena, with particular reference to the unity of the tools of mathematical analysis useful in their study. 381 devoted to discrete methods; 383, continuous methods; 382, a mixture. Mathematical topics and phenomena. Offered jointly with AMATH 381, 382, 383. Prerequisites: 126 and either 205 or 302 for 381, 382; 327 and either 238 or AMATH 351 for 383.

MATH 402, 403, 404 Introduction to Modern Algebra (3,3,3) AS,WS,Sp Algebraic systems; elementary theory of groups, rings, and fields; polynomials; topics in linear algebra; reductions of forms. Prerequisites: 236 or 302 or 336 for 402; 402 for 403; 403 for 404.

MATH 405 Logic and Metamathematics (3) W Predicate logic; equational logic and its models; Boolean algebras and circuits; primitive recursive functions. Prerequisite: 305 or 402 or permission of instructor.

MATH 406 Elementary Set Theory (3) Sp Development of set theory, in particular cardinals and ordinals; axiom of choice; continuum hypothesis; Zermelo-Fraenkel axioms for set theory. Prerequisite: 402 or 405 or 424 or permission of instructor.

MATH 407, 408 Mathematical Optimization Theory (3,3) W,Sp Theory of linear programs and its applications: systems of linear inequalities, duality, the simplex algorithm, matrix games. Nonlinear programs and Lagrange multipliers. Assignment problems and various combinatorial extremum problems involving directed graphs. Prerequisites: 302 for 407; 407 for 408.

MATH 411, 412 Introduction to Modern Algebra for Teachers (3,3) AS,WS Development of the number systems of elementary algebra; groups, rings, integral domains and fields; polynomials. Designed for teaching majors; not open for credit to students who have taken 402, 403. Prerequisites: 205 or 302 for 411; 411 for 412.

MATH 414, 415 Number Theory (3,3) W,Sp Congruences, arithmetic of quadratic fields, binary quadratic forms, Dirichlet's theorem on primes in an arithmetic progression, Chebyshev's theorem on distribution of primes, the partition function, equations over finite fields. Prerequisites: 301 for 414; 414 for 415.

MATH 420 History of Mathematics (3) S Survey of the development of mathematics from its earliest beginnings through the first half of the twentieth century. Prerequisite: 402 or 412.

MATH 424, 425, 426 Fundamental Concepts of Analysis (3,3,3) A,W,Sp Sets, real numbers, topology of metric spaces, normed linear spaces, multivariate calculus from an advanced viewpoint. Introduction to Lebesgue measure and integration. Prerequisites: 329 or 236 or 336, and 303 or permission for 424; 424 for 425; 425 for 426.

MATH 427, 428, 429 Topics in Applied Analysis (3,3,3) AWS,WSpS,SpS Elementary functions of a complex variable; Cauchy integral formula. Taylor and Laurent series; conformal mapping. Fourier series; orthogonal functions; boundary value problems; application. Prerequisites: 334 or 327 for 427; 334 or 327 and 328 for 428; 428 for 429.

MATH 438 Introduction to Partial Differential Equations (3) Integral curves and surfaces of vector fields, initial value problems for first-order linear and quasi-linear equations, Cauchy-Kovalevsky theorem, general Cauchy problem characteristics, special equations. Prerequisites: 205 or 303, 238, and 328.

MATH 441, 442, 443 Advanced Geometry (3,3,3) A,W,Sp Selected topics from among projective geometry, differential geometry, advanced analytic geometry, algebraic geometry, algebraic topology, and the geometry of convex bodies. Prerequisites: 327 or 234 or 334, and 302 or permission of departmental adviser for 441; 441 for 442; 442 for 443.

MATH 444, 445 Foundations of Geometry (3,3) AS,WS Axiomatic treatment of the foundations of Euclidean geometry. Introduction to non-Euclidean geometry. Designed for teaching majors. Prerequisites: 126 or 136 for 444; 444 for 445.

MATH 461, 462 Combinatorial Theory (3,3) Selected topics from among: block designs and finite geometries, coding theory, generating functions and other enumeration methods, graph theory, matroid theory, combinatorial algorithms, applications of combinatorics. Prerequisites: at least one 300-level course in mathematics, statistics, or computer science for 461; 461 for 462.

MATH 464, 465, 466 Numerical Analysis I, II, III (3,3,3) AS,W,Sp Basic principles of numerical analysis, classical interpolation and approximation formulas, finite differences and difference equations. Numerical methods in algebra, systems of linear equations, matrix inversion, successive approximations, iterative and relaxation methods. Numerical differentiation and integration. Solution of differential equations and systems of such equations. Prerequisites: 303, ENGR 141, and/or C SCI 241 or equivalent programming experience for 464; 464 for 465; 238 and 464 for 466.

MATH 496 Honors Seminar (*, max. 9) AWSp Problem seminar for senior honors students and first-year graduate students. Prerequisite: permission of instructor.

MATH 497 Special Topics in Mathematics for Teachers (2-5, max. 15) S Study of selected areas of mathematics. Designed for the improvement of teachers of mathematics. Offered jointly with EDC&I 478.

MATH 498 Special Topics in Mathematics (2-5, max. 15) AWSpS Reading and lecture course intended for special needs of advanced students. Prerequisite: permission of instructor.

Probability and Statistics

MATH 390 Probability and Statistics in Engineering and Science (4) AWSpS Concepts of probability and statistics. Conditional probability, independence, random variables, distribution functions. Descriptive statistics, transformations, sampling errors, confidence intervals, least squares and maximum likelihood. Exploratory data analysis and interactive computing. Offered jointly with STAT 390. Students may not receive credit for both 390 and STAT 481. Prerequisites: 238 or 327, and 205 or 302.

MATH 394 Probability I (3) AWS Sample spaces; basic axioms of probability; combinatorial probability; conditional probability and independence; binomial, Poisson, and normal distributions. Offered jointly with STAT 394. Prerequisite: 327.

MATH 395 Probability II (3) WSpS Random variables; expectation and variance; laws of large numbers; normal approximation and other limit theorems; multidimensional distributions and transformations. Offered jointly with STAT 395. Prerequisite: 394.

MATH 396 Probability III (3) Sp Characteristic functions and generating functions; recurrent events and renewal theory; random walk. Offered jointly with STAT 396. Prerequisite: 395 or STAT 511.

MATH 491, 492 Introduction to Stochastic Processes (3,3) A,W Random walks, Markov chains, branching processes, Poisson process, point processes, birth and death processes, queuing theory, stationary processes. Offered jointly with STAT 491, 492. Prerequisites: 396 for 491; 491 for 492.

Courses for Graduates Only

Every year additional courses are offered, and some of the courses listed are not offered every year. Inquiries about the currently offered courses should be addressed to the Graduate Secretary, Department of Mathematics.

Mathematics

MATH 501, 502, 503 Mathematical Logic (3,3,3) A,W,Sp Theory of formal systems. Formal development of number theory. Completeness and incompleteness, decidability and undecidability. The theorems of Godel, Henkin, Church, Rosser, and Tarski. Selected topics from axiomatic set theory, recursive function theory, theory of models, or advanced theory of formal systems. Prerequisites: 405 or equivalent for 501; 501 for 502; 502 for 503.

MATH 504, 505, 506 Modern Algebra (3,3,3) A,W,Sp Theory of groups, rings, integral domains, and fields; polynomials; vector spaces, Galois theory, and theory of ideals. Prerequisites: 404 or equivalent for 504; 504 for 505; 505 for 506.

MATH 507, 508 Calculus of Variations I, II (3,3) A,W Necessary and sufficient conditions for a weak and strong extremum. Legendre transformation, Hamiltonian systems. Constraints and Lagrange multipliers. Space-time problems with examples from elasticity, electromagnetics, and fluid mechanics. Sturm-Liouville problems. Approximate methods. Offered jointly with AMATH 507, 508. Prerequisites: 238 or AMATH 351, MATH 327, 328, 329 for 507; 507 for 508; recommended 428, 429 or AMATH 402, 403.

MATH 510 Seminar in Algebra (*, max. 5) AWSp Prerequisite: permission of graduate program coordinator.

MATH 511, 512, 513 Special Topics in Algebra (2-3, max. 9; 2-3, max. 9; 2-3, max. 9) A,W,Sp In recent years the following subjects have been covered: Abelian groups, algebraic function fields, algebraic number theory, classical groups, game theory, group extensions, lattice theory, Lie algebras, number theory, and structure of rings.

MATH 519 Tensor Analysis (3) A Cartesian tensors; motivation, manipulation, applications. Riemannian space; Christoffel symbols, geodesics, covariant differentiation. Curvature tensor, geodesic deviations, flat space. Special local coordinate systems. Applications to classical mechanics, continuum mechanisms, electromagnetism, relativity. Special topics. Offered jointly with AMATH 519. Prerequisite: 327 or AMATH 401, or permission of instructor.

MATH 524, 525, 526 Real Variable (3,3,3) A,W,Sp Metric spaces; general measures and integration; differentiation of set functions; real valued functions on the line; Banach spaces. Prerequisites: 426 or equivalent for 524; 524 for 525; 525 for 526.

MATH 527 Elements of Real Variables for Scientists (3) A Compactness theorems, Lebesgue integration and limit theorems, Fubini theorem, L_p spaces, L^2 Fourier transform theory. Prerequisites: 427, 428, 429, or permission of instructor.

MATH 528, 529 Hilbert Space Operators (3,3) W,Sp Spectral theorem for bounded Hermitian operators, statement for unbounded operators, application to ordinary and partial differential operators with Fourier transforms, construction of Green's functions, contour integral representation. Prerequisites: 527 for 528; 528 for 529.

MATH 530 Seminar in Analysis (*, max. 5) AWSp Prerequisite: permission of graduate program coordinator.

MATH 531, 532, 533 Special Topics in Analysis (2-3, max. 9; 2-3, max. 9; 2-3, max. 9) AS,WSp,S In recent years the following subjects have been covered: functional analysis, abstract harmonic analysis, linear operations in Hilbert space, group representations, Fourier series and integrals, topological linear spaces, potential theory, and numerical analysis.

MATH 534, 535, 536 Complex Variable (3,3,3) A,W,Sp Complex numbers; analytic functions; contour integration; power series; analytic continuation; sequences of analytic functions; conformal mapping of simply connected regions. Prerequisites: 426 for 534; 534 for 535; 535 for 536.

MATH 537 Applications of Operator Theory (3) A Schrödinger equations; eigenvalue distributions; perturbation theory; special functions. Prerequisite: 529.

MATH 538, 539 Nonlinear Ordinary Differential Equations (3,3) W,Sp Phase plane; analysis of critical points (nodes, saddle points, foci); theory of oscillations, limit cycles, Poincare-Bendixon theory; topological methods, fixed-point theorems. Prerequisites: 327 (or 236 or 336) and 239 for 538; 538 for 539. (Offered alternately with 578, 579.)

MATH 541, 542, 543 Special Topics in Applied Mathematics (3, max. 9; 3, max 9; 3, max. 9) A,W,Sp Such topics as mathematical quantum theory, fluid mechanics, optimization and operations research, and control theory are covered.

MATH 544, 545, 546 Differential Geometry (3,3,3) A,W,Sp 544: differential analysis in Rn, inverse function theorem, vector fields. Stoke's theorem, existence theorems concerning differential equations. Prerequisite: graduate standing or permission of instructor. 545, 546: differentiable manifolds, differential forms, differential geometry in the large. Prerequisites: 544 for 545; 545 for 546.

MATH 547, 548, 549 Functional Analysis (3,3,3) A,W,Sp Review of Banach, Hilbert, and L_p spaces. Locally convex spaces (duality and separation theory, distributions, and function spaces). Operators on locally convex spaces (adjoints, closed graph/open mapping and Banach-Steinhaus theorems). Banach algebras (spectral theory, elementary applications). Spectral theorem for Hilbert space operators. Additional topics chosen by instructor. A working knowledge of real variables, general topology, and complex variables is assumed.

MATH 550 Seminar in Geometry (*, max. 5) AWSp Prerequisite: permission of graduate program coordinator.

MATH 551, 552, 553 Special Topics in Geometry (2-3, max. 9; 2-3, max. 9; 2-3, max. 9) A,W,Sp In recent years the following subjects have been covered: Riemannian geometry, differentiable manifolds, complex manifolds, geometry of convex bodies.

MATH 557, 558, 559 Special Topics in Numerical Analysis (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp Such topics as linear systems, approximation theory, or the numerical solution of differential equations are covered.

MATH 561, 562, 563 General Topology (3,3,3) AS,W,SpS Theory of sets; metric spaces; topological spaces; compactness and other covering properties; function spaces; polyhedra; dimension theory. Prerequisites: 400, which may be taken concurrently, and 426 for 561; 561 for 562; 562 for 563.

MATH 564, 565, 566 Algebraic Topology (3,3,3) A,W,Sp Classical and modern approaches; complexes and their homology theory; applications. Fixed points, primary obstruction; products and Poincare duality; axiomatic approach, covering spaces. Prerequisites: 506 for 564; 564 for 565; 565 for 566.

MATH 569 Partial Differential Equations (3) Sp *Pearson* Properties of diffusion, wave, and Laplace-type equations. Initial and boundary value problems. Series expansions, transform methods. Singularities, Green's functions. Classification of second-order equations; theory and applications of method of characteristics. Numerical techniques. Offered jointly with A A 569 and AMATH 569. Prerequisite: 428 or AMATH 403 or 568.

MATH 570 Seminar in Topology (*, max. 5) AWSp Prerequisite: permission of graduate program coordinator.

MATH 571, 572, 573 Special Topics in Topology (2-3, max. 9; 2-3, max. 9; 2-3, max. 9) A,W,Sp Special topics from general and algebraic topology.

MATH 574, 575, 576 Advanced Partial Differential Equations (3,3,3) A,W,Sp Classification, existence, uniqueness, and boundary value problems for partial differential equations. Green's function and associated integral equations. Prerequisite: 426 or 527.

MATH 578, 579 Special Functions (3,3) W,Sp Special functions arising from eigenvalue problems, asymptotic developments by contour integration, analytic continuation, complex variable aspects of Fourier integrals. Prerequisite: 427. (Offered alternately with 538, 539.)

MATH 585 Numerical Mathematics (3) Numerical solution of linear algebraic systems, algebraic eigenvalue problems, ordinary and partial differential equations. Offered jointly with C SCI 585. Prerequisites: 239, 303, and programming with a procedure-oriented language.

MATH 586 Numerical Mathematics (3) Continuation of 585. Selected topics in numerical mathematics. Offered jointly with C SCI 586. Prerequisite: 585 or permission of instructor.

MATH 600 Independent Study or Research (*) AWSpS

MATH 700 Master's Thesis (*) AWSpS

MATH 800 Doctoral Dissertation (*)

Probability and Statistics

MATH 521, 522, 523 Advanced Probability (3,3,3) A,W,Sp Measure theory and integration, independence, laws of large numbers, Fourier analysis of distributions, central limit problem and infinitely divisible laws, conditional expectations, martingales. Offered jointly with STAT 521, 522, 523. Prerequisite: 426.

MATH 590 Seminar in Probability (*, max. 5) AWSp Prerequisite: permission of instructor.

MATH 591, 592, 593 Special Topics in Probability (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp In recent years, the following subjects have been covered: advanced probability theory, stochastic processes, distribution-free inference, game and decision theory, advanced theory of estimation (including sequential estimation).

MATH 600 Independent Study or Research (*) AWSpS

MATH 700 Master's Thesis (*) AWSpS

MATH 800 Doctoral Dissertation (*)

Microbiology and Immunology

G305 Health Sciences

Microbiology is a natural science that deals with microscopic organisms, including bacteria, viruses, fungi, protozoa, and algae. It is concerned with the nature and properties of these organisms, their effects on man and the environment, and how microorganisms can be exploited to provide useful products.

Immunology is a natural science that deals with specific and nonspecific resistance to tissue injury by both foreign and self substances. The mechanisms of resistance involve primarily the activities of leukocytes and antibodies, including those concerned with the specific immune response.

Undergraduate Program

Bachelor of Science Degree

Admission Requirements: A minimum of 75 credits with overall grade-point average of 2.25 in required chemistry and biology courses. Students should complete departmental requirements in biology and in inorganic and organic chemistry before applying for admission to the major.

Major Requirements: 45 credits in biological sciences, including BIOL 210, 211, 212 (preferred) or an equivalent 10 to 15 credits in botany or zoology, or both; a minimum of 30 credits in microbiology courses and approved electives, including MICRO 400, 401, 402, 431, 441, 442, 443, and 496 (MICRO 101, 301, 302, 319 cannot be used); a minimum grade-point average of 2.25 in the required microbiology courses as well as in the entire 30 credits of microbiology and approved electives; PHYS 114, 115, 116 or 121, 122, 123; CHEM 140, 150, 151, 160; CHEM 231, 232, or 231, 235, 236 or 335, 336, 337 (three-quarter sequence preferred); CHEM 321; MATH 124 or 157 or Q SCI 381 or 291. Transfer students must complete at least 15 of the 30 credits of required microbiology and immunology courses at this university.

Students interested in majoring in microbiology should obtain the department undergraduate guide, available in G303 Health Sciences.

For faculty listing and course descriptions, see School of Medicine section.

Middle Eastern Studies

See International Studies.

Music

106 Music

The School of Music prepares students for careers as composers, performers, teachers, or researchers. It also offers general courses to nonmajors designed to enhance the student's understanding of the art of music.

Four-year undergraduate programs lead to the degrees of Bachelor of Arts and Bachelor of Music. The school also offers a five-year program leading to the concurrent Bachelor of Arts and Bachelor of Music degrees.

Graduate programs lead to the degrees of Master of Arts, Master of Music, Doctor of Musical Arts, and Doctor of Philosophy.

Undergraduate Program

Admission Requirements: All students must audition and qualify at the 300 level or better in their principal performance areas in order to be admitted as music majors and to receive private instruction. They also must pass an examination in basic keyboard. Students who qualify on another instrument or voice may begin their musical studies, but they also must enroll in the MUSIC 133 series until keyboard proficiency is established.

CLARIFICATION OF MAJOR STATUS

Major status in performance areas is accorded when, after proper admission is acknowledged and the required School of Music audition is completed, the student commences Applied Music study in the major area with a currently approved faculty member of the School of Music. Such study must be undertaken during the first quarter of registration and during each subsequent quarter of registration until the minimum program requirements have been met. Applied Music study should continue as long as the student is registered and in residence until the final approved recital is given. Mere acceptance into a program does not constitute major status.

In academic areas and composition, the faculty members of the particular areas determine the status of individuals accepted. Any departure from the above requirements must have the recommendation of the appropriate divisional Chairperson and the written consent of the Director of the School of Music.

In order to retain major status, the student must make and demonstrate consistent and acceptable progress at the annual required jury. Participation in at least one School of Music ensemble is required each quarter that a student receives Applied Music instruction.

Core Requirements: The music theory-history core, required in each of the undergraduate curricula, is as follows:

Courses		*Credits*
MUSIC 110, 111, 112	First-Year Theory (3,3,3)	9
MUSIC 113, 114, 115	Ear Training (1,1,1)	3
MUSIC 210, 211, 212	Second-Year Theory (3,3,3)	9
MUSIC 213, 214, 215	Music After 1750 (3,3,3)	9
MUSIC 310	Modal Counterpoint (3)	3
MUSIC 311	Tonal Counterpoint (3)	3
MUSIC 312	Twentieth-Century Techniques (3)	3
MUSIC 313, 314	Music Before 1750 (3,3)	6
Music upper-division theory or history electives		9-10
		54-55

Bachelor of Arts Degree

General Requirements: A minimum of 180 credits, of which 90 must be taken in departments other than the School of Music. A grade-point average of 2.50 in music courses is required for graduation.

MUSIC THEORY-HISTORY OPTION

Major Requirements: Music theory-history core, plus 9 credits in upper-division vocal or instrumental instruction, and six quarters of ensembles, for a minimum of 69 credits.

VOCAL OR INSTRUMENTAL OPTION

Major Requirements: Music theory-history core, excluding the 10 credits in theory or history electives, plus 9 credits in lower-division vocal or instrumental instruction, 9 credits in upper-division vocal or instrumental instruction, and eight quarters in ensembles, for a minimum of 70 credits.

Bachelor of Music Degree

Admission Requirements: Intended for specially qualified students who wish to emphasize professional training in performance or composition within a four-year program. Students should see the undergraduate adviser regarding special admission procedures for this program. Admission during the sophomore year is recommended.

General Requirements: A minimum of 180 credits, of which at least 60 must be taken in departments other than the School of Music. These credits must include the basic proficiency requirement of the College of Arts and Sciences, and the distribution requirement in two of the following three areas: humanities, social sciences, and natural sciences.

Major Requirements: Applied music major requirements to include: Music theory-history core (54-55 credits), applied music (43-48 credits), recitals (1-2 credits), and ensembles (12-30 credits). See undergraduate adviser for additional requirements in each major area (piano, organ, strings, voice, and orchestral instruments).

Composition major requirements to include: Music theory-history core (54-55 credits), including MUSIC 487 and MUSIC 490 among upper-division electives; composition (36 credits), applied music (18 credits), ensembles (9-18 credits), and conducting (3 credits).

A grade-point average of 3.20 in music courses is required for graduation.

Bachelor of Arts and Bachelor of Music Degrees (Concurrent)

General Requirements: A minimum of 225 credits, of which 90 must be in areas other than music; all College of Arts and Sciences graduation requirements must be met.

Major Requirements: 2.50 grade-point average in music courses is required for graduation. See undergraduate adviser for special requirements in Ensembles.

COMPOSITION MAJOR

Courses		*Credits*
Music theory-history core		54-55
MUSIC 191, 291, 391, 491	Composition (9,9,9,9)	36
MUSIC 487	Tonal Counterpoint (3)	3
MUSIC 490	Orchestration (3)	3
Vocal or instrumental instruction		24
MUSIC 280, 380, 381	Conducting (1,1,1)	3
Ensembles		12-24
		135-148

MUSIC HISTORY MAJOR

Courses	*Credits*
Music theory-history core	54-55
5 credits from MUSIC 316, 317, 318	5
3 credits from MUSIC 400, 401, 402, 403	3

3 credits from MUSIC 404, 407, 410, 413, 417, 420	3
3 credits from MUSIC 405, 408, 411, 414, 418, 421	3
3 credits from MUSIC 406, 409, 412, 415, 419, 422, 423, 424, 425	3
Music history-literature electives	9
Music electives	9
Vocal or instrumental instruction	24
Ensembles	12-24
	125-138

Students who intend to pursue graduate studies are strongly advised to establish proficiency in German or French and to acquire some acquaintance with one or two additional foreign languages. For emphasis in ethnomusicology, consult the music adviser regarding suitable area studies other than music.

PIANO MAJOR

Courses	*Credits*
Music theory-history core	54-55
MUSAP 321, 371, 421 Private Instruction: Piano	27
MUSAP 471 (two years) Private Instruction: Piano	18
MUSIC 323, 324, 325 Accompanying (2,2,2)	6
MUSIC 326, 327, 328 Repertoire (2,2,2)	6
MUSIC 434, 435, 436 Pedagogy (2,2,2)	6
MUSIC 479 Senior Recital	1
Ensembles	15-30
	133-149

STRING INSTRUMENT MAJOR

Courses	*Credits*
Music theory-history core to include MUSIC 487 Tonal Counterpoint	54-55
MUSAP 324, 325, 326, 374, 375, 376, 424, 425, 426 Private Instruction: Violin-Viola, Violoncello, Contrabass	27
MUSAP 474, 475, 476 (two years) Private Instruction: Violin-Viola, Violoncello, Contrabass	18
MUSIC 479 Senior Recital	1
MUSIC 434, 435, 436 Pedagogy (2,2,2)	6
MUSAP 301 Private Instruction: Piano or MUSIC 234, 235, 236 Secondary Piano (2,2,2)	6
MUSIC 280 Basic Principles of Conducting	1
Ensembles	21-42
	134-156

Violinists should complete one quarter of viola.

VOICE MAJOR

Courses	*Credits*
Music theory-history core	54-55
MUSAP 320, 370, 420 Private Instruction: Voice	27
MUSAP 470 (two years) Private Instruction: Voice	18
MUSAP 301 Private Instruction: Piano or MUSIC 234, 235, 236 Secondary Piano (2,2,2)	6
MUSIC 233 Music Theatre Technique	1
MUSIC 280, 380, 381, 382 Conducting (1,1,1,1)	4
MUSIC 309 Advanced Music Theatre Technique	1
MUSIC 326, 327, 328 Repertoire (2,2,2)	6
MUSIC 434, 435, 436 Pedagogy (2,2,2)	6
MUSIC 479 Senior Recital	1
Ensembles	11-24
	135-149

Voice majors should establish proficiency in French, German, or Italian and complete an additional 15 credits in a second language from this group as well as 5 credits in SPHSC 300 (Speech Science).

ORGAN MAJOR

Courses	*Credits*
Music theory-history core to include MUSIC 487 Tonal Counterpoint	54-55
MUSAP 322, 372, 422 Private Instruction: Organ	27
MUSAP 472 (two years) Private Instruction: Organ	18
MUSIC 479 Senior Recital	1
MUSIC 323, 324 Accompanying (2,2)	4
MUSIC 326, 327, 328 Repertoire (2,2,2)	6
MUSIC 280, 380, 381, 382 Conducting (1,1,1,1)	4
MUSAP 301 Piano (2,2,2)	6
Ensembles	15-30
	135-151

ORCHESTRAL INSTRUMENT MAJOR

Courses	*Credits*
Music theory-history core	54-55
MUSAP 327 through 337, 377 through 387, 427 through 487 Private Instruction	27
MUSAP 477 through 487 (two years) Private Instruction	18
MUSIC 479 Senior Recital	1
MUSAP 301 Private Instruction: Piano or MUSIC 234, 235, 236 Secondary Piano (2,2,2)	6
MUSIC 280, 380, 381, 382 Conducting (1,1,1,1)	4
Ensembles	21-42
	131-153

MUSIC EDUCATION MAJOR

Courses	*Credits*
Music theory-history core exclusive of MUSIC 310, but to include 13 credits in arranging, jazz, composition, and ethnomusicology	54-55
MUSIC 380, 381, 382 Conducting (1,1,1)	3
Two courses from the following	6-8
MUSIC 438 Psychology of Music (5)	
MUSIC 453 Sociology of Music (3)	
MUSIC 456 Music Acoustics (3)	
18 credits from the following:	18
MUSIC 340 Music in General Education (3)	
MUSIC 440 Music in Early Childhood (3)	
MUSIC 442 Instrumental Curriculum: Methods and Materials (3)	
MUSIC 443 Choral Curriculum: Methods and Materials (3)	
MUSIC 452 Ethnomusicology in the Public Schools (3)	
EDUC 301 Introductory Practicum in Community Service Activity (3) or MUSIC 496 Special Topics in Music Education (1, min. 3, max. 10)	
Major performance medium	22
Secondary performance medium(s) including MUSAP 459 (3), and analog or digital music synthesis (3)	18
Ensembles	12-24
	133-148

Graduate Program

Graduate programs in the School of Music take into consideration the dual nature of music's subject matter. First, it is one of the creative arts, requiring constant renewal through the efforts of composers, performers, and teachers. Second, it is a branch of the humanities, subject to scholarly study and interpretation of its theoretical concepts and historical development. Advanced study presupposes an emphasis in one or the other direction without entirely neglecting the alternate aspect.

Special Requirements

Upon admission to the Graduate School as a music major, the student must further qualify for a specific area of specialization. See below.

Financial Aid

A limited number of teaching and staff assistantships are available in voice, theory and ear training, music history and literature, ethnomusicology, piano teaching and accompanying, and choral conducting. Accompanists are also employed at hourly rates. Competitive auditions for performance scholarships for new and returning students are held each year in early spring. The School of Music office may be contacted for details.

Research Facilities

The Music Building contains the music library, an electronic composition laboratory, a listening center, a systematic musicology laboratory, and the usual studio, practice, and classroom facilities of a modern music department. Ensembles available for student participation include opera, Contemporary Group, and several non-Western ensembles among the many traditional large and small choral and instrumental groups.

Master of Music, Doctor of Musical Arts Degrees

The programs with more creative emphasis lead to the degrees of Master of Music and Doctor of Musical Arts. Areas of specialization: performance (piano, organ, voice, strings, other orchestral instruments), instrumental conducting, choral conducting, composition, opera production, piano accompanying-chamber music, and, at the doctoral level, music education.

Master of Music Degree

Admission Requirements: Audition required for entrance to performance and composition. Entrance to other areas by permission. Graduate Record Examination recommended. Details of requirements for each of the areas of specialization are available from the graduate program adviser.

Graduation Requirements: 45 credits, of which 18 must be in courses at the 500 level or above. Demonstration of proficiency in one language from French, German, Italian, and Latin. *With thesis*—Program to include 9 credits in thesis. *Without thesis*—A final oral examination is required. Piano accompanying-chamber music major is a 68-credit, two-year program, with same foreign language requirements stated above; final examination consists of a lecture recital.

Doctor of Musical Arts Degree

Admission Requirements: Audition required for performance and composition. Entrance to other areas by permission. Graduate Record Examination recommended in all areas except music education, where it is required. Details of requirements for each of the areas of specialization are available from the graduate program adviser.

Graduation Requirements: Three academic years of study; dissertation: in lieu of a full-length dissertation, a thesis in three parts may be substituted, of which one must be a research paper and two may be additional research papers, or musical compositions, or documented public performances, or documented lecture demonstrations. Demonstration of proficiency in one language from among French, German, Italian, and Latin, as soon as possible, but, in any case, before taking the General Examination.

Masters of Arts, Doctor of Philosophy Degrees

The research-oriented programs lead to the degrees of Master of Arts and Doctor of Philosophy. Areas of specialization: music theory, music history and literature, ethnomusicology, systematic musicology, and, at the master's level, music education.

Master of Arts Degree

Admission Requirements: Requirements vary for the different areas of specialization. Details of requirements for each of the areas of specialization are available from the School of Music graduate program adviser.

Graduation Requirements: 45 credits, of which 18 must be in courses at the 500 level or above and 9 in thesis. Demonstration of proficiency in one language from among French, German, Italian, and Latin.

Doctor of Philosophy Degree

Admission Requirements: Requirements vary for the different areas of specialization. Details of requirements for each of the areas of specialization are available from the School of Music graduate program adviser.

Graduation Requirements: Three academic years of study; dissertation. Demonstration of proficiency in German and a second language from among French, Italian, and Latin, or another such language as is necessary for research, as soon as possible, but, in any case, before taking the General Examination.

Faculty

Acting Director

James M. Beale

Professors

Beale, James M.,* M.Mus., 1947, Yale; theory/composition.

Bergsma, William,* M.M., 1943, Eastman School of Music; theory/composition.

Carlsen, James C.,* Ph.D., 1962, Northwestern; systematic musicology.

Chapple, Stanley (Emeritus), D.Mus. (Hon.), 1947, Colby; conducting.

Clarke, Henry L. (Emeritus), Ph.D., 1947, Harvard; music history and literature.

Curtis-Verna, Mary V.,* B.A., 1943, Hollins; voice.

Eichinger, Walter E. (Emeritus), M.Mus., 1933, Northwestern; organ.

Feist, Robert,* M.Mus., 1954, Indiana; conducting.

Grossman, Arthur,* Diploma, 1955, Curtis; bassoon.

Guarrera, Frank P.,* Diploma, 1948, Curtis; voice.

Harman, R. Alec (Emeritus), A.R.C.M., G.R., S.M., 1943-49, Royal Academy; music history and literature.

Heinitz, Eva Marie (Emeritus), studied at State Academy of Music (Berlin); violoncello.

Hokanson, Randolph,* studied with Dame Myra Hess, Howard Ferguson (London); piano.

Irvine, Demar (Emeritus), Ph.D., 1937, Harvard; music history and literature.

Kaplan, Abraham,* Postgraduate Diploma, 1957, Juilliard; conducting.

Kechley, Gerald,* M.A., 1959, Washington; theory/composition.

Kind, Sylvia E. (Emeritus), Konzert-Reife-Prufung, 1934, Hochschule fur Musik (Berlin); harpsichord.

Lishner, Leon (Emeritus), B.S.S., 1937, City College (New York); voice.

McColl, William D., Graduate, 1955, State Academy of Music (Vienna); clarinet.

Moore, John T.,* M.Mus., 1941, Illinois; piano.

Munro, Kathleen (Emeritus), Ph.D., 1937, Washington; music history and literature.

O'Doan, Neal D.,* Post Graduate Diploma, 1962, Juilliard; piano.

Rahn, John,* Ph.D., 1974, Princeton; theory/composition.

Skowronek, Felix E.,* B.Mus., 1956, Curtis; flute.

Smith, William O.,* M.A., 1952, California (Berkeley); theory/composition.

Sokol, Vilem,* Grad. Cert., 1939, Conservatory of Music (Prague); violin, viola.

Storch, Laila,* B.A., 1964, Wilkes; oboe.

Terry, Miriam (Emeritus), M.A., 1948, Washington; music history and literature.

Tufts, Paul D., M.A., 1951, Washington; theory/composition.

Verrall, John W. (Emeritus), Cert. of Mus., 1932, Liszt Conservatory (Budapest); theory/composition.

Zsigmondy-Liedemann, Denes, Masterclass, 1943, Liszt Academy (Budapest); violin.

Associate Professors

Alavedra, Montserrat, Diploma, 1973, Escuela Superior de Canto (Spain); voice.

Babb, Warren (Emeritus), M.A., 1939, Harvard; theory.

Benshoof, W. Kenneth, M.A., 1963, San Francisco State; theory/composition.

Conlon, Joan C.,* D.M.A., 1975, Washington; conducting.

Cooper, Elnsta A.,* D.Ed., 1971, Oregon; music education.

Dempster, Stuart R., M.A., 1967, San Francisco State; trombone.

Geissmar, Else Johanna-Marie (Emeritus), M.Mus., 1944, Michigan; piano.

Jussila, Clyde,* (Education), M.S., 1951, Kansas State; music education.

Lundquist, Barbara R.,* D.M.A., 1973, Washington; music education.

Neuman, Daniel,* (International Studies),† Ph.D., 1974, Illinois; ethnomusicology.

Pagtalunga, Augusto N., M.M., 1967, New England Conservatory; voice.

Rosinbum, Ralph R. (Emeritus), M.A., 1948, Washington; opera production.

Sakata, Hiromi Lorraine,* (International Studies),† Ph.D., 1976, Washington; ethnomusicology.

Saks, Toby, M.S., 1966, Juilliard; violoncello.

Thome, Diane D.,* Ph.D., 1973, Princeton; theory/composition.

Woodcock, Edith (Emeritus), B.M., 1936, Washington; music history and literature.

Assistant Professors

Bozarth, George S.,* Ph.D., 1978, Princeton; music history and literature.

Kappy, David L., M.M., 1971, Wisconsin; horn.

Rafols, Alberto P.,* D.M.A., 1975, Washington; piano.

Starr, Lawrence,* Ph.D., 1973, California (Berkeley); music history and literature.

Stewart, Milton L., Ph.D., 1973, Michigan; jazz history.

Taricani, JoAnn (Acting), M.A., 1977, Pennsylvania; music history.

Terry, Carole R.,* D.M.A., 1977, Stanford; early music performance practice.

Troy, Charles E.,* Ph.D., 1972, Harvard; music history and literature.

Instructors

Cummings, Roy M., B.A., 1965, Washington; trumpet.

Harnett, James F., studied at New England Academy; double bass.

Vokolek, Pamela C., M.M., 1965, Cleveland Institute; harp.

Lecturers

Bissell, William E., M.S., 1956, Illinois; marching band.

Liotta, Vincent J.,* M.S., 1975, Indiana; opera stage direction.

Course Descriptions

Courses for Undergraduates

Most ensembles listed are open to nonmusic majors with permission of the undergraduate adviser.

Music Ensemble

MUSEN 100 (University Singers) is open to all students without audition. Other ensembles are open to nonmusic majors by audition or with permission of instructor.

MUSEN 100 University Singers (2, max. 24) AWSp

MUSEN 101 University Symphony Orchestra (2, max. 30) AWSp *Feist*

MUSEN 102 University Band (2, max. 24) WSp

MUSEN 103 Chamber Music (1, max. 12) AWSp

MUSEN 104 Piano Ensemble (1, max. 12) AWSp *O'Doan*

MUSEN 105 Brass Ensemble (1, max. 12) WSp *Kappy*

MUSEN 106 Woodwind Ensemble (1, max. 12) AWSp *Skowronek*

MUSEN 107 Opera Workshop (1, max. 12) AWSp *Liotta*

MUSEN 140 Vocal Jazz Ensemble (2, max. 12) AWSp

MUSEN 147 Opera Chorus (1, max. 12) AWSp

MUSEN 201 Woodwind Sinfonietta (2, max. 24) AWSp

MUSEN 203 Marching Band (2, max. 10) A *Bissell*

MUSEN 204 Percussion Ensemble (1, max. 12) AWSp

MUSEN 205 Harp Ensemble (1, max. 6) Harp ensemble repertoire; study of techniques for ensemble playing; practical application and skill development. Prerequisites: concurrent enrollment in applied harp, permission of instructor.

MUSEN 206 Jazz Workshop (1, max. 12) AWSp *Collier*

MUSEN 207 University Oratorio Chorus (2, max. 24) AWSp *Kaplan*

MUSEN 208 Studio Jazz Ensemble (2, max. 24) AWSp *Cummings*

MUSEN 209 Recorder Ensemble (1) W Prerequisite: MUSIC 241.

MUSEN 307 Advanced Opera Workshop (1) AWSp *Liotta* Preparation and public performance of one-act chamber opera or scenes from the standard opera repertoire. Intended for the mature student with a secure vocal technique. Prerequisite: permission of instructor. Recommended: three quarters of 107.

MUSEN 446 Advanced Studio Jazz Ensemble (2, max. 24) AWSp *Cummings* Preparation and performance of material appropriate to large jazz ensemble concerts, clinics, and radio and television broadcasts. Prerequisite: permission of instructor. Recommended: three quarters of 208.

MUSEN 450 University Chorale (2, max. 24) AWSp *Conlon*

MUSEN 451 Madrigal Singers (2, max. 24) AWSp

MUSEN 461 Advanced Piano Ensemble (1, max. 3) AWSp *O'Doan* Study and performance of works for four hands at one or two pianos. Designed for upper-level piano majors or students with equivalent ability. Prerequisite: permission of instructor.

MUSEN 465, 466, 467 Duo-Sonata Repertoire (2,2,2) A,W,Sp 465: the classical period; 466: the romantic period; 467: the twentieth century. Prerequisite: undergraduate piano performance degree or permission of instructor.

MUSEN 468 Advanced Harp Ensemble (1, max. 12) Advanced harp ensemble, repertoire, development of skills required in large ensembles, emphasis on performance preparation. Prerequisites: concurrent enrollment in applied harp; placement audition by instructor.

MUSEN 469 Baroque Chamber Ensemble (1) AWSp *Terry* Prerequisite: permission of instructor.

MUSEN 480 Sinfonietta (1, max. 6) AWSp *Feist*

MUSEN 481 Chamber Music (1, max. 6) AWSp Prerequisite: graduate standing.

MUSEN 482 Opera Theatre (2, max. 6) AWSp *Liotta* Public performance of roles in opera.

MUSEN 483 Collegium Musicum (1, max. 6) AWSp *Taracani*

MUSEN 484 Contemporary Group (2, max. 12) AWSp *Dempster, Smith* Exploration of notation and performance problems in today's music; preparation for public performance.

Ethnomusicology

MUSIC 300 Music of Greater Mexico (3) Regional styles of Mexico; consideration of pre-Hispanic Indian origins and the music of Chicanos in the American Southwest.

MUSIC 316, 317, 318 Music Cultures of the World (5,5,5) A,W,Sp 316: Near East, Central Asia, Far East, South and Southeast Asia, Indonesia, and the Philippines. 317: music of sub-Saharan Africa, Americas, and Oceania. 318: folk and popular music in western and eastern Europe and the Americas.

MUSIC 319 Afro-American Music (5) Centers on Black music in the United States, but also clarifies the relationship of this music to the musics of other Afro-American cultures as well as to their African roots.

MUSIC 426 Music of Korea (3) Classical instrumental and vocal genres of Korea. Examines both court and folk traditions. Open to students in music and East Asian Area Studies. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 427 Music of Africa (3) Music cultures of sub-Saharan Africa. Traditional styles and more recent developments. Open to all students with an interest in the area. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 428 Music of North India (3) Classical music of North India, the Hindustani tradition with emphasis on the Dhrupad and Khyal styles. Recommended: some background in *either* ethnomusicology or South Asian Studies.

MUSIC 430 Organology (3) Systematic study of musical instruments, involving the history, acoustical phenomena, and physical typologies of instruments from around the world, with emphasis on non-Western music. Prerequisite: 429.

MUSIC 433 Music of Latin America (3) The Indian, African, and European music of the Spanish-, French-, and Portuguese-speaking New World countries. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 439 Music of Indonesia and the Philippines (3) Includes the gong culture traditions of Sumatra, Sunda, Java, Bali, Sunda Islands, and the Philippines. Open to students in music and to students with an interest in the area. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 444 Music of the Near East (3) *Sakata* Classical and folk musical traditions of Iran, Turkey, and the Arab world. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 445 Selected Topics in Ethnomusicology (3) AWSp Deals with topics not covered by regular courses in ethnomusicology. Frequently taught by visiting lecturers. Content varies with different instructors. Prerequisite: permission of instructor.

MUSIC 447 Music of Southern India (3) Classical music of South India, the Karnatic tradition, with emphasis on the concert repertoire. Recommended: background in either ethnomusicology or South Asian Studies.

MUSIC 448 Instrumental Music of China (3) Instrumental traditions of China from the earliest times to the present. Confucian philosophies that relate to music, theory, scale systems, cosmology. Recommended: background in either ethnomusicology or East Asian Studies.

MUSIC 449 Vocal and Dramatic Music of China (3) Vocal and dramatic traditions of China from the earliest times to the present, including the relationship of music and language. Recommended: background in either ethnomusicology or East Asian Studies.

MUSIC 452 Ethnomusicology in the Public Schools (3) WSpS *Lundquist* Issues, teaching materials, and techniques involved in incorporating music of world cultures in public school classrooms. Prerequisite: 340 or permission of instructor.

MUSIC 494 Music of Japan Until 1700 (3) Gagaku, Biwa, shakuhachi, koto, and Noh genres. Open to students in music and East Asian Area Studies. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 495 Music of Japan After 1700 (3) Shamisen, Bunraku, Kabuki, and Sankyoku traditions. Open to students in music and East Asian Area Studies. Prerequisites: 316, 317, 318, or permission of instructor.

MUSIC 498 Music of Spain (3) The major stylistic periods of the music of Spain, with a consideration of the social and historical contexts that formed the music; the music of Islam in terms of its influence in Spain and the vestiges of early Spanish music in the folk and popular music of Spain and Latin America.

Music

Courses Primarily for Nonmajors

MUSIC 116, 117, 118 Elementary Music Theory (2,2,2) AW,WSp,Sp Prerequisites: 116 for 117; 117 for 118.

MUSIC 120 Survey of Music (5) ASp *Troy* Studies in listening with emphasis on the changing components of Western art music. Illustrated lectures, laboratory section meetings, and presentations by guest artists.

MUSIC 121 The Orchestra (2) AWSp *Sokol* Development of the orchestra and its literature.

MUSIC 122 Orchestral Music: Seventeenth and Eighteenth Centuries (2) A *Sokol*

MUSIC 123 Symphonic Music: Nineteenth Century (2) WSp *Sokol*

MUSIC 124 Symphonic Music: Contemporary (2) Sp *Sokol*

MUSIC 130, 131, 132 Basic Musicianship (3,3,3) *Lundquist* Examination of the processes of music from cross-cultural vantage point, primarily African, Latin American, and Afro-American. Development of improvisatory techniques, performance, use of musical notation, development of analytical and score-writing techniques, development of aural perception ability. Prerequisite: permission of instructor.

MUSIC 160 Anglo-American Folk Music (5) Genres and styles from earliest roots to the 1960s; Anglo-American ballads, dance music, French and other European immigrant groups.

MUSIC 161 American Musical Theater (5) W Historical and stylistic study of the development of the American musical theater. European roots in opera and operetta. Contributions from jazz and popular music. Selected musicals studied. Recommended: 160.

MUSIC 162 American Popular Song (5) Sp Historical, social, and stylistic study of popular idioms from the late nineteenth century to the present. Most attention to contemporary idioms (rock, country-Western, soul, disco). Influences of music industry on taste and style. Does not include jazz, blues, or folk music. Recommended: 160, 161.

MUSIC 200 Music and the Child (3) Introductory orientation to music designed to acquaint the student with the structural and esthetic elements in music and those music-related processes of self-expression and communication basic to a child's education. Prerequisite to the course in instructional methodology.

MUSIC 257 Recording and Reproduction of Music (3) W Evolution of recorded music with emphasis upon equipment, processes, and techniques used.

MUSIC 262 Introduction to Twentieth-Century Music (3) *Starr* Listener's survey of important composers and trends, from Debussy through electronic music. Prerequisite: 120 or permission of instructor.

MUSIC 322 Great Conductors (2) A *Sokol* Evolution of conducting leading to the rise of the virtuoso conductor in the nineteenth and twentieth centuries; prominent personalities from Berlioz to Osawa. Prerequisite: 122 or 123 or 124.

MUSIC 330 Music in the United States (3) Contribution of music to the development of American culture.

MUSIC 331 History of Jazz (3) AWSp Development of jazz in the United States, from its beginnings to its present trends.

MUSIC 332 Music in European Society: Antiquity to 1700 (5) Music and its relationship to aspects of European culture and society—philosophy, politics, social conditions, and the visual arts from antiquity to 1700. Prerequisite: 120 or equivalent background.

MUSIC 333 Music in European Society: 1700 to Present (5) Sp *Bozarth* Music as related to other aspects of modern European culture and society—philosophy, politics, social conditions, and the visual arts. Prerequisite: 120 or equivalent.

MUSIC 339 Opera (5) W *Troy* Contributions of music, text, and staging; study of representative works concentrating on problems of combining these elements into a composite work of art.

MUSIC 385 Music in Theatre (3) *Bergsma* Survey of the interaction between musical form and function in relation to various kinds of theatre, from liturgical drama to film and multimedia.

MUSIC 386 Multimedia Music (3) W *Dempster* Survey tracing the development of multimedia music since 1950 (experimental combinations of music with other art forms in unfamiliar circumstances).

MUSIC 429 Music, Literature, and the Arts (3) Literary and visual art works that include musical subject matter and forms; musical genres that incorporate such other arts as opera and ballet. Related philosophical writings. Includes works of a particular time period or investigation of a specific problem in comparative arts. Prerequisite: major in one of the arts, comparative arts, or related humanities field, or permission of instructor.

Courses Primarily for Music Majors

Permission of undergraduate adviser required for all courses.

MUSIC 108 Fundamentals of Electronic Music (2) AWSp Development of proficiency in the use of tape recorders for original recordings, dubbing, and mixing; experience in the setting up and use of the electronic music synthesizer for the composition of electronic music. Each student produces tape-recorded examples of electronic music.

MUSIC 110, 111, 112 First-Year Theory (3,3,3) A,W,Sp Study of basic musical concepts and terminology through a program of listening, analysis, and keyboard practice. To be taken concurrently with 113, 114, 115.

MUSIC 113, 114, 115 Ear Training (1,1,1) A,W,Sp To be taken concurrently with 110, 111, 112.

MUSIC 133, 134, 135 Basic Keyboard (2,2,2) Keyboard harmony and simple keyboard pieces. Class/private instruction. Prerequisites: 133; ability to read notes (treble and bass clefs); 133 for 134; 134 for 135.

MUSIC 137, 138, 139 Class Instruction: Voice (1,1,1) A,W,Sp For music majors only.

MUSIC 144, 145, 146 Diction for Singers (2,2,2) A,W,Sp Application of rules of diction, enunciation, and articulation in typical vocal repertoire in Italian and English (144), German and English (145), French and English (146). Recommended: additional study of grammar, vocabulary, and literature in the several language departments.

MUSIC 167 Oboe Reed-making Techniques (1, max. 3) AWSp *Storch* Group instruction in the elements of oboe reed-making. *Arundo Donax.* Prerequisite: permission of instructor.

MUSIC 168 Clarinet Reed-making Techniques (1, max. 3) AWSp *McColl* Group instruction in the elements of clarinet reed-making. Prerequisite: permission of instructor.

MUSIC 169 Bassoon Reed-making Techniques (1, max. 3) AWSp *Grossman* Group instruction in the elements of bassoon reed-making. Prerequisite: permission of instructor.

MUSIC 191 Composition (3, max. 9) AWSp One-hour private lesson and one-hour laboratory session each week. Intended to develop skill in creative musical expression.

MUSIC 202 Jazz Improvisation (1, max. 6) WSp *Smith* Improvisational techniques in the jazz style for instrumentalists, with priority given to woodwind performers.

MUSIC 210, 211, 212 Second-Year Theory (3,3,3) A,W,Sp *Beale, Benshoof, Kechley, Rahn, Thome, Tufts* Practical writing and analytic experience in diatonic and chromatic harmony as it was used during the eighteenth and nineteenth centuries. To be taken concurrently with 213, 214, 215. Prerequisites: 112 and 115.

MUSIC 213, 214, 215 Music After 1750 (3,3,3) A,W,Sp *Bozarth, Starr* To be taken concurrently with 210, 211, 212. Prerequisite: ability to follow a printed score.

MUSIC 216, 217, 218 Introductory Composition (2,2,2) A,W,Sp *Smith* For students not majoring in composition. Prerequisite: 112.

MUSIC 220, 221 String Techniques and Pedagogy (3,3) A,W Violin, viola, cello, string bass.

MUSIC 226, 227 Woodwind Techniques and Pedagogy: Clarinet (226); Flute (227) (3,3)

MUSIC 229, 230 Brass Techniques and Pedagogy (3,3) A,W 229: trumpet. 230: lower brass.

MUSIC 231 Woodwind Techniques and Pedagogy: Saxophone (2) Basic saxophone literature, material, performance, and teaching techniques for music education majors.

MUSIC 232 Percussion Techniques and Pedagogy (1) A

MUSIC 233 Music Theatre Technique (1) A *Liotta* Stage deportment and dramatic movement for singers.

MUSIC 234, 235, 236 Secondary Piano (2,2,2) Keyboard harmony, harmonization of melodies; lower-intermediate keyboard pieces. Class/private instruction. Prerequisites: 135 for 234; 234 for 235; 235 for 236.

MUSIC 237 Class Instruction: Voice (2, max. 6) AWSp For music majors only.

MUSIC 240 Guitar Techniques I (1) AWSp

MUSIC 241 Recorder Techniques (1) W

MUSIC 250 Guitar Techniques II (1) Sp Prerequisite: 240 or permission of instructor.

MUSIC 280 Basic Principles of Conducting (1) Sp Prerequisite: 212, which may be taken concurrently.

MUSIC 291 Composition (3, max. 9) AWSp One-hour private lesson and one-hour laboratory session per week. Prerequisite: 191.

MUSIC 301 Piano Technology (3) Evolution of the piano; intonation and temperament theory; principles of tuning, voicing, regulating, and evaluating pianos. Prerequisite: MUSAP 371 or permission of keyboard division head.

MUSIC 309 Advanced Music Theatre Technique (1) W *Liotta* Dramatic interpretation of musical style as represented by the major opera composers since Mozart. Prerequisite: 233.

MUSIC 310 Modal Counterpoint (3) A *Bergsma, Rahn, Thome* Sixteenth-century style. To be taken concurrently with 313. Prerequisites: 212 and 215.

MUSIC 311 Tonal Counterpoint (3) W *Beale, Benshoof, Bergsma, Thome* Basic techniques of baroque counterpoint and introduction to the fugue. To be taken concurrently with 314. Prerequisites: 212 and 215.

MUSIC 312 Twentieth-Century Techniques (3) Sp *Benshoof, Bergsma, Smith* Practical writing and analytical study of twentieth-century composition techniques from Debussy to the present.

MUSIC 313, 314 Music Before 1750 (3,3) A,W *Taricani* 313: before 1600. 314: 1600-1750. To be taken concurrently with 310, 311. Prerequisites: 212, 215 for 313; 313 for 314.

MUSIC 323, 324, 325 Accompanying (2,2,2) AW,W,Sp Study and performance of music of different types and periods for voice or instruments in combination with the piano.

MUSIC 326, 327, 328 Repertoire (2,2,2) A,W,Sp For applied music majors.

MUSIC 334 Band Arranging (2) W Prerequisite: 212.

MUSIC 336 Jazz Arranging (2) A *Smith* Writing in jazz style for various instrumental combinations.

MUSIC 338 Baroque Ornamentation (2) *Terry* Musical ornamentation in France, Spain, England, Italy, and Germany from 1608 to 1800, with special reference to the harpsichord.

MUSIC 340 Music in General Education (3) AW An orientation to the broad scope of music in schools (K-12), including identification of musical concepts and skills and the development of strategies and evaluation techniques. Prerequisites: EDUC 302, EDPSY 304, and piano and voice competencies.

MUSIC 379 Junior Recital (1) AWSp For participants in the Bachelor of Music program only.

MUSIC 380, 381, 382 Conducting (1,1,1) A,W,Sp *Kaplan, Sokol* Prerequisite: 280.

MUSIC 391 Composition (3, max. 9) AWSp One-hour private lesson and one-hour laboratory session each week. Prerequisite: 291.

Courses 400 through 423—Prerequisite: 314.

MUSIC 400 Medieval Music: To 1400 (3) A Gregorian chant through Machaut and Landini.

MUSIC 401 Early Renaissance Music: 1400-1525 (3) W Dunstable through Josquin.

MUSIC 402 Late Renaissance Secular Music: 1525-1630 (3) A The madrigal in Italy, England, and Germany. The Chanson, Jannequin through Lassus.

MUSIC 403 Late Renaissance Sacred and Instrumental Music: 1525-1630 (3) W Latin church music. Willaert through G. Gabrieli; early Reformation church music, Walther through Gibbons; instrumental music, Cabezon, the English virginal school, and Sweelinck.

MUSIC 404 Keyboard Music: 1630-1770 (3) A Forms and styles: Frescobaldi through J. S. Bach and C. P. E. Bach.

MUSIC 405 Keyboard Music: 1770-1850 (3) W Haydn through Schumann.

MUSIC 406 Keyboard Music: 1850-1920 (3) Sp Liszt through Debussy.

MUSIC 407 Baroque Solo Song (3) Monody and cantata, Caccini through Handel.

MUSIC 408 The German Lied (3) A Schubert through Strauss.

MUSIC 409 French Art-Song: 1850 to the Present (3) Faure through Poulenc.

MUSIC 410 Chamber Music: 1660-1770 (3) W Frescobaldi through Bach.

MUSIC 411 Chamber Music: 1770-1830 (3) Haydn through Schubert.

MUSIC 412 Chamber Music: 1830-1920 (3) Schumann through Ravel.

MUSIC 413 Orchestral Music: 1620-1760 (3) W Corelli through the Mannheim School.

MUSIC 414 Orchestral Music: 1760-1850 (3) A Haydn through Berlioz.

MUSIC 415 Orchestral Music: 1850-1920 (3) Liszt and Brahms through early Schoenberg and Stravinsky.

MUSIC 417 Choral Music: 1600-1770 (3) Sp Monteverdi through Handel.

MUSIC 418 Choral Music: 1770-1850 (3) A Large works for chorus and orchestra. Haydn through Berlioz.

MUSIC 419 Choral Music: 1850 to the Present (3) Sp Selected choral masterpieces. Brahms through Britten.

MUSIC 420 Opera: 1600-1750 (3) *Troy*

MUSIC 421 Opera: 1750-1850 (3) *Troy* Gluck through Bellini.

MUSIC 422 Opera: 1850-1920 (3) *Troy* Wagner through Puccini.

MUSIC 423 Twentieth-Century Music: to 1945 (3) Intensive study of selected composers and works exemplifying the new vocabularies, grammars, and styles of the early part of the century.

MUSIC 424 Music Since 1945 (3) *Starr* Diversity of the contemporary musical scene. Vocabularies appropriate for the description and understanding of the new music developed through study of representative composers and works, and appropriate readings. Prerequisite: 314.

MUSIC 425 Jazz History and Analysis (3) Major eras and styles of jazz with emphasis on technical aspects of jazz music: composition, arranging, improvisation practices.

MUSIC 431 The Curriculum in Music Education (3, max. 6) WS *Cooper* Principles and practices of curriculum design applied to the development of the music curriculum. Individual or group work on elementary and secondary school music curriculum projects. Prerequisite: music teaching, student teaching, or permission of instructor.

MUSIC 432 The General Music Class (3) Sp *Lundquist* The teaching of music and its literature in nonperforming classes on the junior and senior high school level. Prerequisite: 340.

MUSIC 434, 435, 436 Pedagogy (2,2,2) A,W,Sp Principles of effective studio teaching; survey and evaluation of teaching materials.

MUSIC 437 Advanced Jazz Improvisation (2, max. 12) AWSp *Collier, Cummings* Preparation and performance of jazz improvisation for the instrumentalist and vocalist. Recommended: three quarters of 202. Prerequisite: permission of instructor.

MUSIC 438 Psychology of Music (5) A or W *Carlsen* Study of human response to musical phenomena, with particular emphasis on perception, learning, measurement, and functional applications.

MUSIC 440 Music in Early Childhood (3) A Identification and selection of appropriate objectives, materials, teaching strategies and evaluation techniques used in music teaching from nursery school through grade 3, with consideration of various methods (e.g., Kodaly, Orff) for early childhood development in music. Prerequisite: 340.

MUSIC 441 Music in Later Childhood (3) Sp The identification and selection of appropriate objectives, materials, teaching strategies, and evaluation techniques used in music teaching in grades 4 through 6, with consideration of various methods (e.g., Kodaly, Orff) for later childhood development in music. Prerequisite: 340.

MUSIC 442 Instrumental Curriculum: Methods and Materials (3) *Jussila* Study of the organization and administration of school instrumental music; the selection and use of materials and teaching strategies from beginning to advanced levels of instrumental instruction. Prerequisites: 340 and permission of instructor.

MUSIC 443 Choral Curriculum: Methods and Materials (3) W Study of the organization and administration of school choral music; the selection and use of materials and teaching strategies from beginning to advanced levels of choral instruction. Prerequisites: 340 and permission of instructor.

MUSIC 453 Sociology of Music (3) Sp *Lundquist* Interrelationships between music and its social context. Specific musical phenomena and the social factors influencing their development.

MUSIC 455 Choral Arranging (3) Sp *Kechley* Primarily for choral conductors who need to modify or arrange material to suit the capabilities of specific choral groups and performance situations. Prerequisite: senior standing or permission of instructor.

MUSIC 456 Music Acoustics (3) Sp How musical instruments function and interact with acoustics of rooms, with particular emphasis upon musical aspects of acoustics. Prerequisites: PHYS 207 and permission of instructor.

MUSIC 457 Research Laboratory Instrumentation (3) A Theory and operation of laboratory instruments used in systematic musicology such as signal generators, volt meters, attenuators, filters, oscilloscopes, tuning devices, and melograph-type. Prerequisite: permission of instructor.

MUSIC 458 Organ Repertoire: Middle Ages Through Baroque (3) *Terry* Analysis and performance practices of organ literature, Middle Ages through Baroque period. Development of the organ as musical instrument. Prerequisites: one 400-level history course, pre-1750, in addition to history core.

MUSIC 459 Organ Repertoire: Bach to Present (3) *Terry* Analysis and performance practices of organ literature, Classic period through the twentieth century. Development of the organ as a musical instrument. Prerequisites: one 400-level history course, post-1750, in addition to history core.

MUSIC 460 Advanced Piano Repertoire (3, max. 9) AWSpS *Hokanson* For piano majors. Examination in depth of more difficult works, by genres and by individual composers. Prerequisites: 326, 327, 328, and permission of instructor.

MUSIC 462 Impressionism and Symbolism (3) Relationship between Debussy and the impressionist and symbolist schools. Main works to be covered: Pelleas and Melisande, preludes, songs, orchestral works, neoclassical works. Prerequisite: major standing in music; available to non-music majors who have knowledge of music and are able to read scores.

MUSIC 463 History of Organ Design and Construction (3) A Evaluation of organ design and construction practices from antiquity to the present.

MUSIC 470 Contemporary Theories I: Tonal Music (3) *Rahn* Recent tonal theories, including introduction to the various developments of the theories of Heinrich Schenker; not restricted to music written before 1900. Prerequisites: 215 and 312, or permission of instructor.

MUSIC 471 Contemporary Theories II: Non-Tonal Music, 1900-1950 (3) *Rahn* Includes both "free atonal" and "classical serial" music. Systematic analysis of works of Schoenberg, Webern, Berg, and others. Prerequisites: 215 and 312, or permission of instructor.

MUSIC 472 Contemporary Theories III: Seminar in New Music (3, max. 6) *Rahn* Continuation of 471. Emphasis on the many organizational systems aspiring to extend or replace tonality: late Stravinsky and other semiserial matrix systems; "total serialism" and "systematic serialism" developed by and from Milton Babbitt; recent developments in nonserial "pitch-centric" and "set-centric" systems. Prerequisite: 471 or permission of instructor.

MUSIC 473 Keyboard Harmony and Transposition (3) A *Terry* Keyboard harmonization from the baroque period to present; transposition of vocal and instrumental pieces to different pitch levels. Prerequisite: 312 or permission of instructor. (Offered alternate years.)

MUSIC 474 Keyboard Harmony and Transposition (3) W *Terry* Keyboard harmonization from baroque period to present; transposition of vocal and instrumental pieces to different pitch levels. Prerequisite: 473 or permission of instructor. (Offered alternate years.)

MUSIC 475 Figured Bass Realization (3) Sp *Terry* Various styles of continuo realization for keyboardists, emphasizing Bach cantatas, Haydn symphonies, and Mozart operas. (Offered alternate years.) Prerequisite: 473 or permission of instructor.

MUSIC 476 Advanced Vocal Repertoire: Seventeenth and Eighteenth Centuries (2) *Hokanson* Professional preparation of pre-nineteenth century songs with a view to total artistic-musical realization in performance. Appropriate style, character, balance, phrasing, diction, and projection for vocalists and pianists. Prerequisites: 326, 327, 328, or permission of instructor.

MUSIC 477 Advanced Vocal Repertoire: Nineteenth Century (2) *Hokanson* Professional preparation of works from the literature of nineteenth-century German lieder, with a view to total artistic-musical realization in performance. Appropriate style, character, balance, phrasing, diction, and projection for vocalists and pianists. Prerequisites: 326, 327, 328, or permission of instructor.

MUSIC 478 Advanced Vocal Repertoire: Twentieth Century (2) *Hokanson* Preparation of works from the twentieth-century repertoire of French, German, Italian, Spanish, and English songs, with a view to total artistic-musical realization in performance. Appropriate style, character, balance, phrasing, diction, and projection for vocalists and pianists. Prerequisites: 326, 327, 328, or permission of instructor

MUSIC 479 Senior Recital (1) AWSp

MUSIC 485 Computer Music Seminar (3, max. 9) AWSp *Rahn* Use of computers in musical composition, software digital sound synthesis, core generation, theoretical investigations. Prerequisites: 212 or 456 or PHYS 207 or programming experience; permission of instructor.

MUSIC 487 Tonal Counterpoint (3) Sp *Beale* Evaluation of fugal practice from the baroque era to the present. Prerequisite: 311.

MUSIC 488 Computer Applications in Music Research (3) W Digital programming and instrumentation control techniques used in music research. Prerequisite: competency in one programming language.

MUSIC 489 Special Topics in Music Theory (3, max. 9) Prerequisites: 312 and 314.

MUSIC 490 Orchestration (3) Sp

MUSIC 491 Composition (3, max. 18) AWSp One-hour private lesson and one-hour laboratory session each week. Prerequisite: 391.

MUSIC 492, 493 Opera Direction and Production (4,4) A,W *Liotta* Practical experience with problems of the theater. Prerequisite: 492 for 493.

MUSIC 496 Special Topics in Music Education (1-3, max. 10) S Special studies designed to reflect contemporary emphases and concerns in the music education profession.

MUSIC 497 Special Topics in Music History (1-3, max. 6) Topics vary each quarter.

MUSIC 499 Undergraduate Research (*, max. 6) AWSp

Courses for Undergraduates and Graduates

Music Applied

Admission by Audition—Courses 300-317, 350-367, 400-417, and 450-467 are private instruction primarily for majors not specializing in performance. Also available to qualified nonmajors. Prerequisites: audition and permission of instructor. Courses 500-517 are for graduate performance majors who have not yet been formally admitted by jury examination for the 520-537 series.

MUSAP 239 Secondary Piano (2) Intermediate-level keyboard repertory. Private instruction. Prerequisite: 238.

MUSAP 300, 350, 400, 450, 500 Private Instruction: Voice (2-3 each, max. 9 each for 300, 350, 400; max. 18 for 450; 3, max. 9 for 500) AWSpS *Alavedra, Curtis-Verna, Guarrera, Paglialunga*

MUSAP 301, 351, 401, 451, 501 Private Instruction: Piano (2-3 each, max. 9 each for 301, 351, 401; max. 18 for 451; 3, max. 9 for 501) AWSp *Hokanson, Moore, O'Doan, Rafols*

MUSAP 302, 352, 402, 452, 502 Private Instruction: Organ (2-3 each, max. 9 each for 302, 352, 402; max. 18 for 452; 3, max. 9 for 502) AWSpS *Martin, Terry*

MUSAP 303, 353, 403, 453, 503 Private Instruction: Harpsichord (2-3 each, max. 9 each for 303, 353, 403; max. 18 for 453; 3, max. 9 for 503) AWSpS *Terry*

MUSAP 304, 354, 404, 454, 504 Private Instruction: Violin-Viola (2-3 each, max. 9 each for 304, 354, 404; max. 18 for 454; 3, max. 9 for 504) AWSpS *Sokol, Zsigmondy*

MUSAP 305, 355, 405, 455, 505 Private Instruction: Violoncello (2-3 each, max. 9 each for 305, 355, 405; max. 18 for 455; 3, max. 9 for 505) AWSp *Saks*

MUSAP 306, 356, 406, 456, 506 Private Instruction: Contrabass (2-3 each, max. 9 each for 306, 356, 406; max. 18 for 456; 3, max. 9 for 506) AWSpS *Hamett*

MUSAP 307, 357, 407, 457, 507 Private Instruction: Flute (2-3 each, max. 9 each for 307, 357, 407; max. 18 for 457; 3, max. 9 for 507) AWSpS *Skowronek*

MUSAP 308, 358, 408, 458, 508 Private Instruction: Oboe (2-3 each, max. 9 each for 308, 358, 408; max. 18 for 458; 3, max. 9 for 508) AWSpS *Storch*

MUSAP 309, 359, 409, 459, 509 Private Instruction: Clarinet (2-3 each, max. 9 each for 309, 359, 409; max. 18 for 459; 3, max. 9 for 509) AWSpS *McColl*

MUSAP 310, 360, 410, 460, 510 Private Instruction: Bassoon (2-3 each, max. 9 each for 310, 360, 410; max. 18 for 460; 3, max. 9 for 510) AWSpS *Grossman*

MUSAP 311, 361. 411, 461, 511 Private Instruction: Saxophone (2-3 each, max. 9 each for 311, 361, 411; max. 18 for 461; 3, max. 9 for 511) AWSpS *Jessen*

MUSAP 312, 362, 412, 462, 512 Private Instruction: Horn (2-3 each, max. 9 each for 312, 362, 412; max. 18 for 462; 3, max. 9 for 512) AWSpS *Kappy*

MUSAP 313, 363, 413, 463, 513 Private Instruction: Trumpet (2-3 each, max. 9 each for 313, 363, 413; max. 18 for 463; 3, max. 9 for 513) AWSpS *Cummings*

MUSAP 314, 364, 414, 464, 514 Private Instruction: Trombone (2-3 each, max. 9 each for 314, 364, 414; max. 18 for 464; 3, max. 9 for 514) AWSpS *Dempster*

MUSAP 315, 365, 415, 465, 515 Private Instruction: Tuba (2-3 each, max. 9 each for 315, 365, 415; max. 18 for 465; 3, max. 9 for 515) AWSpS *Kappy*

MUSAP 316, 366, 416, 466, 516 Private Instruction: Harp (2-3 each, max. 9 each for 316, 366, 416; max. 18 for 466; 3, max. 9 for 516) AWSpS *Vokolek*

MUSAP 317, 367, 417, 467, 517 Private Instruction: Percussion (2-3 each, max. 9 each for 317, 367, 417; max. 18 for 467; 3, max. 9 for 517) AWSpS *Collier*

Courses 320-337, 370-387, 420-437, and 470-487 are for music majors specializing in performance. Courses 520-537 are primarily for graduate performance majors in the M.Mus. degree program.

MUSAP 320, 370, 420, 470, 520 Private Instruction: Voice (3-4 each, max. 12 each for 320, 370, 420; max. 18 for 470; 3, max. 12 for 520) AWSpS *Alavedra, Curtis-Verna, Guarrera, Paglialunga*

MUSAP 321, 371, 421, 471, 521 Private Instruction: Piano (3-4 each, max. 12 each for 321, 371, 421; max. 18 for 471; 3, max. 12 for 521) AWSpS *Hokanson, Moore, O'Doan, Rafols*

MUSAP 322, 372, 422, 472, 522 Private Instruction: Organ (3-4 each, max. 12 each for 322, 372, 422; max. 18 for 472; 3, max. 12 for 522) AWSpS *Terry*

MUSAP 323, 373, 423, 473, 523 Private Instruction: Harpsichord (3-4 each, max. 12 each for 323, 373, 423; max. 18 for 473; 3, max. 12 for 523) AWSpS *Terry*

MUSAP 324, 374, 424, 474, 524 Private Instruction: Violin-Viola (3-4 each, max. 12 each for 324, 374, 424; max. 18 for 474; 3, max. 12 for 524) AWSpS *Sokol, Zsigmondy*

MUSAP 325, 375, 425, 475, 525 Private Instruction: Violoncello (3-4 each, max. 12 each for 325, 375, 425; max. 18 for 475; 3, max. 12 for 525) AWSpS *Saks*

MUSAP 326, 376, 426, 476, 526 Private Instruction: Double Bass (3-4 each, max. 12 each for 326, 376, 426; max. 18 for 476; 3, max. 12 for 526) AWSpS *Hamett*

MUSAP 327, 377, 427, 477, 527 Private Instruction: Flute (3-4 each, max. 12 each for 327, 377, 427; max. 18 for 477; 3, max. 12 for 527) AWSpS *Skowronek*

MUSAP 328, 378, 428, 478, 528 Private Instruction: Oboe (3-4 each, max. 12 each for 328, 378, 428; max. 18 for 478; 3, max. 12 for 528) AWSpS *Storch*

MUSAP 329, 379, 429, 479, 529 Private Instruction: Clarinet (3-4 each, max. 12 each for 329, 379, 429; max. 18 for 479; 3, max. 12 for 529) AWSpS *McColl*

MUSAP 330, 380, 430, 480, 530 Private Instruction: Bassoon (3-4 each, max. 12 each for 330, 380, 430; max. 18 for 480; 3, max. 12 for 530) AWSpS *Grossman*

MUSAP 331, 381, 431, 481, 531 Private Instruction: Saxophone (3-4 each, max. 12 each for 331, 381, 431; max. 18 for 481; 3 for 531) AWSpS *Jessen*

MUSAP 332, 382, 432, 482, 532 Private Instruction: Horn (3-4 each, max. 12 each for 332, 382, 432; max. 18 for 482; 3, max. 12 for 532) AWSpS *Kappy*

MUSAP 333, 383, 433, 483, 533 Private Instruction: Trumpet (3-4 each, max. 12 each for 333, 383, 433; max. 18 for 483; 3, max. 12 for 533) AWSpS *Cummings*

MUSAP 334, 384, 434, 484, 534 Private Instruction: Trombone (3-4 each, max. 12 each for 334, 384, 434; max. 18 for 484; 3, max. 12 for 534) AWSpS *Dempster*

MUSAP 335, 385, 435, 485, 535 Private Instruction: Tuba (3-4 each, max. 12 each for 335, 385, 435; max. 18 for 485; 3, max. 12 for 535) AWSpS *Kappy*

MUSAP 336, 386, 436, 486, 536 Private Instruction: Harp (3-4 each, max. 12 each for 336, 386, 436; max. 18 for 486; 3, max. 12 for 536) AWSpS *Vokolek*

MUSAP 337, 387, 437, 487, 537 Private Instruction: Percussion (3-4 each, max. 12 each for 337, 387, 437; max. 18 for 487; 3, max. 12 for 537) AWSpS *Collier*

MUSAP 489 World Music (2-3, max. 18) AWSpS World music traditions taught by visiting native artists. Consult ethnomusicology staff for current offerings. Primarily for majors; nonmajors on a space-available basis.

Courses for Graduates Only

Ethnomusicology

MUSIC 511 Seminar in Field and Laboratory Methods (3) Study of the methodology of research in ethnomusicology along with practical experience in recording and processing field and laboratory materials. Prerequisites: 429 and permission of instructor.

MUSIC 512 Seminar in Ethnomusicology (3) Study of methodological procedures in ethnomusicology applied to specific research problems.

MUSIC 531 Proseminar in Ethnomusicology (3) Theoretical and methodological practices in ethnomusicology, based on existing major writings. Critical evaluations of works with a view toward developing ethnomusicological graduate research. Prerequisite: graduate student standing in ethnomusicology or permission of instructor.

MUSIC 533, 534, 535 Preceptorial Reading in Ethnomusicology (5,5,5) A,W,Sp Significant ethnomusicological literature on the major music cultures.

MUSIC 536 Transcription and Analysis (3) Study of practice in different notational analytical systems used in non-Western music. Prerequisite: 429.

Music

MUSIC 500 Seminar in Methods of Musical Research (3) AW This is a prerequisite course for all graduate history courses except 515.

MUSIC 501, 502, 503 Seminar in Musical Analysis (3,3,3) A,W,Sp *Beale, Bergsma, Rahn, Thome* 501: chant to middle baroque. 502: high baroque through nineteenth century. 503: Impressionists to present.

MUSIC 504 Seminar in Medieval Music (3, max. 6) Prerequisite: 400.

MUSIC 505 Seminar in Renaissance Music (3, max. 6) Prerequisite: one or more courses from 401, 402, and 403.

MUSIC 506 Seminar in Baroque Music (3, max. 6) Prerequisite: one or more courses from 404, 407, 410, 413, 417, or 420.

MUSIC 507 Seminar in Rococo and Pre-Classical Music: 1700-1760 (3, max. 6) Prerequisite: one or more courses from 404, 410, 413, 420.

MUSIC 508 Seminar in the Viennese Classical Period: 1760-1830 (3, max. 6) Prerequisite: one or more courses from 405, 411, 414, 418, or 421.

MUSIC 509 Seminar in Nineteenth-Century Music: 1830-90 (3, max. 6) Prerequisite: one or more courses from 406, 408, 409, 412, 415, 419, or 422.

MUSIC 510 Seminar in Music Since 1890 (3, max. 6) Prerequisite: one or more courses from 406, 408, 409, 412, 415, 419, 422, or 423.

MUSIC 514 Proseminar in Systematic Musicology (3) A *Carlsen* Examination of the principal research literature in the areas of systematic musicology.

MUSIC 515 Seminar in Medieval and Renaissance Notation (5) Gregorian chant through sixteenth-century prints.

MUSIC 517 Seminar in Musical Styles (3, max. 6) Investigations into the stylistic criteria for specific composers and groups of composers.

MUSIC 519 Seminar in Modern Editorial Procedures (5) Study of modern procedures for preparing critical editions. Related areas of study may include analysis of musical style and historical and performance problems inherent in works being edited.

MUSIC 520 Seminar in American Music (3, max. 6) *Starr* Research in the life, works, and times of composers in the United States from colonial days to the present.

MUSIC 521 Seminar in Music Perception (3, max. 6) *Carlsen* Current state of research in the aural perception of musical sounds in context. May be repeated for credit. Prerequisite: 438.

MUSIC 522 Contemporary Contrapuntal Technique (3) Study of the art of invention, canon, and fugue in the twentieth century, from both analytic and practical viewpoints.

MUSIC 523 Seminar in Music and Socialization (3, max. 6) A The socialization process and music, including the interaction whereby music culture is learned. Prerequisite: 453 or permission of instructor.

MUSIC 524 Seminar in Music Education (3) *Cooper* Special problems in the teaching and supervision of music in the elementary grades. Prerequisite: one year of teaching experience.

MUSIC 525 Seminar in Music Education (3) *Jussila* Special problems in the teaching and administration of music in the secondary school and community college. Prerequisite: one year of teaching experience.

MUSIC 526, 527, 528 History of Theory (3,3,3) 526: ancient, medieval, early Renaissance. 527: Renaissance, baroque, early classic. 528: classic, romantic, twentieth century.

MUSIC 530 Seminar in Music Learning (3, max. 6) *Carlsen* Study of learning research as it relates to nonverbal musical learning. Prerequisite: 438.

MUSIC 532 Opera Direction and Production (4 or 6, max. 12) AWSp *Liotta* Practical experience with problems of the opera theatre.

MUSIC 537 Seminar on Opera (3, max. 6) *Troy* Seminar in music history, providing a complement to history of opera series (420, 421, and 422). Prerequisite: one or more courses from 420, 421, or 422, or permission of instructor.

MUSIC 540 History of Music Education (3) A *Jussila* Chronological examination of contributions, events, philosophies, and people that characterize the development of music education in the schools of the United States.

MUSIC 541 Seminar in Music and Society (3, max. 6) *Lundquist* Examination of human needs and prototypes of trends in current society and the potential of music to satisfy those needs. Prerequisite: 453 or permission of instructor.

MUSIC 542 Comparative Music Education (3) *Cooper* Comparative examination of the philosophy and practice of music education in the United States and in other countries.

MUSIC 551 Practicum in Music Instruction (3, max. 9) AWSp Practical application and validation of results of investigation in curriculum, music teaching and learning, performance and theoretical studies. Prerequisites: teaching experience and permission of instructor.

MUSIC 555 Systematic Methods of Music Research (3) W *Carlsen* Seminar in problem identification and definition, theory development, research design, data analysis and interpretation; an examination of the philosophy of science in music research.

MUSIC 556 Seminar in Music Acoustics (3, max. 9) Sp Selected problems in acoustical measurement, electroacoustics, and music instrument analysis. Prerequisite: 456 or permission of instructor.

MUSIC 559 Master's Recital (3) AWSp Public performance for students in the Master of Music program.

MUSIC 561 Seminar in Theories of Music Instruction (3, max. 6) Sp *Carlsen* Theories of music instruction, with special attention to curriculum, instructional procedures, and assessment of learning. Prerequisite: 555 or permission of instructor.

MUSIC 570 Seminar in Tonality (3, max. 9) *Rahn* Advanced theoretical and analytical work in triadic-tonal music and related systems. Prerequisite: 470 or equivalent.

MUSIC 571 Seminar in Serialism (3, max. 9) *Rahn* Advanced theoretical and analytical work in serialism and other nontonal systems. Prerequisite: 471 or equivalent.

MUSIC 575 Seminar in Theory (3, max. 18) *Rahn* Development and discussion of current student and faculty research in compositional/analytical theory and metatheory.

MUSIC 580, 581, 582 Advanced Conducting (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp *Feist*

MUSIC 583 Advanced Choral Conducting (3, max. 27) AWSp *Kaplan*

MUSIC 590 Doctoral Recital (2-6, max. 18) AWSp Public performance for students in the Doctor of Musical Arts program.

MUSIC 591 Graduate Composition (*) AWSp *Beale, Benshoof, Bergsma, Kechley, Rahn, Smith, Thome, Tufts*

MUSIC 595, 596, 597 Seminar in Systematic Field and Laboratory Research (3, max. 9; 3, max. 9; 3, max. 9) A,W,Sp *Carlsen, Lundquist* Various methodologies of research in systematic musicology: state of the science in specific musical problems. Practical experience in data collection and analysis for seminar presentations. Prerequisite: 555, which may be taken concurrently.

MUSIC 600 Independent Study or Research (*) AWSp

MUSIC 700 Master's Thesis (*) AWSp

MUSIC 800 Doctoral Dissertation (*) AWSp

Music Applied

Courses 570 through 573 are for graduate performance majors who have been formally admitted by jury examination to the D.M.A. degree program.

MUSAP 570 Private Instruction: Voice (3, max. 27) AWSpS *Alavedra, Curtis-Verna, Guarrera, Paglialunga*

MUSAP 571 Private Instruction: Piano (3, max. 27) AWSpS *Hokanson, Moore, O'Doan, Rafols*

MUSAP 572 Private Instruction: Organ (3, max. 27) AWSpS *Terry*

MUSAP 573 Private Instruction: Harpsichord (3, max. 27) AWSpS *Terry*

MUSAP 574 Private Instruction: Violin-Viola (3, max. 27) AWSpS *Sokol, Zsigmondy*

MUSAP 575 Private Instruction: Violoncello (3, max. 27) AWSpS *Saks*

MUSAP 576 Private Instruction: Double Bass (3, max. 27) *Hamett*

MUSAP 577 Private Instruction: Flute (3, max. 27) *Skowronek*

MUSAP 578 Private Instruction: Oboe (3, max. 27) AWSpS *Storch*

MUSAP 579 Private Instruction: Clarinet (3, max. 27) AWSpS *McColl*

MUSAP 580 Private Instruction: Bassoon (3, max. 27) AWSpS *Grossman*

MUSAP 581 Private Instruction: Saxophone (3, max. 27) *Jessen*

MUSAP 582 Private Instruction: Horn (3, max. 27) AWSpS *Kappy*

MUSAP 583 Private Instruction: Trumpet (3, max. 27) AWSpS *Cummings*

MUSAP 584 Private Instruction: Trombone (3, max. 27) AWSpS *Dempster*

MUSAP 585 Private Instruction: Tuba (3, max. 27) AWSpS *Kappy*

MUSAP 586 Private Instruction: Harp (3, max. 27) AWSpS *Vokolek*

MUSAP 587 Private Instruction: Percussion (3, max. 27) AWSpS *Collier*

MUSAP 589 World Music Laboratory (3) World music traditions taught by visiting artists with emphasis on cultural pedagogy and traditional theory. The culture studied changes from year to year. Required of all graduate students in ethnomusicology. Prerequisite: 459.

Near Eastern Languages and Civilization

229B Denny

Undergraduate Program

The program focuses on the languages and literary cultures of the Islamic and Semitic Near East, with an emphasis on the cultural traditions, their ancient and medieval roots, and, to a lesser extent, the relation between the traditions and recent cultural developments. Each of the languages offered represents the linguistic core of a major literature. Arabic, Persian, Turkish, and Central Asian Turkic are the languages of the most significant manifestations of Islamic culture, while Hebrew, Akkadian, Aramaic, and Ugaritic are the linguistic roots of the Old Testament and Judaic culture. The languages are taught in conjunction with their sociocultural contexts, so that linguistic skills will be formed and enhanced by a broad and sympathetic understanding and a firm foundation will be laid for both intellectual exploration and practical experience.

Bachelor of Arts Degree

Major Requirements: An approved program of 30 credits, excluding language courses, in courses offered by the department or courses on the Near East offered by other departments, or both, plus at least 9 credits in literature courses at the 400 level in the major language for which courses numbered 311, 312, 313, and 321, 322, and 323 are usually prerequisites. Study opportunities in Egypt and Syria are available on a competitive basis for a limited number of students.

Graduate Program

The Department of Near Eastern Languages and Civilization offers a graduate program of studies leading to the Master of Arts degree. The program is designed to provide students with advanced training in at least one Near Eastern language and in a specific field of specialization. Students may concentrate in Arabic, Hebrew, Persian, or Turkish and Central Asian Turkic and may choose as their field of specialization a civilization or literature related to their language of concentration. The program is intended not only for those students who wish to continue their studies at the doctoral level but also for students who wish to pursue careers in government or business.

Research Facilities

The University of Washington libraries hold an extensive collection of books and materials in the languages of the Near East and in European languages on Near Eastern languages, literatures, and culture. Master of Arts degree aspirants, as well as Special Individual Ph.D. aspirants, find in the collection adequate resources for their research.

Admission Requirements

Statement of purpose; a sample of written work; three letters of recommendation, of which at least two must attest to scholarly ability. Although knowledge of a Near Eastern language is not a prerequisite for admission, applicants are generally expected to have had the equivalent of two years' study of the language in which they plan to concentrate.

Graduation Requirements

Departmental requirements, in addition to those required by the Graduate School for the Master of Arts degree, include a reading knowledge of French or German; a seminar paper representing the student's best work; a written examination consisting of four parts: (1) on the general culture of the Near East, (2) on the student's field of specialization, (3) on the student's language of concentration, (4) on a second Near Eastern language related to the language concentration.

Fulfillment of these requirements will normally entail the completion of two years (54 credits) of study.

Financial Aid

The department awards some teaching assistantships annually. These are available to students in the department who are fluent in speaking and writing a Near Eastern language. A limited number of National Resource Fellowships are available to students studying Arabic, Persian, or Turkish.

Correspondence and Information

Chairperson
229B Denny, DH-20

Faculty

Chairperson

Nicholas L. Heer

Professors

Bacharach, Jere L.,*‡ (History), Ph.D., 1967, Michigan; history of the Near East.

Heer, Nicholas L.,* Ph.D., 1955, Princeton; Arabic language and literature, Islamic theology and philosophy.

MacKay, Pierre A.,* (Classics, Comparative Literature),† Ph.D., 1964, California (Berkeley); topography of the Near East, Ottoman Turkish and classical Arabic literatures.

Zladeh, Farhat J.,*‡ (Law), (Comparative Literature),† LL.B., 1940, London; Arabic language and literature, Islamic law, Islamic institutions.

Associate Professors

Andrews, Walter G.,* (Comparative Literature),† Ph.D., 1970, Michigan; Turkish language and literature, Ottoman Turkish.

Cirtautas, Ilse D.,*‡ (Asian Languages and Literature), Ph.D., 1958, Hamburg; Turkic language and literature.

Loraine, Michael B.,* (Comparative Literature),† Ph.D., 1968, Cambridge; Persian language and literature.

Assistant Professors

Benin, Stephen D.,‡ (Comparative Religion), Ph.D., 1980, California (Berkeley); medieval Jewish history and thought.

Siddiq, Muhammad,* Ph.D., 1981, California (Berkeley); Arabic and Hebrew literature.

Course Descriptions

Courses for Undergraduates

Akkadian

AKKAD 401, 402, 403 Elementary Akkadian (3,3,3) A,W, Sp Introduction to the Akkadian language (Assyrian and Babylonian). Graded readings in Latin characters from historical, legal, and literary texts. Prerequisites: HEBR 400 or ARAB 323 or equivalent for 401; 401 for 402; 402 for 403. (Offered every third year.)

AKKAD 421, 422, 423 Intermediate Akkadian (3,3,3) A,W,Sp Readings in Akkadian Gilgamesh and Creation epics, historical descriptions. Introduction to the cuneiform script. Prerequisites: 403 for 421; 421 for 422; 422 for 423. (Offered every third year.)

Arabic

ARAB 111, 112, 113 Eastern Arabic: The Spoken Arabic of Palestine, Syria, Lebanon, and Egypt (5,5,5) A,W,Sp Introduces the student to the colloquial language used in the Arab countries of the Eastern Mediterranean region, emphasizing the language of everyday conversation of the educated city dweller. Transliteration into Latin characters used throughout the course.

ARAB 311, 312, 313 Elementary Arabic (5,5,5) A,W,Sp *Heer, Siddiq, Ziadeh* Intensive study of grammar, with oral and written drill and reading of simple texts.

ARAB 315 Intensive Elementary Arabic (15) S *Siddiq* Intensive study of grammar, with oral and written drill and reading of simple texts.

ARAB 321, 322, 323 Intermediate Arabic (5,5,5) A,W,Sp *Heer, Siddiq, Ziadeh* Reading of selected texts in standard Arabic, with continuing emphasis on grammar and syntax. Prerequisites: 313 for 321; 321 for 322; 322 for 323.

ARAB 401 Adab Prose: Jahiz (3) A *Siddiq, Ziadeh* Readings in early Arabic prose, especially the writings of Jahiz. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 402 Maqamat (Assemblies): Hamadhani, Hariri (3) W *MacKay, Ziadeh* Reading of several *maqamat* (essays in rhymed prose) of al-Hamadhani and al-Hariri. Examination of the *maqamat* genre as a whole. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 403 Historians: Tabari (3) Sp *Ziadeh* Readings in Arab historians with particular reference to al-Tabari and his school of historical writing. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 404 Qur'an and Tafsir (3) A *Ziadeh* Reading of various sections from the Qur'an with the relevant exegetical writings on religious, philological, and grammatical points. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 405 Hadith and Law (3) W *Ziadeh* Selected readings from the traditions *(hadith)* of Muhammad, and from works on jurisprudence and law based on the holy texts. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 406 Islamic Political Theorists (3) Sp *Ziadeh* Readings from the main political theorists: al-Baghdadi, al-Mawardi, and Ibn Khaldun. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 411 Desert Poetry: Pre-Islamic and Umayyad (3) A *Siddiq, Ziadeh* Reading and analysis of selected poems from pre-Islamic and Umayyad times. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 412 Urban Poetry: The New 'Abbasid Poetry (3) W *MacKay, Siddiq* Reading of the new poetry of the 'Abbasid period and studying of the social and political factors that gave rise to it; al-Mutanabbi and al-Ma'arri. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 413 Modern Poetry (3) Sp *Siddiq, Ziadeh* Neoclassical poetry of the nineteenth and twentieth centuries, and the development of modern verse. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 414 Islamic Philosophical Literature (3) A *Heer* Reading of selected texts by representative Islamic philosophers. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 415 Islamic Theological and Mystical Literature (3) W *Heer* Reading of selected texts representative of Islamic theological and mystical schools. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 416 Modern Prose (3) Sp *Siddiq, Ziadeh* Modern essays, fiction, and ideological writings. Prerequisite: 323 or equivalent. (Offered alternate years.)

ARAB 431, 432, 433 Advanced Modern Arabic (5,5,5) A,W,Sp *Siddiq, Ziadeh* Designed to impart to the student an active knowledge of Arabic structure and syntax and to increase his or her vocabulary power through supervised composition, translation into Arabic, and précis of expository writings. Particular emphasis is placed on journalistic articles and editorials. Prerequisite: 323 or equivalent.

ARAB 470 Intensive Arabic Morphology and Syntax (15) S *Siddiq* Allows students in the graduate programs of the Department of Near Eastern Languages and Civilization and other departments to complete the first year of Arabic during Summer Quarter. Primarily for graduate students.

ARAB 471, 472, 473 Arabic Morphology and Syntax (5,5,5) *Heer, Siddiq, Ziadeh* Allows students with knowledge above the elementary level in one Near Eastern Language other than Arabic to begin study of Arabic. Primarily for graduate students.

ARAB 474, 475, 476 Arabic Texts (5,5,5) A,W,Sp *Heer, Siddiq, Ziadeh* Readings in Arabic texts. Prerequisites: 473, for 474; 474 for 475; 475 for 476. Primarily for graduate students.

ARAB 490 Supervised Study (1-6, max. 18) AWSp Special work in literary texts for graduates and undergraduates. Prerequisite: 323 or equivalent.

ARAB 499 Undergraduate Research (1-6, max. 18) AWSp

Aramaic

ARAM 401 Biblical Aramaic (3) A Introduction to Biblical Aramaic (Ezra, Daniel). Selections from Targumim. Prerequisite: HEBR 400 or equivalent. (Offered alternate years.)

ARAM 411 Aramaic Epigraphy (3) Sp Readings in the Aramaic inscriptions and the Elephantine Papyri. Prerequisite: HEBR 400 or equivalent. (Offered alternate years.)

Hebrew

HEBR 311, 312, 313 Modern Hebrew (5,5,5) A,W,Sp Modern Israeli Hebrew. Core vocabulary, grammar, conversational text, and oral and written communication. Excerpts from modern Hebrew prose and poetry.

HEBR 321, 322, 323 Intermediate Modern Hebrew (5,5,5) A,W,Sp Readings of selected texts in modern Hebrew with continuing emphasis on grammar and syntax. Prerequisites: 313 for 321; 321 for 322; 322 for 323.

HEBR 400 Biblical Hebrew (3) A Introduction. Elements of grammar and reading of various styles found in the Hebrew Bible and Rabbinical texts. Prerequisite: 313.

HEBR 401, 402, 403 Hebrew Prophecy (3,3,3) A,W,Sp Readings in the Hebrew prophets. Prerequisites: 400 or permission for 401; 401 for 402; 402 for 403. (Offered alternate years.)

HEBR 404, 405, 406 Hebrew Historiography (3,3,3) A,W,Sp Readings of classical Hebrew prose selected from the historical books of the Bible: Joshua, Judges, Samuel, Kings, Chronicles. Prerequisite: 400 or permission of instructor.

HEBR 411, 412, 413 Classical Hebrew Poetry (3,3,3) A,W,Sp Readings in classical Hebrew poetry: Psalms and Wisdom literature. Prerequisites: 400 or permission of instructor for 411; 411 for 412; 412 for 413. (Offered alternate years.)

HEBR 414, 415, 416 Pentateuch (3,3,3) A,W,Sp Readings in classical Hebrew selected from the books of the Pentateuch/Torah: Genesis, Exodus, Leviticus, Numbers, Deuteronomy. Prerequisite: 400 or permission of instructor.

HEBR 423 Advanced Post-Biblical Hebrew: Modern Narrative (3) Sp Advanced readings in modern Hebrew narrative, with emphasis on the short narratives of Chaim Nachman Bialik. Oral practice is included. Prerequisite: 323 or equivalent.

HEBR 425 Hebrew Literature of Spain (3) W Readings in classical Hebrew selected from the writings of Jewish scholars in Spain during the years 1000-1500, with emphasis on the background of the period and the literary philosophy of the time. Selected readings from Jehudah Halevi and Ibn Gabirol are used along with secondary sources. Prerequisite: 400 or permission of instructor.

HEBR 426 Golden Age of Hebrew Poetry (3) W Reading and analysis of selected poems from the golden age of Spanish Jewish literature with particular reference to Ibn Gabirol. Prerequisite: 400 or permission of instructor. (Offered alternate years.)

HEBR 427 Bialik's *Sefer Aggadah* (3) Sp Readings in the *Sefer Aggadah*, a collection of the literary and legendary elements from the Talmud that has been translated from the original Aramaic into modern Hebrew by Chaim Nachman Bialik. Prerequisite: 323 or permission of instructor.

HEBR 431 Canaanite and Hebrew Inscriptions (3) Sp Readings in the Canaanite (Phoenician) and Hebrew inscriptions in facsimile. Studies of the development of the Canaanite script and dialects. Prerequisite: 400 or equivalent. (Offered alternate years.)

HEBR 441, 442, 443 Septuagint Studies (3,3,3) A,W,Sp Textual studies in the Greek version of the Bible in comparison with the Hebrew. Prerequisites: ability to read Greek and Hebrew for 441; 441 for 442; 442 for 443. (Offered on demand.)

HEBR 461, 462 *Mishnah* and *Talmud* (3,3) From the literatures of the *Mishnah and Talmud* is derived a corpus of Jewish philosophical and literary work principally in law, history, and ethics. 461 (Autumn Quarter): the *Mishnah*. 462 (Winter Quarter): the *Talmud*. Prerequisite for both courses: 400 or permission of instructor.

HEBR 471, 472, 473 Hebrew Morphology and Syntax (5,5,5) A,W,Sp Allows students with knowledge above the elementary level in one Near Eastern language other than Hebrew to begin study of Hebrew. Primarily for graduate students.

HEBR 474, 475, 476 Hebrew Texts (5,5,5) A,W,Sp Readings in Hebrew texts. Prerequisites: 473 for 474; 474 for 475; 475 for 476. Primarily for graduate students.

HEBR 490 Supervised Study (1-6, max. 18) AWSp Special work in literary texts for graduates and undergraduates. Prerequisite: 323 or equivalent.

HEBR 499 Undergraduate Research (1-6, max. 18) AWSp

Persian

PRSAN 311, 312, 313 Elementary Persian (5,5,5) A,W,Sp *Loraine* Beginning course in pronunciation, conversation, grammar, and graded reading.

PRSAN 321, 322, 323 Intermediate Persian (5,5,5) A,W,Sp *Loraine* Introduction to Persian literature, with continuing emphasis on grammar and syntax. Prosody taught, using the numerous short verses in various metres in the Gulistan as models. Prerequisites: 313 for 321; 321 for 322; 322 for 323.

PRSAN 401 Sa'di (3) A *Loraine* Selected readings from the *Gulistan, Bustan,* and *Diwan,* which represent a high point in classical Persian verse and prose and give great insight into Persian manners and ways of thought. Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 402 Lyric Poetry (3) W *Loraine* Selections from various authors, chiefly up to Hafiz. This course introduces examples of the *ghazal,* mainly as an important literary type; it also gives an outline of the development of the type and introduces the chief writers of it in the context of literary history. Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 403 Firdawsi (3) Sp *Loraine* Selected readings from the *Shahnama.* The course introduces the particular style and vocabulary of the epic and illustrates the legendary careers of certain well-known heroes. Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 411 Siyasat-nama (3) A *Loraine* The "Book of Government" of Nizam al-Mulk draws on the full range of traditional Persian wisdom and thus links itself to the *Qabusnama* and the works of Sa'di. Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 412 Rumi (3) W *Loraine* Selected readings from the *Mathnawi* and poems from the *Diwan-i Shams-i Tabriz.* Students are introduced to Rumi's unique style of anecdote, illustration, and didactic. Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 413 Hafiz (3) Sp *Loraine* Selected poems from the *Diwan.* Prerequisite: 323 or equivalent. (Offered alternate years.)

PRSAN 471, 472, 473 Persian Morphology and Syntax (5,5,5) A,W,Sp *Loraine* Allows students with knowledge above the elementary level in one Near Eastern language other than Persian to begin study of Persian. Primarily for graduate students.

PRSAN 474, 475, 476 Persian Texts (5,5,5) A,W,Sp *Loraine* Readings in Persian texts. Prerequisites: 473 for 474; 474 for 475; 475 for 476. Primarily for graduate students.

PRSAN 490 Supervised Study (1-6, max. 18) AWSp Special work in literary texts for graduates and undergraduates. Prerequisite: 313 or equivalent.

PRSAN 499 Undergraduate Research (1-6, max. 18) AWSp

Turkish

TKISH 311, 312, 313 Elementary Turkish (5,5,5) A,W,Sp *Andrews* Introduction to modern Turkish. Pronunciation and conversation, grammar and composition, graded reading. Latin characters used throughout.

TKISH 321, 322, 323 Intermediate Turkish (5,5,5) A,W,Sp *Andrews* Introduction to modern Turkish literature. Prerequisites: 313 for 321; 321 for 322; 322 for 323.

TKISH 400 Introduction to Ottoman Turkish (3) A *Andrews* Introduction to Turkish in Arabic characters to cover the peculiar grammatical and syntactical problems of Ottoman. Prerequisites: 323 and ARAB 313 or PRSAN 313.

TKISH 401 Tanzimat Poetry and Prose (3) A *Andrews* Readings from the poetry and prose of the *Tanzimat* period. Prerequisite: 400 or permission of instructor. (Offered alternate years.)

TKISH 402 Early Ottoman Historians (3) W *Andrews* Readings in the early *Tevarih-i Al-I Osman*. Prerequisite: 400. (Offered alternate years.)

TKISH 403 Ottoman Travelers and Geography (3) Sp *MacKay* Introduction to the geographic literature of Ottoman Turkish: readings from traditional cosmographies, travel journals, sailing instructions (portulans), ambassadorial and secret service reports, etc. Prerequisite: 400. (Offered alternate years.)

TKISH 411 Classical Ottoman Historians (3) A *Andrews* Readings in the high classical narrative histories of Kemal Pasazade, Hoca Sa'duddin, and other sixteenth- and seventeenth-century historians. Prerequisite: 400. (Offered alternate years.)

TKISH 412 Ottoman Lyric Poetry (3) W *Andrews* Introduction to classical Ottoman poetry, including rhyme, meter, and rhetoric, through readings in Ottoman lyrics. Prerequisite: 400. (Offered alternate years.)

TKISH 413 Ottoman Epic and Narrative Poetry (3) Sp *Andrews* Readings in major Ottoman epic and narrative poetry. Prerequisite: 400. (Offered alternate years.)

TKISH 471, 472, 473 Turkish Morphology and Syntax (5,5,5) A,W,Sp *Andrews* Allows students with knowledge above the elementary level in one Near Eastern language other than Turkish to begin study of Turkish. Primarily for graduate students.

TKISH 474, 475, 476 Turkish Texts (5,5,5) A,W,Sp *Andrews* Readings in Turkish texts. Primarily for graduate students.

TKISH 490 Supervised Study (1-6, max. 18) AWSp *Andrews* Special work in literary texts for graduates and undergraduates. Prerequisite: 323 or equivalent.

TKISH 499 Undergraduate Research (1-6, max. 18) AWSp

Ugaritic

UGAR 401, 402, 403 Ugaritic Language and Literature (3,3,3) A,W,Sp Readings in the Ugaritic texts from Ras Shamra. Epic, Mythological, and other texts. Prerequisite: intermediate knowledge of a cognate language (Akkadian, Arabic, Aramaic, Hebrew). (Offered every third year.)

Near Eastern Courses in English

N E 210 Studies in Islamic Culture (5) A *Siddiq* Fundamentals of Islamic culture presented in selected texts in translation. Selections from the Koran, Islamic law, poetry, theology, and philosophy. Offered jointly with SISME 210.

N E 220 Religion, Art, and Life in the Ancient Near East (5) W Ancient Near Eastern Civilization as seen in the art and literature of Sumer, Babylon, Assyria, and the other cities and states of the northwest Semitic area.

N E 230 Themes in Near Eastern Literature (5) Sp Significant and interesting aspects of Near Eastern culture and society as represented by literary themes. Aspects of Near Eastern life and art such as women, minority groups, mysticism, and modern literature. Content varies.

N E 240 Introduction to the Bible (Old Testament) (5) Sp Introduction to the Hebrew Bible in English. Results of modern critical studies on the Bible and the ancient Near East. Concentrates on the meaning of the Biblical records in their own time and environment.

N E 325 Modern Hebrew Literature in English (3) W Major developments in Hebrew literature from the Enlightenment to the current Israeli literature. Examines the development of modern Hebrew thought and literary style.

N E 350 The City of Cairo (3) *MacKay* Development of Fustat and Cairo, 600-1800, with special emphasis on art and architecture. Consideration of the economic, social, and geographical influences on the creation of the distinctive Egyptian styles of Islamic art. Offered jointly with ART H 350.

N E 420 Islamic Theological Literature in English (3) A *Heer* Readings from Mu'tazilite and Ash'arite works and from traditionalist works opposed to theology.

N E 421 Islamic Mystical Literature in English (3) W *Heer* Readings from the works of principal Sufi writers and poets.

N E 422 Islamic Philosophical and Scientific Literature in English (3) *Heer* Readings in philosophy, the physical sciences, and medicine.

N E 425 Current Trends in Modern Near Eastern Literature and Criticism (3) *Siddiq* Modern literary tradition of the Near East with emphasis on major literary movements and/or genres and literary criticism in the modern period. The literatures of the Arab world, Persia, Turkey, and Israel are considered in alternate quarters.

N E 430 Islam (5) *Ziadeh* Religious and cultural milieu of Arabia before Muhammad; Muhammad's call and struggle to establish the new faith; Qur'anic content and style; Western and Muslim scholarship and the Qur'an; place of traditions in the Islamic edifice; Muslim political and religious thought; sources of Muslim religious law; and modern Muslim movements. In English. Offered jointly with RELIG 430.

N E 432 Islamic Literature on Jurisprudence and Law in English (3) Sp *Ziadeh* The origins of the *shari'ah*, its development throughout the Islamic period, and the modern reform of this law. Offered jointly with LAW B 543.

N E 434 Modern Near East Fiction in Translation (3) *Andrews, Loraine, Siddiq* Literary genres; literary theory; principal literary authors of Arabic, of Persian, and of Turkish and their works. From the beginnings to the modern period.

N E 435 Major Trends in Modern Arabic Fiction (3) Sp *Siddiq* Development of the Arabic novel from the end of the nineteenth century to the present. In English translation.

N E 490 Supervised Study (1-6, max. 18) AWSp Special work in Near Eastern studies for graduates and undergraduates.

N E 499 Undergraduate Research (1-6, max. 18) AWSp

Courses for Graduates Only

Arabic

ARAB 600 Independent Study or Research (*) AWSp

Hebrew

HEBR 600 Independent Study or Research (*) AWSp

Near East

N E 520 Seminar on Near Eastern Civilization and Thought (3, max. 27)

N E 521 Research Methods (3) A *Heer* Introduction to research in Islamic civilization. Research methods, primary sources, evidence and documentation, reference works, transliteration systems, scholarly writing style.

N E 522 Islamic Theology (3) W *Heer* Various schools of Islamic theology.

N E 523 Islamic Philosophy (3) Sp *Heer* Various topics and problems dealt with by the Islamic philosophers.

N E 524 Islamic Law (3) A *Ziadeh* Selected topics in Islamic law that highlight major aspects of Islamic civilization.

N E 525 Islamic Institutions (3) Sp *Ziadeh* Islamic institutions of the caliphate, the sultanate, the bureaucracy, taxation, mosques, and madrasahs, as well as theories of government.

N E 530 Seminar on Near Eastern Literature (3, max. 27) Prerequisite: reading knowledge of at least one Near Eastern language.

N E 531 Proseminar in Literary Analysis (3) A *Andrews* Introduction to the theory and techniques of the study of literature in general and Near Eastern literatures in particular. Prerequisite: reading knowledge of at least one Near Eastern language.

N E 532 Theory and Practice in Modern Near Eastern Literature (3) W *Siddiq* Application of literary theory to works of modern Near Eastern literature. Concentrates on one major theory each year.

N E 533 Islamic Poetry and Poetics (3) Sp *Loraine* Detailed introduction to prosody and rhyme in classical Arabic and Persian, followed by critical analysis of selected texts. Prerequisite: advanced level of Arabic or Persian; some knowledge of the other recommended.

N E 600 Independent Study or Research (*) AWSp

Persian

PRSAN 600 Independent Study or Research (*) AWSp

Turkish

TKISH 600 Independent Study or Research (*) AWSp

Philosophy

345 Savery

Philosophy is the study of the most fundamental issues concerning reality, knowledge, and value, and of the basic concepts, principles, and arguments of the major intellectual disciplines. Its fields include metaphysics, epistemology, logic, ethics, history of philosophy, political philosophy, esthetics, philosophy of science, philosophy of language, philosophy of law, and philosophy of religion.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements: 50 credits in philosophy, which must include: (1) at least 25 credits at the University of Washington; (2) at least four courses at the 400 level or above, excluding transfer credits and reading courses (PHIL 484 and 584), which normally cannot be used to satisfy this requirement; (3) PHIL 120 or 370; and (4) PHIL 320 and 322 (or upper-division courses in the same areas; undergraduate adviser must approve substitutions).

Graduate Program

The Department of Philosophy offers programs of study leading to the Master of Arts and Doctor of Philosophy degrees, the regular M.A. program option serving as the initial stage of the Ph.D. program. (In addition to the regular M.A. program, described here, the department offers an alternate M.A. program option designed for, and restricted to, persons not interested in becoming professional philosophers. Details on the alternate M.A. program are available from the Graduate Program Coordinator.)

The regular Master of Arts program option is a two-year nonthesis program. The student must take twelve courses in philosophy, satisfy a logic requirement, and, at the end of the second year, submit three research papers for evaluation by the graduate faculty of the department. The courses and the papers must satisfy a distribution requirement. The departmental evaluation of the student's papers and course work determines whether an M.A. degree is awarded and also whether admission to the Ph.D. program is granted. The Ph.D. program, which normally requires at least two years of study beyond the M.A., has five general requirements: (1) presentation of a paper at a philosophy colloquium, (2) teaching experience as a teaching assistant, (3) General Examination, (4) dissertation, and (5) Final Examination.

Research Facilities

The department maintains its own research library. This library of more than fifteen thousand volumes contains nearly all of the material needed for any philosophical research.

Special Requirements

An undergraduate major in philosophy is not required for admission to the M.A. program. An applicant's philosophical potential is assessed primarily on the basis of a sample of his or her written work in philosophy and secondarily on the basis of his or her undergraduate record, Graduate Record Examination scores, and letters of recommendation. A reading knowledge of at least one foreign language is strongly recommended.

Financial Aid

A number of teaching assistantships are available each year to new graduate students. At present, eleven students of a total enrollment of thirty-six hold teaching assistantships.

Correspondence and Information

Graduate Program Coordinator
345 Savery, DK-50

Faculty

Chairperson

S. Marc Cohen

Professors

Boler, John F.,* Ph.D., 1960, Harvard; medieval philosophy.
Coburn, Robert C.,* Ph.D., 1958, Harvard; metaphysics, social philosophy.

Cohen, S. Marc,* Ph.D., 1967, Cornell; ancient philosophy, metaphysics, philosophy of mind.

Dietrichson, Paul,* Ph.D., 1955, Yale; philosophy of religion, ethics, metaphysics.

Keyt, David,* Ph.D., 1955, Cornell; ancient and contemporary philosophy.

Marks, Charles E.,* Ph.D., 1972, Cornell; contemporary philosophy, British empiricism and continental rationalism.

Potter, Karl H.,* (International Studies, Asian Languages and Literature), Ph.D., 1955, Harvard; Indian philosophy, epistemology.

Richman, Robert J.,* Ph.D., 1953, Harvard; ethics, epistemology.

Associate Professors

BonJour, Laurence A.,* Ph.D., 1969, Princeton; epistemology.

Clatterbaugh, Kenneth C.,* Ph.D., 1967, Indiana; philosophy of science, ancient philosophy, continental rationalism.

Moore, Ronald M.,* Ph.D., 1971, Columbia; philosophy of law, esthetics.

Assistant Professor

Mish'alani, James K.,* Ph.D., 1961, Brown; ethics, philosophical psychology.

Course Descriptions

Courses for Undergraduates

PHIL 100 Introduction to Philosophy (5) AWSp Major philosophical questions relating to such matters as ethics, the existence of God, the foundations of knowledge, and the nature of reality. Problems studied and works read vary.

PHIL 101 Philosophical Classics (5) Selected works of some of the major philosophers such as Plato, Aristotle, Descartes, Hume, Kant. The philosophers studied vary.

PHIL 102 Contemporary Moral Problems (5) *BonJour, Richman* Philosophical consideration of some of the main moral problems of modern society and civilization, such as abortion, euthanasia, war, sexual morality, governmental paternalism, reverse discrimination, and capital punishment. Topics vary.

PHIL 104 Ideas in the Western Tradition—Ancient (5) *Keyt* Philosophy of the ancient world, primarily the views of man and the universe in selected works of Greek and Roman thought.

PHIL 105 Ideas in the Medieval and Renaissance Periods (5) *Boler* Major ideas in Christian, Jewish, and Islamic thought from late antiquity to the beginnings of the modern period.

PHIL 106 Ideas in the Western Tradition—Modern (5) *Coburn* Basic ideas about man and the world since the Renaissance. Content and emphasis vary.

PHIL 110 Introduction to Social and Political Philosophy (5) *Coburn* Examination of such ideals as liberty, distributive justice, democracy, peace, and human survival. Problems involved in achieving social change are also considered. Content varies.

PHIL 114 Philosophical Issues in the Law (5) *Moore* Analysis and critical assessment of various philosophical issues in law and legal reasoning. Material drawn from actual law cases, as well as writings by contemporary philosophers of law and lawyers. Topics include criminal responsibility, civil disobedience, abortion, reverse discrimination, enforcement of morals. No special legal or philosophical training required.

PHIL 115 Practical Reasoning (5) Introduction to logic emphasizing concepts and methods useful for practical analysis of arguments in everyday contexts. Meaning, syllogisms, logical diagrams, inductive and statistical inference, informal fallacies, argument structure, perhaps some beginning symbolic logic. A wide variety of examples, including logical puzzles, considered.

PHIL 120 Introduction to Logic (5) AWSp Elementary symbolic logic. The development, application, and theoretical properties of an artificial symbolic language designed to provide a clear representation of the logical structure of deductive arguments.

PHIL 160 A Historical Introduction to the Philosophy of Science (5) *Clatterbaugh* Study of how scientific theories are justified and why they are accepted, using selected examples from the history of science.

PHIL 200 Types of Philosophy (5) Introductory philosophy. The content of the course is entirely at the discretion of the instructor.

PHIL 206 Philosophy of Feminism (3) Philosophical analysis of the concepts and assumptions central to feminism. Theoretical positions within the feminist movement; views of the ideal society, goals and strategies of the movement, its relation to racial liberation, and ethical issues. Offered jointly with WOMEN 206. Not open to students who have taken GIS 106.

PHIL 230 Philosophic Issues in World Affairs (3) *Coburn* Moral problems that arise in connection with such topics as affluence, hunger, and overpopulation; global environmental degradation; war and weaponry; restructuring the international order.

PHIL 240 Introduction to Ethics (5) *Mish'alani, Richman* Critical study of some typical views of the basis and presuppositions of morality and of moral knowledge. Custom, theology, human nature, and happiness as standards of moral judgments. Consideration of such topics as free will and responsibility, ethical relativism, and the problem of evil.

PHIL 267 Introduction to Philosophy of Religion (5) *Dietrichson, Mish'alani* Study of religious thought. Examination of the problem of evil, of the nature of mysticism, atheism, and theism, and of the relationship between religion and morality.

PHIL 320 Ancient Philosophy (5) A *Cohen, Keyt* Survey of the history of ancient Greek philosophy. The metaphysical and epistemological theories of Plato, Aristotle, and the Atomists, their origins in the thought of Socrates and the pre-Socratics, and their development by the Stoics, Skeptics, Epicureans, and Plotinus.

PHIL 321 Medieval Philosophy (5) *Boler* Development of main lines of philosophical thought in the Latin West from 400 to 1400, with emphasis on Augustine, Anselm, Abelard, Aquinas, and Occam. Recommended: 320.

PHIL 322 Modern Philosophy (5) W *Clatterbaugh* Examination of the development of philosophy in the seventeenth and eighteenth centuries, focusing especially on the problem of scepticism.

PHIL 325 Nineteenth-Century Philosophy (5) Post-Kantian idealism, Schopenhauer and Hegel and the revival of materialism in Feuerbach, Marx, and Engels. Some consideration of Kierkegaard and Nietzsche.

PHIL 326 Twentieth-Century Philosophy (5) *Marks* Survey of the main problems in philosophical analysis from the English Realist reaction against Idealism at the beginning of this century to the present. Includes the logical atomism of Russell and Wittgenstein and the logical positivism of the Vienna Circle as well as more recent developments.

PHIL 327 American Philosophy (5) *Boler, Potter* Study of several of the major American philosophers: Peirce, Royce, Dewey, William James, C. I. Lewis, Goodman, Quine. Recommended: at least one course in philosophy.

PHIL 330 History of Ancient Political Philosophy (4) *Keyt* Political philosophy of fourth- and fifth-century Greece, especially the Sophists, Plato, and Aristotle, stressing the connection between the political philosophy and the underlying philosophical system of each philosopher. Recommended: at least one course in philosophy.

PHIL 331 History of Medieval Political Philosophy (4) *Boler* Political philosophy in the Middle Ages, especially the major figures (Augustine, Aquinas, Occam), with special emphasis on the setting of their political thought in the context of their general philosophical positions. Recommended: at least one course in philosophy.

PHIL 332 History of Modern Political Philosophy (5) Examination of major political philosophies from the sixteenth century to the nineteenth century, with attention to the underlying philosophical methods and foundations.

PHIL 334 Philosophy of Marxism (3) Philosophy of Marx and the Marxist tradition with attention to the philosophical method and foundation of Marxism.

PHIL 338 Philosophy of Human Rights (3) *Coburn* Theories of human rights and the bearing of these theories on such issues of public policy as the legitimacy of war and terrorism, whether people have rights to a clean environment or a welfare floor, and whether future generations have rights.

PHIL 340 History of Ancient Ethics (5) *Richman* Development of moral thought from Socrates through the Stoics. Particular emphasis on the ethical writings of Plato and Aristotle. Recommended: one course in philosophy.

PHIL 342 History of Modern Ethics (5) *Richman* Development of moral thought from Hobbes through Nietzsche, with particular emphasis on the ethical writings of Hume, Kant, and John Stuart Mill. Recommended: one course in philosophy.

PHIL 344 History of Recent Ethics (5) *Richman* Study of major ethical writings in the twentieth century, with principal emphasis on the Anglo-American tradition. Recommended: one course in philosophy.

PHIL 345 Moral Issues of Life and Death (4) *Coburn* Examination of such topics as war and murder, famine relief, capital punishment, high-risk technologies, abortion, suicide, and the rights of future generations. Prerequisite: one course in philosophy or junior standing.

PHIL 346 Personal Values and Human Good (3) *Coburn* Examination of the idea of a good human life. Emphases differ from year to year. Typical topics include happiness and prudence, rationality and life plans, personal values and the meaning of life, autonomy and false consciousness, self-respect and self-esteem, honesty and self-deception, faith and "vital lies." Prerequisites: two previous courses in philosophy.

PHIL 347 Philosophy in Literature (3) *Marks, Mish'alani* Study of philosophical ideas expressed in works of literature.

PHIL 350 Introduction to Epistemology (4) *BonJour* Introduction to the theory of knowledge. Nature, definition, and possibility of knowledge. Problems about our knowledge of the external world, the past, other minds, mathematics, etc. Prerequisites: two previous courses in philosophy.

PHIL 353 Introduction to the Philosophy of Language (5) Introduction to philosophical theories about the nature of language. Topics include meaning, reference, truth, propositions, relations between language and thought and between language and logic, relation of philosophy of language to linguistics and psychology. Recommended: 120.

PHIL 363 Introduction to the Philosophy of Mind (5) *Cohen, Marks* Introduction to the philosophy of mind. Various theories of the nature of mind, the relationship between mind and body, the self, memory, the unconscious, introspection, and knowledge of other minds. Recommended: one course in philosophy.

PHIL 370 Intermediate Logic (5) A An advanced treatment of sentential logic. Proof theory, model theory, and their interrelations.

PHIL 372 Introduction to Set Theory (5) Historical development and basic concepts of set theory. Set theoretical paradoxes and their proposed solutions.

PHIL 386 Introduction to the Philosophical Systems of India (5) A *Potter* The fundamental views of classical Indian philosophical schools on epistemology and metaphysics through readings in translation of basic works. Nyaya, Vaisesika, Samkhya, Yoga, Jain philosophy, Vijnanavada and Madhyamika Buddhism, Advaita Vedanta and later developments. Offered jointly with SISSA 386. Prerequisite: SISSA 210 or one course in philosophy.

PHIL 410 Social Philosophy (3) *Coburn* Examination of social ideals such as liberty and justice, and of social problems associated with current and prospective technological developments. Emphases of the course vary each year.

PHIL 412 Indian Philosophy (5) *Potter* Historical survey of the major systems and the traditional problems of philosophy in India. Readings in Buddhism, Nyaya, Samkhya, and Vedanta. Recommended: 100 or 386.

PHIL 413 Studies in Indian Philosophy (3, max. 9) *Potter* Study of one or more individual figures or problems in Indian philosophy selected by the instructor. Prerequisite: 412.

PHIL 414 Philosophy of Law (3) *Moore* Nature and function of law. Relation of law to morality. Legal rights, judicial reasoning. Recommended: 110 or 114 or 240.

PHIL 415 Chinese Philosophy (5) Development of Chinese philosophy from the sixth century B.C. to modern times. Emphasis on Confucianism, Mohism, Taoism, Legalism, the Dialecticians, Buddhism, and Neo-Confucianism; reevaluation of them in the light of new trends of thought after contact with the West.

PHIL 416 Neo-Confucianism (5) Systematic study of Neo-Confucianism, its background and development with emphasis on the Rationalistic school of Ch'eng-Chu and the Idealistic school of Lu-Wang. Prerequisite: 415 or permission of instructor.

PHIL 418 Indian and Tibetan Buddhist Philosophy (3) Topics from Buddhist thought, both Sravakayanist and Mahayanist, touching on the following areas: epistemology, theory of liberation, metaphysics and the theory of the absolute, cosmology, and ethics. Readings in translation. At least one course in Indian philosophy or Hinduism or Buddhism recommended.

PHIL 421 Studies in Medieval Philosophy (3, max. 9) *Boler* Detailed study of an individual figure or problem in medieval philosophy (of the Latin West) selected by the instructor. Recommended: 321.

PHIL 422 Studies in Continental Rationalism (3, max. 9) *Clatterbaugh, Marks* Study of one or more of the major continental Rationalists: Descartes, Spinoza, Leibniz. Recommended: 322.

PHIL 431 Philosophy of Plato (3) *Cohen, Keyt* Study of selected middle and late dialogues. Recommended: 320.

PHIL 433 Philosophy of Aristotle (3) *Cohen, Keyt* Study of several major Aristotelian treatises. Recommended: 320.

PHIL 434 Philosophy of Thomas Aquinas (3) *Boler* Examination of the major philosophical positions of Thomas Aquinas in the theory of knowledge, metaphysics, and ethics. Recommended: 321.

PHIL 436 British Empiricism (3) *BonJour, Marks* Examination of the metaphysical and epistemological views of Locke and Berkeley, with perhaps some attention also to Hume. Recommended: 322.

PHIL 437 Philosophy of Hume (3) *Marks, Richman* Study of the principles and methods employed by Hume in his analyses of knowledge, the passions, and morals. Recommended: 322.

PHIL 438 Philosophy of Kant (5) *BonJour, Dietrichson* Systematic study of *The Critique of Pure Reason* or of one or more other major works of Kant. Recommended: one course in philosophy (other than logic) beyond the introductory level.

PHIL 439 The Later Philosophy of Wittgenstein (3) *Coburn, Marks* Detailed study of topics in the later philosophy of Wittgenstein, with particular attention to the *Philosophical Investigations*. Recommended: 322.

PHIL 440 Advanced Ethics (3) *Coburn, Richman* Critical examination of the concepts and judgments of value, including an analytical treatment of the notions of good and bad, right and wrong, and obligation. Recommended: 240.

PHIL 443 Philosophy and Linguistics (3) Study of philosophical problems that arise in the attempt to understand current linguistic theories and of the implications of linguistics for philosophy. Offered jointly with LING 443.

PHIL 445 Philosophy of Art (5) *Moore* Critical examination of various accounts of the nature of art, artistic activity, the esthetic experience. The philosophy of criticism, the role of the critic, and problems in interpretation and evaluation of works of art.

PHIL 446 Development of Esthetic Theory (5) *Moore* Historical development of esthetics, emphasizing such major figures as Plato, Aristotle, Hume, Kant, Hegel, and Goodman. Recommended: 100 or 445.

PHIL 447 Philosophy of Literature (3) *Mish'alani* Investigation of philosophical questions about literature: What is literature? Why write? Must literature be interpreted? What is interpretation? Literature and ideology; criticism of literature and society.

PHIL 450 Epistemology (3) *BonJour* Systematic study of some of the main problems of the theory of knowledge, such as: the definition of "knowledge"; *a priori* knowledge; perception and knowledge of the external world; memory knowledge; theoretical knowledge; knowledge of other minds; and whether knowledge has or requires a foundation. Recommended: 350 or 322.

PHIL 453 Philosophy of Language (5) Current theories of meaning, reference, predication, and related concepts. Offered jointly with LING 476. Recommended: 120.

PHIL 456 Metaphysics (3) *Coburn* Examination of issues and problems that arise in connection with such topics as freedom of the will, the nature of persons and personal identity, the existence of God, time, necessary truth, and universals. The emphases vary from year to year.

PHIL 458 Phenomenology (5) *Mish'alani* The contribution of phenomenology to selected topics in the theory of meaning, philosophy of mind, ontology, and epistemology.

PHIL 460 Philosophy of Science (5) *Clatterbaugh* Critical study of different theories about the nature of scientific theory. Topics include the relation of theory to observation, the use of mathematics, how theories change, the requirements for the meaningfulness of a theory, and the relation between theory and methodology.

PHIL 461, 462 Philosophy of Man and Culture I, II (3,3) *Mish'alani* Treatment of philosophical questions and concepts pertaining to the collective production and appropriation of culture (e.g., explanation and interpretation; structural analysis; history and culture; cultural invariance; the structuring of experience by collective representations; the nature of conflict and domination). Recommended: 461 prior to 462.

PHIL 463 Philosophy of Mind (3) *Marks* Examination of current theories of the nature of the mind and mental processes. Recommended: 363 or permission of instructor.

PHIL 464 Philosophy of Psychology (3) *Marks* Philosophical problems connected with research in psychology and/or artificial intelligence. Topics vary. Readings from both philosophical and scientific literature. Accessible to nonphilosophers with suitable interests and backgrounds.

PHIL 465 Philosophy of History (3) *Mish'alani* Analyses of basic concepts employed in historical interpretation, and study of some of the principal philosophers of history, such as Plato, Saint Augustine, Hegel, Marx, Spengler, Toynbee.

PHIL 466 Philosophy of the Social Sciences (3) *Coburn* Examination of fundamental issues in the methodology and the interpretation of the social sciences. Particular emphasis on value orientation and objectivity, functionalism, reductionism, and the status of idealized models. Recommended: 120 or 160 or 460, or course beyond introductory level in a social science.

PHIL 467 Philosophy of Religion (5) *BonJour, Dietrichson* Study of selected topics and problems in the philosophy of religion, such as: arguments for the existence of God; the problem of evil; atheism; faith; religious experience and revelation; the attributes of God; miracles; immortality; and the relation between religion and morality. Readings from historical and contemporary authors. Recommended: one course in philosophy, other than logic, beyond the introductory level.

PHIL 469 Existentialist Philosophy (3) *Dietrichson* Critical examination of major ideas in Kierkegaard's philosophy and in Sartre's or Heidegger's philosophy. Recommended: one course in philosophy, other than logic, beyond the introductory level.

PHIL 470 Advanced Logic (5) Advanced treatment of predicate logic. Proof theory, model theory, and their interrelations.

PHIL 472 Axiomatic Set Theory (5) Development of axiomatic set theory up to and including the consistency of the Axiom of Choice and Continuum Hypothesis with the Zermelo-Fraenkel Axioms. Recommended: 370 or permission of instructor.

PHIL 473 Philosophy of Mathematics (5) Traditional accounts of the nature of mathematical entities and mathematical truth given by logicism, intuitionism, and formalism, and the impact of Godel's incompleteness theorems on these accounts. Recommended: some background in mathematics and formal logic.

PHIL 474 Modal Logic (5) Notions of necessity and possibility, using the classical systems T, S4, and S5, and the syntax and the semantics (Kripke models) of these systems. Recommended: 370.

PHIL 479 Formal Semantics and Natural Language (3) Introduction to formal characterization of linguistic meaning. Emphasis on nature and purpose of formal semantics and on its relation to formal syntax. Typical topics: Tarskian definitions of truth; "truth theory" and theory of meaning; possible world semantics; Montague semantics; generative semantics; Chomsky on syntax and semantics. Offered jointly with LING 479. Recommended: 120 or 370.

PHIL 484 Reading in Philosophy (1-5, max. 15) AWSp Reading of approved philosophical works. Prerequisite: permission of instructor.

Courses for Graduates Only

PHIL 500 Proseminar in Philosophy (5) Development of oral skills in the presentation, criticism, and discussion of philosophical problems and arguments. Student presentations and responses to criticism on a variety of basic philosophical issues. Recommended for all first-year graduate students.

PHIL 514 Seminar in Legal Philosophy (5, max. 20) *Moore*

PHIL 520 Seminar in Ancient Philosophy (5, max. 20) *Cohen, Keyt*

PHIL 521 Seminar in Medieval Philosophy (5, max. 20) *Boler*

PHIL 522 Seminar in Modern Philosophy (5, max. 20) *Clatterbaugh*

PHIL 525 Seminar in Nineteenth-Century Philosophy (5, max. 20)

PHIL 526 Seminar in Recent Philosophy (5, max. 20) *Keyt, Marks*

PHIL 540 Seminar in Ethics (5, max. 20) *Coburn, Keyt, Richman*

PHIL 545 Seminar in the Philosophy of Art (5, max. 20) *Moore*

PHIL 550 Seminar in Epistemology (5, max. 20) *BonJour, Cohen*

PHIL 553 Seminar in Philosophy of Language (5, max. 20) Topics may vary, but emphasis on contemporary research in field. Sample topics: truth; intensionality and actuality; treatments of quantification; semantics for psychological verbs.

PHIL 556 Seminar in Metaphysics (5, max. 20) *Coburn, Cohen*

PHIL 560 Seminar in the Philosophy of Science (5, max. 20) *Clatterbaugh*

PHIL 563 Seminar in the Philosophy of Mind (5, max. 20) *Marks*

PHIL 565 Seminar in the Philosophy of History (5, max. 20) *Mish'alani*

PHIL 566 Seminar in Philosophy of the Social Sciences (5)

PHIL 567 Seminar in the Philosophy of Religion (5, max. 20) *Dietrichson*

PHIL 570 Seminar in Logic (5, max. 20)

PHIL 584 Reading in Philosophy (1-4, max. 12) AWSp Intensive reading in philosophical literature. The name of the staff member with whom research will be done *must* be indicated in registration. Prerequisite: permission of graduate program coordinator.

PHIL 586 Seminar in Indian Philosophy (5, max. 20) *Potter* Prerequisite: 412.

PHIL 587 Contemporary Analytic Philosophy (5, max. 20) *Marks, Richman*

PHIL 600 Independent Study or Research (*) AWSp Prerequisite: permission of graduate program coordinator.

PHIL 700 Master's Thesis (*) AWSp

PHIL 800 Doctoral Dissertation (*) AWSp

Physics

215 Physics

Physics is the study of the fundamental structure of matter and the interaction of its constituents, as well as the basic natural laws governing the behavior of matter.

Undergraduate Program

Bachelor of Science Degree

Admission: Recommended preparation includes four years of college preparatory mathematics, one year of physics, and one year of chemistry.

Major Requirements: (1) Core courses—PHYS 121, 122, 123, 131, 132, 133, 224, 225, 226, 321, 322, 334, 335; (2) 3 credits selected from upper-division lecture courses in modern physics; (3) 3 credits selected from upper-division physics laboratory courses; (4) 8 credits selected from approved upper-division physics courses or approved courses in cognate subjects; (5) MATH 124, 125, 126, 238, 327, 328 or MATH 134, 135, 136, 334, 335, 336; (6) MATH 205 or 302; (7) 9 credits selected from physical or biological sciences other than physics or mathematics, or from the history or philosophy of science, in addition to any courses in these fields taken to satisfy requirement (4); (8) at least 12 credits of the physics courses presented to satisfy requirements (1) through (4) shall be in physics courses numbered 300 or above taken at the University of Washington. Grades of 2.0 or better are required in all courses presented in fulfillment of requirements (1) through (4). Students who plan graduate study in physics are strongly advised to complete, in addition to courses listed in requirement (1), the following: PHYS 323, 324, 325, 328, 331, 421, 422, 423, 424, 425, 426, 431, 432, 433, and MATH 427, 428, 429.

Progress Requirement: In each academic year, every undergraduate physics major who either has completed the required 200-level courses in physics or has begun physics courses beyond the 200 level must (1) complete at least 15 credits of course work acceptable in fulfillment of the departmental degree requirements exclusive of credits earned by repeating courses in which acceptable credit has been earned previously, *or* (2) complete satisfactorily an approved part-time program of study. Students who do not satisfy the above requirement will be dropped as physics majors unless exempted explicitly by the Physics Undergraduate Affairs Committee. Students dropped for this reason may petition the committee for readmission to the major.

Graduate Program

The Department of Physics offers studies leading to the degrees of Master of Science and Doctor of Philosophy. The department has a permanent faculty of fifty-six members and a research, visiting, and cooperating faculty that normally numbers about thirty-five. About ten Ph.D. degrees in physics have been awarded annually in recent years.

Research Facilities

The department is well equipped, both in staff and facilities, for instruction and research in a discipline that emphasizes fundamental problems in understanding the physical universe. Areas of research available to the Ph.D. student include astrophysics, nuclear physics, elementary-particle physics, low-temperature and condensed-matter physics, general relativity, atomic physics, and physics education. Members of the nuclear physics group are involved in studies using the facilities of the Nuclear Physics Laboratory on campus, as well as facilities at Los Alamos, while the high-energy experimental groups are heavily engaged in experiments in the large accelerators, SLAC and Fermilab. Experimental work on atomic physics using radio-frequency spectroscopy, laser techniques, and trapping of single electrons, and condensed matter-low temperature work on thin films, matter under high pressure, and various properties of materials are under way within the physics building itself. Synchrotron radiation from facilities at SLAC and Brookhaven are being used to study molecules and solids. On the theoretical side, members of the department are concerned with problems in the theories of elementary particles and quantum fields, nuclear and high-energy reactions, phase transitions and statistical mechanics; and condensed-matter physics, atomic physics, general relativity, and astrophysics. Students in physics are encouraged to pursue appropriate interdisciplinary interests and research in applied physics with faculty members in other departments.

Departmental facilities are housed in Physics Hall and the Nuclear Physics and High-Energy Physics Laboratories. Contained therein are offices, classrooms, research and instructional laboratories; machine, glass, and electronics shops; computers; and an extensive physics branch library. The main facility at the Nuclear Physics Laboratory is a three-stage FN tandem electrostatic accelerator equipped with computers for on- and off-line data analysis and with a variety of special ion sources and detection apparatus.

Master of Science, Doctor of Philosophy Degrees

Admission Requirements: Undergraduate preparation to include upper-division courses in mechanics; electricity and magnetism; statistical physics and thermodynamics; modern physics, including an introduction to quantum mechanics; and advanced laboratory work. Preparation in mathematics to include vector analysis, complex variables, ordinary differential equations, Fourier analysis, boundary-value problems, and special functions. Admissibility is determined by the applicant's undergraduate program, undergraduate grades, Graduate Record Examination aptitude and advanced physics scores, letters of recommendation, and a statement of educational and professional objectives. In recent years, the advanced physics scores for entering students have averaged about 790. Students admitted without an advanced physics Graduate Record Examination score or with a score below 750 are expected to obtain a score of 750 or above before being allowed to take the qualifying examination.

Graduation Requirements: Department requirements include standard Graduate School requirements. In addition, 3 credits must be in PHYS 600 and at least 12 other credits in physics graduate courses. A final examination is required. A thesis or foreign-language study is not required.

Master of Science Degree (Applications of Physics)

Admission Requirements: This option is designed for students who are currently employed and whose backgrounds are in physical science, engineering, or mathematics. Admission is based on course grades in physics and related fields, adequacy of preparation in physics, and interest in areas of specialization offered in the physics department.

Graduation Requirements: In addition to the standard Graduate School requirements, students are expected to complete the sequence of core courses PHYS 441, 541, and 543 and to select appropriate specialized courses. Students are expected to undertake an independent study project in consultation with a faculty member. This project may be carried out at the University or at the student's place of employment. Students must take at least 3 credits of PHYS 600 and at least 12 in other physics graduate courses. A final examination is required. A thesis or foreign-language study is not required.

Doctor of Philosophy Degree

Graduation Requirements: The student is expected to obtain, here or elsewhere, a background in physics equivalent to that contained in the following sequences of basic graduate courses: PHYS 505, 506; 513, 514, 515; 517, 518, 519, 520; and 524, 525; and in specialized courses appropriate to each student's interests. The student is required to pass, successively, a written qualifying examination (in the autumn of the second year), an oral General Examination for admission to candidacy, and an oral Final Examination. In order to take the General Examination, the student must have been accepted by a graduate faculty member as a research student and have completed the graduate studies outlined above. This examination covers the area in which the dissertation research is planned. Teaching experience is required of all candidates. Foreign-language study is not required.

Financial Aid

Most of the 116 graduate students are supported by fellowships and assistantships. Application for these should be made along with the application for admission.

Faculty

Chairperson

David Bodansky

Professors

Adelberger, Eric G.,* Ph.D., 1967, California Institute of Technology; experimental nuclear physics.

Arons, Arnold B. (Emeritus), Ph.D., 1943, Harvard; physical oceanography, physics education.

Baker, Marshall,* (Applied Mathematics), Ph.D., 1958, Harvard; field theory, theoretical elementary-particle physics.

Bardeen, James M.,* Ph.D., 1965, California Institute of Technology; general relativity, theoretical astrophysics.

Bodansky, David,* Ph.D., 1950, Harvard; experimental nuclear physics.

Boulware, David G.,* Ph.D., 1962, Harvard; field theory, theoretical elementary-particle physics, general relativity.

Boynton, Paul E.,* (Astronomy),† Ph.D., 1967, Princeton; high-energy astrophysics, astronomy.

Brown, Lowell S.,* Ph.D., 1961, Harvard; field theory, theoretical elementary-particle physics.

Clark, Kenneth C.,* (Geophysics),† Ph.D., 1947, Harvard; optical spectroscopy, upper atmosphere.

Cook, Victor,* Ph.D., 1962, California (Berkeley); experimental high-energy physics.

Cramer, John G., Jr.,* Ph.D., 1961, Rice; experimental nuclear physics.

Dash, J. Gregory,* Ph.D., 1951, Columbia; low-temperature condensed-matter physics.

Dehmelt, Hans G.,* Ph.D., 1950, Goettingen; radio-frequency spectroscopy.

Fain, Samuel C.,* Ph.D., 1969, Illinois; experimental condensed-matter physics, surface physics.

Farwell, George W.,* Ph.D., 1948, Chicago; experimental nuclear physics.

Fortson, E. Norval,* Ph.D., 1963, Harvard; radio-frequency spectroscopy, experimental atomic physics.

Geballe, Ronald,* Ph.D., 1943, California (Berkeley); atomic and molecular collisions.

Gerhart, James B.,* Ph.D., 1954, Princeton; experimental nuclear physics, physics education.

Halpern, Isaac,* Ph.D., 1948, Massachusetts Institute of Technology; experimental nuclear physics.

Henderson, Joseph E. (Emeritus), Ph.D., 1928, Yale; physics.

Henley, Ernest M.,* Ph.D., 1952, California (Berkeley); theoretical nuclear physics, theoretical elementary-particle physics.

Ingalls, Robert L.,* Ph.D., 1962, Carnegie Institute of Technology; experimental condensed-matter physics.

Lord, Jere J.,* Ph.D., 1950, Chicago; cosmic rays, experimental elementary-particle physics.

Lubatti, Henry J.,* Ph.D., 1966, California (Berkeley); experimental elementary-particle physics.

Margon, Bruce,*‡ (Astronomy), Ph.D., 1973, California (Berkeley); x-ray astronomy, counterparts of x-ray sources.

McDermott, Lillian C.,* Ph.D., 1959, Columbia; physics education.

McDermott, Mark N.,* Ph.D., 1959, Columbia; radio-frequency spectroscopy.

Mockett, Paul M.* (Research), Ph.D., 1965, Massachusetts Institute of Technology; experimental elementary-particle physics.

Neddermeyer, Seth H. (Emeritus), Ph.D., 1935, California Institute of Technology; physics.

Parks, George K.,*‡ (Geophysics), Ph.D., 1966, California (Berkeley); particles and waves in auroral, magnetospheric, and interplanetary space plasma phenomena.

Peierls, Sir Rudolf E. (Emeritus), Ph.D., 1929, Leipzig; physics.

Peters, Philip C.,* Ph.D., 1964, California Institute of Technology; general relativity, theoretical astrophysics.

Puff, Robert D.,* Ph.D., 1960, Harvard; many-body theory, statistical physics.

Riedel, Eberhard K.,* Ph.D., 1966, Munich Technical (Germany); theoretical condensed-matter physics.

Rothberg, Joseph E.,* Ph.D., 1963, Columbia; experimental high-energy physics.

Schick, Michael,* Ph.D., 1967, Stanford; theoretical condensed-matter physics.

Schmidt, Fred H.,* Ph.D., 1945, California (Berkeley); experimental nuclear physics.

Snover, Kurt A.* (Research), Ph.D., 1969, Stanford; experimental nuclear physics.

Stern, Edward A.,* Ph.D., 1955, California Institute of Technology; experimental condensed-matter physics.

Streib, John F. (Emeritus), Ph.D., 1942, California Institute of Technology; physics.

Thouless, David J.,* Ph.D., 1958, Cornell; theoretical condensed-matter physics.

Uehling, Edwin A. (Emeritus), Ph.D., 1932, Michigan; physics.

Vandenbosch, Robert,*‡ (Chemistry), Ph.D., 1957, California (Berkeley); nuclear studies and spectroscopy.

Vilches, Oscar E.,* Doctor en Fisica, 1966, Univ. Nac. de Cuyo (Argentina); low-temperature condensed-matter physics.

Vlases, George C.,*‡ (Nuclear Engineering), Ph.D., 1962, California Institute of Technology; nuclear engineering.

Weitkamp, William G.* (Research), Ph.D., 1965, Wisconsin; experimental nuclear physics.

Wilets, Lawrence,* Ph.D., 1952, Princeton; theoretical nuclear and atomic physics.

Williams, Robert W.,* Ph.D., 1948, Massachusetts Institute of Technology; experimental high-energy physics, cosmic rays.

Young, Kenneth K.,* Ph.D., 1965, Pennsylvania; experimental high-energy physics.

Zee, Anthony,* Ph.D., 1970, Harvard; theoretical elementary-particle physics.

Associate Professors

Burnett, Thompson H.,* Ph.D., 1968, California (San Diego); experimental elementary-particle physics.

Chaloupka, Vladimir,* Ph.D., 1975, Geneva (Switzerland); experimental elementary-particle physics.

Ellis, Stephen D.,* Ph.D., 1971, California Institute of Technology; theoretical elementary-particle physics.

Engel, Thomas,*‡ (Chemistry), Ph.D., 1969, Chicago; surface chemistry and catalysis.

Haxton, Wick, Ph.D., 1975, Stanford; theoretical nuclear physics.

McLerran, Larry D.,* Ph.D., 1975, Washington; theoretical elementary-particle physics.

Miller Gerald A.,* Ph.D., 1972, Massachusetts Institute of Technology; theoretical nuclear physics.

Rehr, John J.,* Ph.D., 1972, Cornell; theoretical condensed-matter physics.

Rutherfoord, John P.* (Research), Ph.D., 1968, Cornell; experimental high-energy physics.

Trainor, Thomas A.* (Research), Ph.D., 1973, North Carolina; experimental nuclear physics.

Van Dyck, Robert S., Jr.,* Ph.D., 1971, California (Berkeley); experimental atomic physics.

Assistant Professors

Barr, Stephen M.* (Research), Ph.D., 1978, Princeton; theoretical elementary-particle physics.

den Nijs, Marcel,* Ph.D., 1979, Katholieke University (Netherlands); theoretical condensed-matter physics.

Gabrielse, Gerald* (Research), Ph.D., 1978, Chicago; experimental atomic physics.

Heckel, Blayne,* Ph.D., 1981, Harvard; experimental atomic physics.

Holzworth, Robert,*‡ (Geophysics), Ph.D., 1977, California (Berkeley).

Lazzarini, Albert J.* (Research), Ph.D., 1978, Massachusetts Institute of Technology; experimental nuclear physics.

Nagoumey, Warren* (Research), Ph.D., 1972, Columbia; experimental atomic physics.

Sorensen, Larry B.,* Ph.D, 1979, Illinois; experimental condensed-matter physics.

Course Descriptions

Courses for Undergraduates

PHYS 101-102, 103 Introductory Physics (5-5,5) A,W,Sp Basic concepts of physics presented in a laboratory setting. Useful for students whose high school preparation in science is weak and who plan to take standard college science courses. Also provides background needed by teachers for effective use of science curriculum materials in the schools. Prerequisites: 101- for -102; -102 for 103.

PHYS 104 Introduction to Mechanics (3) Problem-solving techniques applicable to elementary Newtonian mechanics. Prerequisite: concurrent registration in 103.

PHYS 110, 111, 112 Liberal Arts Physics (5,5,5) AS, W,Sp Basic concepts of physics presented with emphasis on their origin and their impact on society and the Western intellectual tradition. Primarily for students in the arts, humanities, and social sciences. Also useful in lieu of high school physics. Prerequisites: 110 for 111; 111 for 112.

PHYS 114, 115, 116 General Physics (4,4,4) AWSpS, AWSpS,AWSpS Basic principles of physics presented without use of college-level mathematics. Suitable for students majoring in technically oriented fields other than engineering or the physical sciences. Concurrent registration in 117, 118, 119 strongly recommended. 114: mechanics and sound. 115: heat and electromagnetism. 116: light and modern physics. Prerequisites: working knowledge of algebra and trigonometry, one year of high school physics or one quarter of college-level physical science; 114 for 115; 115 for 116.

Credit is not given for both 114 and 121, 115 and 122, 116 and 123, 117 and 131, 118 and 132, 119 and 133.

PHYS 117, 118, 119 General Physics Laboratory (1,1,1) AWSpS,AWSpS,AWSpS 117: mechanics laboratory, to be taken concurrently with 114. 118: heat and electromagnetism laboratory, to be taken concurrently with 115. 119: sound, light, and modern physics laboratory, to be taken concurrently with 116.

The courses 121, 122, 123, 224, 225 plus appropriate laboratory together make up the general physics sequence for science and engineering students.

PHYS 121 Mechanics (4) AWSpS Basic principles of mechanics. Concurrent registration in 131 strongly recommended. Prerequisites: one year of high school physics or permission of academic adviser, concurrent or previous MATH 124 or 134.

PHYS 122 Electromagnetism and Oscillatory Motion (4) AWSpS Basic principles of electromagnetism, the mechanics of oscillatory motion. Concurrent registration in 132 strongly recommended. Prerequisites: 121, concurrent or previous MATH 125 or 135.

PHYS 123 Waves (4) AWSpS Electromagnetic waves, optics, and waves in matter. Concurrent registration in 133 strongly recommended. Prerequisites: 122, concurrent or previous MATH 126 or 136.

PHYS 131, 132, 133 Experimental Physics (1,1,1) Experimental topics in physics for science and engineering majors. Prerequisites: concurrent or previous enrollment in 121 for 131; 122 for 132; 123 for 133.

PHYS 205 Concepts of Physical Science (3) The nature, origin, and use of selected concepts of the physical sciences.

PHYS 207 The Physics of Music (3) The nature of sound; vibrations; traveling and standing waves; response of the ear to sound; production of musical sounds.

PHYS 210, 211, 212 Intermediate Physics for Teachers and Students in Liberal Arts (5,5,5) A,W,Sp Individualized study of selected topics emphasizing depth of understanding and development of skills essential to the scientific process. Useful as background for teaching physical sciences. Prerequisites: at least two quarters of physics at the 100 level; 210 strongly recommended prior to 211.

PHYS 214 Light and Color (3) A Compares past explanation of certain familiar natural phenomena with present understandings. Lamps and lighting,outdoor light, optical devices, color vision, perspective, paints, and pigments. Quantitative comparison critical to the course, but college-level mathematics background not required. Intended for nonscience students.

PHYS 215 Order and Disorder (3) W *Halpern* Includes symmetry in biological systems and in inanimate nature, relation of structure to size, and micro- and macrostructure of universe, systems in chaos. Quantitative comparison critical to course, but college-level mathematics background not required. 214, 215, 216 may be taken independently or in any order. Intended for nonscience students.

PHYS 216 Time and Change (3) Sp *Halpern* Includes miracles and magic, how and why things move, basic forces in nature, quantum mechanics, relativity, past and future of the universe. Quantitative comparison critical to course, but college-level mathematics background not required. 214, 215, 216 may be taken independently or in any order. Intended for nonscience students.

PHYS 224 Thermal Physics (3) Introduction to heat, thermodynamics, elementary kinetic theory, and the physics of continuous media. Prerequisites: 122 and MATH 126, which may be taken concurrently.

PHYS 225 Modern Physics (3) AWSpS Special theory of relativity; phenomena of modern physics with emphasis on photons, electrons, and atoms; introduction to quantum physics. Prerequisites: 123, concurrent or previous MATH 126 or 136.

PHYS 226 Elementary Mathematical Physics (3) Sp Applications of mathematics to physics, particularly as illustrated by classical mechanics. Prerequisites: 123 and MATH 238.

PHYS 321, 322, 323 Electromagnetism (3,3,3) A,W,Sp Charges at rest and in motion; dielectric and magnetic media; electromagnetic waves; relativity and electromagnetism; physical optics. Prerequisites: 123, MATH 328, which may be taken concurrently, for 321; 321 for 322; 322 for 323.

PHYS 324, 325 Quantum Mechanics (3,3) A,W Introduction to nonrelativistic quantum mechanics. Prerequisites: 225, MATH 327 for 324; 324 for 325. MATH 205 or 302 recommended.

PHYS 327 Introduction to Nuclear Physics (3) Nuclear structure, including nuclear reactions, fission, particle accelerators, and nuclear instrumentation; applications of nuclear phenomena in atomic energy and astrophysics. Not open for credit to students who have completed 422. Prerequisite: 225 or permission of instructor.

PHYS 328 Statistical Physics (3) Sp Elements of statistical mechanics and their applications. Prerequisites: 224, 225, 226, 324 or a similar introduction to quantum mechanics; MATH 327.

PHYS 331 Optics Laboratory (3) Sp Optical and spectroscopic measurements. Prerequisite: 323 (preferably concurrent).

PHYS 334, 335 Electric Circuits Laboratory (3,3) W,Sp Basic elements of DC, AC, and transient circuits; electronic devices; electrical measurements. Prerequisites: 123, MATH 126 or 136 for 334; 334 for 335.

PHYS 401, 402, 403 Special Problems (*,*,*) Supervised individual study.

PHYS 405-406 Physical Science for Teachers (2, max. 6)-(2, max. 6) AWSpS,AWSpS Basic concepts of physical sciences providing background for teaching modern elementary school curricula. Primarily for NSF Institute participants. Prerequisite: permission of instructor.

PHYS 407, 408, 409 Physics for Teachers (5,5,5) Individualized study of selected topics in basic physics with emphasis on depth of understanding and development of skills essential to the scientific process. Background for teaching physics at secondary school and introductory college levels. Prerequisite: permission of instructor. 407 strongly recommended to be taken prior to 408.

PHYS 410 Physical Science for In-service Teachers (1-2, max. 10) A "hands-on" inquiry-oriented course designed to train in-service teachers in the use of the physical science content of any of several science programs that might be selected by a school or school district. Prerequisite: in-service teacher in cooperating school district.

PHYS 411, 412, 413 Physical Science for Lead Teachers (1-4, max. 4; 1-4, max. 4; 1-4, max. 4) For preservice and in-service teachers. Extends the physical science content covered in previous courses and helps prepare lead teachers to train their colleagues in the use of the physical science content of any of several science programs that might be selected by a school or school district. Prerequisite: 101-102 or 400 or 405-406.

PHYS 421 Atomic and Molecular Physics (3) A Survey of the principal phenomena of atomic and molecular physics. Prerequisites: 323 and 325, or permission of instructor.

PHYS 422 Nuclear and Elementary-Particle Physics (3) W Survey of the principal phenomena of nuclear and elementary-particle physics. Not open for credit to students who have completed 327. Prerequisites: 323 and 325, or permission of instructor.

PHYS 423 Solid-State Physics (3) Sp Survey of the principal phenomena of solid-state physics. Prerequisites: 323 and 325, or permission of instructor.

PHYS 424, 425, 426 Mathematical Physics (3,3,3) A,W,Sp 424: advanced classical mechanics. Prerequisites: 323 and 325, or permission. 425, 426: mathematical techniques of particular use in physics, including partial differential equations. Prerequisites: 323 and 325, or permission of instructor for 425; 425 for 426.

PHYS 427 Applications of Physics (1-3, max. 12) Current applications of physics to problems in the sciences and technology.

PHYS 428 Selected Topics in Physics (1-3, max. 12)

PHYS 431, 432, 433 Modern Physics Laboratory (3,3,3) A,W,Sp 431, 432: measurement in modern atomic, molecular, and solid-state physics. Prerequisite: 30 credits in physics or permission. 433: techniques in nuclear and elementary-particle research. Prerequisite: 327 or 422, or permission of instructor.

PHYS 434 Application of Computers to Physical Measurement (3) Laboratory giving specific instruction and experience in interfacing a minicomputer to laboratory equipment. Prerequisite: junior standing or permission of instructor.

PHYS 441 Quantum Physics (4) A Methods of quantum mechanics and applications to physical systems. Examples from such fields as atomic and molecular systems, atomic collisions, nuclear physics, solid-state physics. Students are helped to make up deficiencies in physics background and mathematics proficiency. Typical preparation: 30 credits in physical science or engineering.

PHYS 485, 486, 487 Senior Honors Seminar (1,1,1) A,W,Sp

Courses for Graduates Only

PHYS 505, 506 Mathematical Methods of Physics (3,3) A,W Mathematical techniques discussed in the context of the physics problems where they arise. Differential and integral equations with boundary conditions applied to the conduction and diffusion, hydrodynamics, acoustics, classical and quantum mechanics.

PHYS 507 Physical Applications of Group Theory (3) Applications of finite and continuous groups, representation theory, symmetry, and conservation laws to physical systems.

PHYS 513, 514, 515 Electromagnetism and Relativity (4,4,4) A,W,Sp Properties of electric and magnetic fields in free space and material media; boundary-value problems; radiation from accelerated charges and electromagnetic waves; the theory of special relativity leading to a relativistic formulation of electromagnetism and particle dynamics.

PHYS 517, 518, 519 Quantum Mechanics (4,4,4) A,W,Sp The uncertainty principle and the interpretation of quantum mechanics; solutions of the Schrodinger equation in three dimensions; Dirac notation and matrix formulation; angular momentum; Wigner-Eckart theorem; elementary collision theory; density matrix; approximation methods; atomic structure; semiclassical radiation theory; introduction to group theory and symmetry.

PHYS 520 Advanced Quantum Mechanics (4) A Second quantization; applications to the many-body problem; Dirac equation; Klein-Gordon equation; radiation theory; elementary meson theory. Prerequisite: 519.

PHYS 524, 525 Thermodynamics and Statistical Mechanics (3,3) A,W Statistical mechanical basis for the fundamental thermodynamical laws and concepts; applications of thermodynamic reasoning to selected physical problems; classical statistical distribution functions; quantum statistical mechanics; introduction to equilibrium many-body problems. Prerequisite: 517, which may be taken concurrently.

PHYS 527, 528 Current Problems in Physics (1,1) Introduction to current research topics for beginning graduate students.

PHYS 530 Physics Colloquium (*)

PHYS 531 Seminar in High-Energy Physics (*)

PHYS 532 Seminar in Atomic Collisions and Spectroscopy (*)

PHYS 533 Seminar in Relativistic Astrophysics (*)

PHYS 534 Seminar in Coherent Spectroscopy (*)

PHYS 535 Seminar in Nuclear Physics (*)

PHYS 536 Seminar in Low-Temperature and Solid-State Physics (*)

PHYS 537 Seminar in Theoretical Physics (*)

PHYS 538 Seminar in Cosmic Ray Physics (*)

PHYS 539 Seminar in Problems of Physics Education (*)

PHYS 541 Applications of Quantum Physics (4) Sp Techniques of quantum mechanics applied to lasers, quantum electronics, solids, and surfaces. Emphasis on approximation methods and interaction of electromagnetic radiation with matter. Prerequisite: 421 or 441 or equivalent.

PHYS 542 Numerical Methods in Physics (4) Numerical methods for analysis and computation in physics. Topics include: interpolation, approximation, integration, differential and difference equations, transcendental equations, optimization. Emphasis on physical applications, eigenvalue and scattering problems, modeling.

PHYS 543 Electromagnetic Waves (4) Principal concepts of electromagnetism and classical mechanics. Boundary-value problems. Electromagnetic waves with applications in materials, optics, wave guides. Special relativity and electromagnetism. Prerequisite: 30 credits in physical sciences or engineering.

PHYS 544 Electromagnetic Theory and Plasma Physics (4) Review of electromagnetic theory in terms of Maxwell's equations. Basic fluid mechanics and kinetic theory. Magnetohydrodynamics and plasma physics with the aim of providing an understanding of the principles underlying fusion reactors and other applications.

PHYS 545 Contemporary Optics (4) Coordinated lecture and laboratory treatment of topics in contemporary optics. Subjects include Fourier optics, lens systems, interferometry, laser optics, holography, polarization, crystal optics, birefringence, laser and conventional light sources, optical detectors. Prerequisite: 543 or equivalent.

PHYS 546 Condensed-Matter Physics (4) Experimental techniques for investigating surface geometrical and electronic structure, surface composition, and surface thermodynamics. Auger electron spectroscopy, photo-electron spectroscopy, low-energy electron diffraction, ion sputtering. Prerequisite: 441 or equivalent.

PHYS 547 Electronics for Physics Research (4) Electronic techniques as applied in physics research. Topics include noise, control-system analysis, operational amplifiers, lock-in amplifiers, precision power supplies and metering, data transmission, microprocessors. Several integrated measurement systems are examined in the context of specific research problems. Prerequisite: elementary electronics.

PHYS 548 Nuclear Instrumentation (4) Techniques of nuclear particle detection and radiation detection; position detection; signal preparation and amplification; signal transmission and termination; noise suppression; pulse height discrimination; analog signal processing; fast logic; fast and slow timing; time-to-amplitude conversion; pile-up rejection; singles pulse height analysis; multiparameter pulse height analysis; computer-based data collection; interfacing. Prerequisites: 334 and 335 or equivalent courses.

PHYS 549 Low-Temperature Physics and Cryogenics (4) Condensed-matter physics at low and ultralow temperatures. Production of low temperatures; liquefaction of gases, dilution refrigeration, magnetic and compressional cooling. Macroscopic quantum effects: superconductivity, superfluidity. Applications of superconductors. The ultralow temperature frontier.

PHYS 550, 551 Atomic Physics (3,3) Theory of atomic structure and spectra; atomic and molecular beams; resonance techniques; atomic collisions; topics of current interest. Prerequisite: 519.

PHYS 552 Introduction to Cosmic Ray Physics (3) The nature and cosmological significance of cosmic ray photons and particles. The motion and confinement of particles in the geophysical, interplanetary, and interstellar medium. Theories of the processes involved in the high-energy interaction of cosmic rays, including shower theory. Methods of measurement and current problems. Prerequisite: introductory quantum mechanics.

PHYS 557, 558, 559 High Energy Physics (3,3,3) High-energy kinematics; phenomenonology of high-energy collisions. Second quarter is devoted to strong interactions, and the third quarter discusses weak interactions. Experimental results are emphasized. Prerequisite: 519.

PHYS 560, 561, 562 Theoretical Nuclear Physics (3,3,3) Nuclear structure, scattering, reactions, and decays in terms of elementary properties of nucleons and current theoretical models. Prerequisite: 519.

PHYS 564, 565 General Relativity (3,3) General covariance and tensor analysis, the relativistic theory of gravitation as given by Einstein's field equations, experimental tests and their significance, and applications of general relativity, particularly in the areas of astrophysics and cosmology. Prerequisite: 515.

PHYS 567, 568, 569 Theory of Solids (3,3,3) A,W,Sp A three-quarter course covering the fundamentals of solid-state physics. Various topics in solid-state physics are covered in considerable detail, bringing knowledge up to the current literature. Prerequisite: 519.

PHYS 570, 571 Quantum Field Theory (3,3) Emphasis varies in different years between relativistic quantum field theory and the many-body problem. Prerequisite: 520.

PHYS 576 Selected Topics in Experimental Physics (*)

PHYS 578 Selected Topics in Theoretical Physics (*)

PHYS 580 Laser Physics (4) Physics underlying laser design and operation in the context of common laboratory systems. Topics may include continuous and pulsed lasers; solid, liquid, and gas gain media; Q-switching, mode-locking, resonator theory, nonlinear optics, and others. Prerequisites: basic quantum mechanics, electromagnetism, and optics; recommended: 541.

PHYS 581 Fluid Mechanics (4) Mechanics of ideal and viscous fluids. Topics may include turbulence, thermal conduction and diffusion, shock waves, and others.

PHYS 600 Independent Study or Research (*) Study or research under the supervision of individual faculty members. Prerequisite: permission of supervisor.

PHYS 800 Doctoral Dissertation (*) Prerequisite: permission of Supervisory Committee chairperson.

Political Science

101 Gowen

Students of political science examine the theory and practice of government and politics. They acquire knowledge of political institutions and processes and learn to think critically about public policies and their consequences. They learn how to evaluate individual, group, and mass behavior in political settings. Because of their understanding and interest in political systems, students who major in political science enter such career fields as government service, law, journalism, politics, public policy analysis, and the teaching of political or social science.

Undergraduate Program

Students begin their concentration by choosing three basic courses that define the discipline and its major areas of specialization, then advance to more specialized study in their fields of interest. Knowledge of a foreign language is strongly encouraged for students interested in international and comparative politics. A background of statistics is recommended for students concentrating in American politics.

Major Requirements: 50 credits in political science, including (1) 15 credits from POL S 101, 201, 202, 203, 204, or 205; (2) 35 credits from three of five fields: political theory, comparative politics, international relations, American politics, and research methods. Majors must maintain a 2.25 cumulative grade-point average in political science. Transfer and fifth year students must meet all major requirements and complete a minimum of 10 upper-division graded credits in political science at this university.

Political Economy Option. The department also offers a political economy focus, a specialized program of study that combines political science and economics. Students choosing this option major in political science but receive a certificate from the department indicating the special focus. 50 required credits in political science. Selection of course work as follows: (1) 15 credits in POL S 270, 370 and ECON 200; (2) 20 credits from POL S 406, 409, 416, ECON 201 and 306; (3) remaining credits chosen from a list available in political science advising. (Economics courses do not count toward the 50 political science credits).

Internships. Undergraduate students are encouraged to acquire professional experience through internships in local agencies (POL S 496), in the state legislature during Winter Quarter (POL S 497), or in Washington, D.C. (POL S 498). Students in any major may apply for the Washington Center program which places students in Washington, D.C., every quarter.

Graduate Program

Programs of study are offered leading to both Master of Arts and Doctor of Philosophy degrees. The M.A. program is made flexible in order to serve the needs both of students who are intending to go on to the Ph.D. and of students with more immediate goals. Approximately two-thirds of the program is made discretionary. M.A. aspirants must submit an essay of distinction and pass comprehensive oral examinations in three fields. Two of these fields must be chosen from four general fields: political theory, international relations, comparative politics, and American politics. The third field may be chosen from outside the discipline of political science or may be tailored to the specialized needs of the student. The M.A. degree requires the completion of 46 credits, of which 23 must be at the 500 level or above. One course in quantitative political analysis is required.

The Ph.D. program is built around the four general fields, with each student required to select at least two of these fields. Two additional fields may be selected from more specialized offerings within the department or from outside the discipline. Comprehensive written examinations must be completed in each of the four fields, and a dissertation must be defended in a final Oral Examination. One course in the philosophy of political research or a two-quarter research practicum is required. Foreign-language study is not required. The Ph.D. degree requires the completion of a total of 124 graduate credits, of which at least 58 must be at the 500 level or above. 36 credits are allowed for the dissertation.

The department has long been outstanding in comparative and international politics, especially in the study of Asian political phenomena. Recently, the department has augmented its faculty strength in American politics, political economy, public policy, and methodology. Students may also work with other campus units, such as the Institute for Marine Studies, the Graduate School of Public Affairs, the Henry M. Jackson School of International Studies, the Institute for Environmental Studies, and the School of Law. Joint degree programs may be arranged.

Research Facilities

The University library system, the largest research library in the Pacific Northwest, has a collection of more than two million volumes, with specialized collections for the Pacific Northwest, Near East, South Asia, and Slavic and East European areas. A separate Political Science library serves the specialized needs of the department. Interactive and batch-processing computing is available through several large computers. Specialized access to these facilities and access to extensive data holdings are available through the Center for Social Science Computation and Research. The department's own Political Science Psychology Laboratory and Treaty Research Center offer unique computing research and training opportunities. The University is a member of the Inter-University Consortium for Political and Social Research.

Admission and Financial Aid

Admission and financial aid decisions are based on the applicant's academic transcript, Graduate Record Examination scores, three letters of reference, and a statement of purpose. Foreign students are required to submit TOEFL scores. Students are admitted Autumn, Winter, and Spring quarters. Application deadlines are: April 1, Autumn Quarter; October 15, Winter Quarter; and January 15, Spring Quarter.

Two types of financial assistance are available. Several J. Allen Smith fellowships in political science are awarded annually to outstanding first-year students. Teaching and research assistantships, which may include residency status, are also available to qualified students. Applications for financial aid are due by February 15.

Correspondence and Information

Graduate Program Coordinator
101 Gowen, DO-30

Faculty

Chairperson

David J. Olson

Professors

Bennett, Lance W.,* Ph.D., 1974, Yale; American politics, political psychology.

Blalock, Hubert M.,*‡ (Sociology), Ph.D., 1954, North Carolina; methodology.

Bone, Hugh A. (Emeritus), Ph.D., 1937, Northwestern; American government and politics.

Brass, Paul R.,* (International Studies),† Ph.D., 1964, Chicago; comparative government, international relations.

Cassinelli, C. W.,* Ph.D., 1953, Harvard; comparative government (Latin America).

Cole, Kenneth C. (Emeritus), Ph.D., 1930, Harvard; political science.

Gerberding, William P., Ph.D., 1959, Chicago; political science.

Gore, William J.,* Ph.D., 1952, Southern California; public policy, public administration.

Hellmann, Donald C.,* (International Studies),† Ph.D., 1964, California (Berkeley); comparative government, international relations.

Hitchner, Dell G. (Emeritus), Ph.D., 1940, Wisconsin; political science.

Kroll, Morton,* (Public Affairs),† Ph.D., 1952, California (Los Angeles); comparative administration, public policy.

Lev, Daniel S.,* Ph.D., 1964, Cornell; comparative politics (Southeast Asia).

Lujan, Herman D.,* Ph.D., 1964, Idaho; American government and politics, public administration.

Lyden, Fremont J.,*‡ (Public Affairs), Ph.D., 1960, Washington; public policy and administration.

Matthews, Donald R.,* Ph.D., 1953, Princeton; American government and politics.

McCrone, Donald J.,* Ph.D., 1966, North Carolina; American politics, political economy.

Migdal, Joel S.,‡ (International Studies), Ph.D., 1972, Harvard; international political economy.

Modelski, George,* Ph.D., 1954, London; international relations, international political economy.

Olson, David J.,* Ph.D., 1971, Wisconsin; American government and politics.

Ottenberg, Simon,*‡ (Anthropology), Ph.D., 1957, Northwestern; comparative politics (Africa), political theory and methodology.

Reshetar, John S.,* Ph.D., 1950, Harvard; comparative government (Soviet Union), international relations.

Scheingold,Stuart A.,* Ph.D., 1963, California (Berkeley); American politics (public law).

Shipman, George A. (Emeritus), Ph.D., 1931, Cornell; political science.

Townsend, James R.,* (International Studies),† Ph.D., 1965, California (Berkeley); comparative government (China), politics of development.

Webster, Donald H. (Emeritus), Ph.D., 1933, Washington; political science.

Associate Professors

Cumings, Bruce G.,*‡ (International Studies), Ph.D., 1975, Columbia; comparative politics (Asia).

Elmore, Richard F.,‡ (Public Affairs), Ph.D., 1976, Harvard; public program and policy analysis, decision making.

Gottfried, Alex (Emeritus), Ph.D., 1952, Chicago; American government and politics.

Hartsock, Nancy C. M., (Women Studies),† Ph.D., 1972, Chicago; political theory, philosophy of feminism, feminist theory.

Horowitz, Ruth L.,* Ph.D., 1972, Washington (St. Louis); political theory and methodology.

Lee, Kai N.,* (Environmental Studies),† Ph.D., 1971, Princeton; American government and politics, political economy.

Levi, Margaret A.,* Ph.D., 1974, Harvard; American government and politics, political economy.

Perry, Elizabeth J.,*‡ (International Studies), Ph.D., 1978, Michigan; comparative politics (China and Japan), political theory.

Pool, Jonathan R.,* Ph.D., 1971, Chicago; comparative government, methodology, political economy, political psychology.

Riley, Walter L. (Emeritus), Ph.D., 1957, Washington; political science.

Rohn, Peter H.,* Ph.D., 1958, Washington; international relations, international law.

Assistant Professors

Keeler, John T. S.,* Ph.D., 1978, Harvard; comparative government (Western Europe), international relations.

May, Peter J.,* (Public Affairs),† Ph.D., 1979, California (Berkeley); public policy, political economy, methodology.

McCann, Michael, Ph.D., 1983, California (Berkeley); American government and politics, public law, political theory.

Peretz, Paul, Ph.D., 1978, Chicago; American politics and government; political economy.

Sheikholeslami, A. Reza, Ph.D., 1976, California (Los Angeles); comparative government.

Lecturer

Chandler, Trevor L., Ph.D., 1970, Oregon; American government and politics, minority politics.

Course Descriptions

Most upper-division courses (300- and 400-level) do not require prerequisites. However, because these courses generally offer more advanced subject matter, they are recommended for juniors and seniors. Interested freshmen or sophomores who wish to enroll in upper-division courses may do so, but they should consult with the instructor or the departmental adviser first.

Courses for Undergraduates

POL S 101 Introduction to Politics (5) AWSpS Political problems that affect our lives and shape the world around us. Recommended for nonmajors, for students who are thinking about political science as a major, and for political science majors who haven't decided on an area of specialization.

POL S 201 Introduction to Political Theory (5) Philosophical bases of politics and political activity. Provides an introduction to the study of politics by the reading of a few books in political philosophy. Organized around several key political concepts, such as liberty, equality, justice, authority, rights, and citizenship.

POL S 202 Introduction to American Politics (5) AWSpS Institutions and politics in the American political system. Ways of thinking about how significant problems, crises, and conflicts of American society are resolved politically.

POL S 203 Introduction to International Relations (5) AWSp The world community, its politics, and government.

POL S 204 Introduction to Comparative Politics (5) Political systems in a comparative framework. Traditional and contemporary approaches to the study of governments and societies in different countries.

POL S 205 Introduction to Quantitative Political Analysis (5) Skills of analytical reasoning and scientific methods applied to social problems. Reading graphs and tables, discovering fallacies in arguments, evaluating the evidence for an assertion, and determining which of several decisions would be optimal. Students learn to do elementary operations on a computer.

POL S 210 Ethnic Minorities and American Politics (5) Ethnic groups in American politics; minorities in urban society; sources of tension and frustration; historical relationship of minorities to the political process; protest as political activity; urban services and urban politics; the effect of national politics and policies on urban minorities. Each quarter focuses on one minority group.

POL S 211 The Future of American Minorities (5) Alternatives open to different minority groups in the United States; their development and place in American politics, the possibilities of community formation, integration, separatism, competitive economic structures, coalitions, etc. Prerequisite: 210 or permission of instructor.

POL S 270 Introduction to Political Economy (5) *Levi, McCrone, Peretz* Political economy as a tool for understanding and evaluating the political world. Combines theory, methods, and insights derived from economics and political science and applies them to a range of substantive issues.

POL S 300 Practical Political Research (5) Techniques for research and report writing in practical politics (e.g., election campaigns, public interest groups, government agencies, political analyses for business). Supervised group research in the computer analysis of current political data. For a sequence in political statistics, students may also take 205 and/or 490.

POL S 301 Special Topics in Political Theory (5, max. 10) *Horowitz, McCann* Selected contemporary political issues. Political principles as reflected in concrete political problems. Topics might include: women's rights, civil disobedience, national health care, affirmative action, environmental protection, privacy, human rights, and redistribution of property. Recommended: Introductory course in political science at the 100 or 200 level.

POL S 302 Field Experience in Politics (5, max. 10) Analysis of political theory and of methods of political research, combined with extensive field research in contemporary problems of government and politics experienced by people of the Seattle community.

POL S 303 Public Policy Formation in the United States (5) *Lujan, May* Policy decision making with emphasis on: how issues arise, the way they become part of the policy agenda of the executive and the legislature, how these institutions organize to handle policy issues, and the roles of the legislature, the executive, and the bureaucracy. Public policy literature and familiarization with key aspects of policy decision making at the national, state, and local levels.

POL S 304 The Press and Politics in the United States (3) Journalists' role in elections and public policy. Relationship between news coverage and political campaigns. Study and analysis of local political newswriting, reporting and response by local and state political figures. Extensive off-campus experience included. Offered jointly with CMU 304.

POL S 305 The Politics of Mass Communication in America (5) *Bennett* Role of mass audiences in politics from the standpoint of the communication strategies used to shape their political involvement. Topics include: social structure and political participation, political propaganda and persuasion, the political uses of public opinion, and the mass media and politics.

POL S 311 Theories of Modern Government (5) The principal political ideas of recent times with particular reference to their significance for democracy and liberal values. A course intended especially for nonmajors. Recommended: 201 or equivalent.

POL S 313 Women in Politics (5) *Levi* Political theory, historical and contemporary, including writings of the women's liberation movement on the political role of women in society. Empirical studies of the "apolitical" woman, and on the process of political socialization in various cultural contexts. Offered jointly with WOMEN 313. Prerequisite: WOMEN 200 or political science course.

POL S 321 American Foreign Policy (5) *Hellmann, Keeler* Constitutional framework; major factors in formulation and execution of policy; policies as modified by recent developments; the principal policymakers—President, Congress, political parties, pressure groups, and public opinion. Recommended: 101 or 202.

POL S 324 Europe in World Politics (5) *Keeler* Independent and coordinated efforts of Britain, France, and West Germany to adapt to the post-World War II global system. Creation and development of the Atlantic alliance. Relations with the Soviet bloc. Decolonization and the evolution of relations with the Third World. The movement for European integration. Prerequisite: 203 or equivalent.

POL S 325 The Arab-Israeli Conflict (5) *Sheikholeslami* The politics of conflicting ideologies: Zionism and Arab nationalism; formation of the state of Israel; development of Palestinian nationalism; Arab-Israeli wars. Reemergence of Palestinian activism; domestic sources of foreign policy; the role of the superpowers.

POL S 328 The United Nations and Specialized Agencies (5) The structure and functions of the United Nations and specialized agencies; accomplishments; proposals for strengthening; relations of regional bodies and member states.

POL S 331 Government and Politics in the Middle East and North Africa (5) *Sheikholeslami* Breakdown of traditional society and the problems of building modern political systems.

POL S 340 Government and Politics of South Asia (5) *Brass* Comparison of problems of national integration and political development in India, Pakistan, and Ceylon.

POL S 341 Government and Politics of Canada (5) Critical analysis of parliamentary institutions, political parties, and the federal system in Canada. Prerequisite: 101.

POL S 342 Government and Politics of Latin America (5) *Cassinelli* Analysis of the political dynamics of change in Latin America comparing various national approaches to the political problems of modernization, economic development, and social change. Prerequisite: upper-division standing or permission of instructor.

POL S 343 Government and Politics of Southeast Asia (5) *Lev* Government and politics in the countries of Southeast Asia, with attention given to the nature of the social and economic environments that condition them. Recommended: 101.

POL S 346 Governments of Western Europe (5) *Keeler* Modern government and politics of Great Britain, France, Germany, and Italy.

POL S 347 Governments of Eastern Europe (5) *Ramet* Survey of the communist regimes of Poland, Hungary, Czechoslovakia, East Germany, and the Balkans.

POL S 349 Communism, Literature, and the Movies (5) Film and literature as media of social and political commentary in communist societies. The role of the cultural intellectual under conditions of political constraint. Emphasis is on materials from eastern Europe, although in some years attention will be given to selected Soviet works. Offered jointly with SISRE 360.

POL S 350 Government and Interest Groups in the United States (5) Agrarian, labor, professional, business, and ethnic interest in politics; impact on representative institutions and governmental processes. Recommended: 101.

POL S 351 The American Democracy (5) Democratic theory; constitutional theory; the Presidency; Congress; the Supreme Court; civil rights and civil liberties. Designed for nonmajors. Recommended: 202 or equivalent.

POL S 352 American Political Parties (5) Theories of American parties, campaigns and voting behavior; party leadership; political socialization and participation. Recommended: 101 or 202.

POL S 353 U.S. Congress (5) *Matthews* Organization and procedure of Congress; state legislative politics; lobbying; legislative roles; the theory and practice of representative government. Prerequisite: 101 or 202.

POL S 354 Elections and Voting in the United States (5) *Bennett, McCrone* Electoral institutions and processes of the United States: the idea and practice of elections, the electoral system, individual voting behavior, collective voting behavior, and the impact of elections on policy. Recommended: 101 or 202.

POL S 355 The American Presidency (5) The American presidency; its evolution, its occupants, and its place within the American system. Topics include presidential character, war, elections, Watergate, the economy, and the Constitution.

POL S 360 Introduction to United States Constitutional Law (5) *McCann* Growth and development of the United States Constitution as reflected in decisions of the Supreme Court; political, social, and economic effects.

POL S 361 United States Courts and Civil Liberty (5) *McCann* Cases and literature bearing on protection of constitutionally guaranteed private rights, with particular reference to the period since 1937.

POL S 365 Lawyers in American Politics (5) *Scheingold* Influence of lawyers on American politics. Official and unofficial political roles, lawyers as lobbyists, as legislators, in the bureaucracy, politics of the American Bar Association. Includes study of legal education, professional values, and avenues of political access.

POL S 370 Government and the American Economy (5) *Peretz* Economic and political aspects of the regulation of business, budgetary policy, and tax policy. Processes of policy formulation, policy conflicts, role of private interests and their effects, and strategies for policy change.

POL S 381 Introduction to Large City Government and Politics in the United States (5) *Olson* Contemporary large-city politics. Social, economic, and political trends that have shaped characteristics of large American cities. Distribution and use of economic and political power at national and local levels. Future of large cities and politics of change. Recommended: 101 or 202.

POL S 382 State Government (5) Focus on the structures, processes, and policy outputs of state governments in the United States.

POL S 383 Environmental Politics and Policy in the United States (5) *Lee* Interrelation between technological and environmental change and policy formation. Consideration of political behavior related to these phenomena and the capacity of urban public organizations to predict change and to formulate policies that can take future states into account.

POL S 398 Honors Seminar (5, max. 15) AWSp Intensive and advanced studies in various aspects of political science. Open only to participants in the departmental honors program.

POL S 405 American Politics Seminar (5, max. 10) Intensive reading and research in selected problems or fields of political analysis. Recommended: 202.

POL S 406 Marxian Political Economy (5) *Levi* Explores the relationship between social classes, the state, and political power in advanced capitalist societies. Investigates this relationship primarily by means of the tools of Marxian political economy and, in the process, evaluates these tools. Emphasis on theoretical perspectives, although the reading list has a few empirical applications as well. Prerequisite: 201.

POL S 408 Problems of Peace and Conflict Resolution (5) *Pool* Factors involved in conflict and conflict resolution; application to international and other problems. Lectures, discussions, and readings in social psychology, political science, and economics. Suitable for nonmajors. Recommended: 205, MATH 106.

POL S 409 Undergraduate Seminar in Political Economy (5) *Levi* Seminar in political economy with focus on Marxian and public choice approaches to political economy. Explores the questions raised by each approach, the assumption(s) and testability of hypotheses, and applies these approaches to a number of problems in political economy. Offered jointly with ECON 409. Prerequisites: 201, ECON 300, and permission of instructor.

POL S 411 The Western Tradition of Political Thought: Ancient and Medieval (5) A Origin and evolution of major political concepts from ancient Greece to the eighteenth century that underlie much contemporary thinking. A background in history is desirable. Prerequisite: 101 or permission of instructor.

POL S 412 The Western Tradition of Political Thought: Modern (5) W Continuation of 411, treating materials from the seventeenth century through the early nineteenth century, Hobbes through Hegel. Prerequisite: 411 or permission of instructor.

POL S 413 Contemporary Political Thought (5) Sp Developments from the eighteenth century to the present as a basis for contemporary philosophies of democracy, communism, and fascism. Prerequisite: 411 or equivalent.

POL S 414 Chinese Political Thought (5) Theories of the Oriental state as exhibited in the writings of diplomats and philosophers.

POL S 416 Economic Theory as Applied to the Political System (5) Explanation and evaluation of the political system, using elementary economics theory. Topics include alternative voting rules, the political effectiveness of various types of groups, causes and consequences of logrolling, and bureaucratic organizations. Offered jointly with ECON 452. Prerequisite: ECON 200 or 400 or equivalent.

POL S 418 American Political Thought (5) Major thinkers and movements from the colonial period to the present in the context of American culture.

POL S 419 Asian Marxist Thought (3) Theory and practice of Marxist-Leninism in Asia from 1920 to present. Emphasizes relation of Asian Marxist thought to specific domestic and international conditions of time and to classical ideas of Marx and Lenin. Offered jointly with SISEA 419. Prerequisite: one course from either the nineteenth- or twentieth-century Marxism series or a course in modern Asian politics or history

POL S 420 Foreign Relations of the Soviet Union (5) *Reshetar* Ideological, historical, and strategic components of Soviet foreign policy; Comintern, Cominform, and international communist movement; Soviet policy in foreign trade, in international law and organization, and in specific geographic areas.

POL S 421 Relations Among Communist States (5) *Reshetar* Major disputes and types of relationships among different communist states and ruling parties, attempts at integration and methods of alliance maintenance, tensions and contradictions in relations. Nature of the socialist commonwealth and the communist state system.

POL S 423 International Law (5) A *Rohn* History and present status of international law. Feedback between law and politics in international relations. Current trends in treaties and court cases. Recommended: 203 or equivalent.

POL S 424 International and European Regional Courts (5) W *Rohn* Survey and comparison of formal dispute settlement procedures among sovereign states (i.e., various *ad hoc* arbitration tribunals), projects for regional courts (Arab, Latin American, Commonwealth), and the role of courts in early federal systems (United States, Switzerland, Canada). Recommended: 423 or equivalent.

POL S 425 Advanced International Law (5) Sp Selected research projects, changing from year to year, on the legal context of major international events (e.g., the Iranian hostage crisis; the rich-poor dialogue in trade and aid; new rules for the seabed, polar caps, and outer space). New approaches to old problems (e.g., human rights, refugees, extradition). Quantitative and computerized methods of research. Prerequisite: 423; recommended: 424.

POL S 426 World Politics (5) A *Modelski* The nation-state system and its alternatives; world distributions of preferences and power; structure of international authority; historical world societies and their politics. Offered jointly with SIS 426.

POL S 427 Multinationals and World Order (5) *Modelski* Multinational corporations as a problem for world order. MNCs and the global political economy; theories of multinational activity; governance and regulation; international organizations, world politics, and MNCs. Prerequisities: introductory courses in international relations and international studies.

POL S 431 International Relations in the Middle East (5) *Sheikholeslami* Study of domestic sources of foreign policy in the Middle East; politics of oil; the East-West rivalry in the arena and conflict and collaboration among the local powers.

POL S 434 International Relations of South Asia (5) *Brass* Interrelationships of domestic, interstate, and extraregional forces and their effects upon the resolution or expansion of interstate conflicts in South Asia.

POL S 435 Japanese Government and Politics (5) *Hellmann* Government and politics of Japan with emphasis on the period since 1945.

POL S 436 Ethnic Politics and Nationalism in Multi-Ethnic Societies (5) *Brass, Chandler* Provides a broad theoretical base, both descriptive and analytical, for the comparative study of ethnicity and nationalism. Examples drawn from ethnic movements in different societies. Some previous exposure either to introductory courses in political science or to courses in ethnicity in other departments is desirable. Prerequisite: junior standing.

POL S 439 Politics of Korea (5) *Cumings* Korean politics in the twentieth century, treating political legacy of ancient regime, colonial period, Korean War, and the politics of North and South Korea. Comparative treatment of both Koreas, in light of the Chinese and Japanese experience. Includes the American-Korean relationship. Offered jointly with SISEA 439. Recommended: SISEA 210 or equivalent.

POL S 440 European Fascism (5) *Keeler* Analysis of fascism as revolutionary movement and type of political system in post-World War I Europe: Hitler's Third Reich, Mussolini's Italy, and Vichy France. Consideration of dynamics of resistance, policies that produced Holocaust, and questions raised at trials of fascist leaders in Nuremberg and elsewhere. Prerequisite: permission of instructor.

POL S 441 Government and Politics of the Soviet Union (5) A *Reshetar* Ideological and historical bases of Soviet politics; Leninism-Stalinism; Communist Party structure and functions; administrative agencies; the police and military; law and the judiciary; Soviet federalism and nationality policy.

POL S 442 Government and Politics of China (5) *Perry, Townsend* Post-1949 government and politics, with emphasis on problems of political change in modern China. Prerequisite: junior standing.

POL S 443 Comparative Political Societies (5) W *Cassinelli* Analyses of modern and premodern types of stable political society; special attention to contemporary representative democracy.

POL S 444 Revolutionary Regimes (5) *Cassinelli* Analysis of the several types of political regimes concerned with effecting fundamental social change; emphasis on the twentieth century.

POL S 446 Peasants in Politics (5) *Perry* Interdisciplinary study of peasants, with special attention to questions of rural transformation. Peasant involvement in an increasingly interdependent world. Rebellion and revolution, impact of the international market, agricultural development. Offered jointly with SIS 444.

POL S 447 Comparative Politics Seminar (5, max. 10) Selected comparative political problems, political institutions, processes, and issues in comparative perspective. Strongly recommended: 204.

POL S 448 Comparative Political Organizations (5) Dynamics of political organizations (political parties and interest groups) and the roles they play in the political processes of democratic policies. Theories of organizational behavior are tested through consideration of selected cases drawn primarily from the United States and western Europe.

POL S 449 Politics of Developing Areas (5) *Brass, Lev, Townsend* Comparative study of problems of national integration and political development in the new states of Asia and Africa. Prerequisite: junior standing.

POL S 450 State-Society Relations in Third World Countries (5) *Migdal* Relationships among political, social, and economic changes in Asia, Africa, and Latin America. Problems of economic and political development, revolution and reform, state-society relations, imperialism and dependency. Offered jointly with SIS 456.

POL S 452 Political Processes and Public Opinion in the United States (5) *Bennett* The foundations and environment of opinion; organization and implementation of opinion in controlling government and public opinion as a force in the development of public policy; public relations activities of government agencies.

POL S 453 The State Legislature (5) Study of American state legislatures, with special reference to Washington State Legislature. Student must spend several Fridays in Olympia when the legislature is in session. Those desiring a more extensive involvement with the legislature should enroll in the political internship or general studies special projects course. Prerequisites: upper-division standing and permission of instructor.

POL S 462 The Supreme Court in American Politics (5) *Scheingold* Introductory public law course that examines the interplay of constitutional law and American politics with particular attention to the role of the Supreme Court in the formulation and implementation of public policy in such matters as criminal-law enforcement, civil rights political expression, and economic regulation.

POL S 463 Political Analysis of United States Social Programs (5) *Peretz* Social problems in the United States and policy responses. National policies concerning poverty, health, welfare, manpower, and the Social Security system. Examination of subgovernments that cluster around each policy area.

POL S 464 The Politics of American Criminal Justice (5) *Scheingold* Political forces and value choices associated with the enforcement of criminal law. Distribution of resources among participants in the criminal justice system (e.g., police, attorneys, defendants, and judges). Understanding and evaluation of the interaction of criminal justice processes with the political system. Prerequisite: junior or senior standing.

POL S 465 Law and Public Policy in the United States (5) *Scheingold* Relationship between law and public policy, with particular attention to problems of social, economic, and political change. The course considers legal and constitutional processes as they relate to such problems of public policy as race relations, the environment, and the economy. Prerequisite: junior or senior standing.

POL S 470 Public Bureaucracies in the American Political Order (5) *Gore* Growth, power, and roles of governmental bureaucracies in America; conflict and conformity with American political thought, other political institutions, and the public.

POL S 471 Administrative Processes (5) *Gore*

POL S 480 Introduction to Urban, Suburban, and Metropolitan Political Systems (5) Causes and consequences of variations in urban form and political structure. Social, economic, and cultural characteristics of different urban forms, and processes by which they have developed; emphasis on suburbanization and metropolitanism. Offered jointly with URB P 480. Recommended: 101 or 202.

POL S 485 Problems in Urban Political Analysis (5, max. 10) *May* Advanced undergraduate course in urban politics. Opportunity for more independent and intensive analysis of particular problems or lines of inquiry. Prerequisites: 101 or 202 and 480 or 381.

POL S 487 Intergovernmental Relations (5) Analysis of the content and dynamics of the relations between federal, state, and local governments, with emphasis upon patterns in these relationships that reflect program structures.

POL S 488-489 Honors Senior Thesis (5-5) A,W Students individually arrange for independent study of selected topics under the direction of a faculty member. Research paper is student's senior thesis. Students meet periodically as a group to discuss research in progress. Prerequisites: 15 credits in 398, senior honors standing, and permission of instructor.

POL S 490 Quantitative Political Analysis (5) *May, Pool* Major quantitative methods of empirical research in political science. Primary emphasis on research design, data collection, data analysis, and use of computers. Prerequisite: 205 or equivalent or graduate standing or permission of instructor.

POL S 491 Political Behavior Methodology (5) *May, Pool* Numeric and symbolic approaches to the study of political phenomena. Analysis of the behavior of lawmakers, judges, administrators, and citizens. Students work on attitude measurement, cross-cultural comparison, analysis of change and causation, precise description of structures and processes, probability and sampling, statistical and experimental control, and decision analysis. Graphical techniques, matrix operations, and conversational computer programming. Prerequisite: 490 or equivalent.

POL S 492 Politics and Culture (5) *Bennett* How people interpret and shape the political world around them through the use of such cultural resources as language, symbolism, myth, and ritual. The various uses of these cultural elements establish the place of the individual in society, influence the perception of political events, and create opportunities for individual and mass political responses. Prerequisite: junior or senior standing.

POL S 493 Language and Politics (5) *Pool* Language as a political phenomenon, a tool of political power, and a source of political problems. Includes the effects of "public doublespeak," the role of language in racism and sexism, and the search for ways to overcome national and international language barriers in several parts of the world. Primarily for students in political science, languages, and area studies. Prerequisite: permission of instructor.

POL S 495 Psychology in American Politics (5) Contributions of cognitive psychology, social psychology, and psychoanalysis to the understanding of politics. Topics include psychological analysis of leadership, mass political behavior, voting and public opinion, group conflict, and decision making in executive, judicial, legislative, and bargaining institutions.

POL S 496 Undergraduate Internship (5, max. 15) Students serving in approved internships. Prerequisities: sophomore standing or above and permission of undergraduate adviser.

POL S 497 Political Internship in State Government (5, max. 20) Students serving in approved internship program with state government agencies. Prerequisites: junior standing or above and permission of undergraduate adviser.

POL S 498 Washington Center for Learning Alternatives Internship (15) AWSpS Full-time academic internship with the Washington Center for Learning Alternatives in Washington, D.C. Includes internship activities, academic seminar, assemblies, and related activities. Prerequisites; 202, junior standing or above; one year at this university; application and acceptance to program, permission of undergraduate adviser.

POL S 499 Individual Conference and Research (2-5, max. 20) Intensive study with faculty supervision. No more than one registration in 499 under same instructor. Prerequisites: junior or higher standing and permission of undergraduate adviser.

Courses for Graduates Only

POL S 501 Survey of American Government (3) *Gore* Conceptual perspectives toward American government. Alternative ways of considering policy issues. Focuses on such models as legal-constitutional, pluralistic competition, political economy, public interest, and conflict resolution. For graduate students outside political science.

POL S 505 Comparative Politics (5) Core course. Modern theories, approaches, and methods in the study of comparative politics.

POL S 506 Contemporary Problems, Domestic and Foreign (3, max. 6)

POL S 509 Reason, Value, and Politics I (3) Selected topics in the relationships between ethics and politics.

POL S 510 Reason, Value, and Politics II (3) Research and writing in the relationships between ethics and politics. Prerequisite: 509.

POL S 511, 512 Seminar in Political Theory I, II (5,5) Core course in political theory. Major authors and moral-political issues in contemporary political theory with some focus on past theorists and history of political theory. Prerequisites: undergraduate course work in political theory and permission of instructor.

POL S 514 Seminar in Problems of Political Theory (3, max. 9) Selected topics, historical and conceptual, national, regional, and universal. Prerequisite: permission of instructor.

POL S 515 Scope and Methods in Political Science (3) Inquiry into the philosophic foundations of various approaches in political science and their possible contributions to an understanding of politics. Recommended: Substantial background in philosophy, as well as in political science.

POL S 517, 518 Modern Philosophy and Political Thought (3,3) Focuses on major representatives of analytic, existentialist, Marxist, and phenomenological schools of philosophy and further analyzes the terms and extent of their bearing on analysis of political phenomena.

POL S 519 Theories of Decision Making (3) *Pool* Survey of the several theories of collective decision making, including analysis of alternative strategies and the spectrum of decisional functions associated with each strategy.

POL S 520 Seminar on the Foreign Policy of the Soviet Union (3) *Reshetar* Selected topics in the development, methods, and objectives of the foreign policy of the Soviet Union. Prerequisite: permission of instructor.

POL S 521 International Relations I: Theory and Method (5) *Modelski* Part one of the core course in the field of international relations. Reviews contemporary theory, research, and methodology in the study of world politics.

POL S 522 International Relations II: Organization and Politics (5) *Modelski* Part two of the core course in the field of international relations. Reviews basic literature on diplomacy and world organization, history of world politics, and selected special fields, including foreign policies of major powers, international political economy, and global problems.

POL S 525 International Law I: Policy (3) *Rohn* Inputs of international law into the decisional process in foreign policy. Effect of policy on law. Relevant roles of individuals and institutions in routine and crisis situations. Prerequisite: 423 or permission of instructor.

POL S 529 Problems of American Foreign Policy (3) Critical analysis of the historical foundations and contemporary problems of foreign-policy making, with attention given to selected foreign-policy decisions. Prerequisite: 321 or permission of instructor.

POL S 532 The Chinese Political System (3) *Townsend* Examination of key approaches, interpretations, and secondary literature in the study of contemporary Chinese politics. Prerequisite: permission of instructor.

POL S 533 Seminar on Contemporary Chinese Politics (3) *Townsend* Research on selected problems in contemporary Chinese politics. Prerequisite: 532 or permission of instructor.

POL S 534 American Foreign Policy Formation (3) American foreign policy viewed whole, including defense policy, the relationships of foreign policy to domestic policies and priorities, and the full range of historical, constitutional, institutional, political, and theoretical questions related to the formation and execution of foreign policy in this broad sense. Offered jointly with PB AF 534.

POL S 535 International Relations of Modern China (3-5) Foreign policy of the People's Republic of China: historical antecedents; domestic and international systemic determinants; and Chinese policies toward major states, regions, and issues. Prerequisite: a course on contemporary Chinese politics or history, or permission of instructor.

POL S 536 Ethnic Politics and Nationality Formation (3) *Brass* Seminar on analysis and theoretical understanding of two interrelated processes: ethnic group persistence and change over time; and the transformation of ethnic groups into politically self-conscious and influential nationalities. The readings and discussions deal with these two processes in the contexts both of developing societies and of advanced industrial societies.

POL S 537 Approaches to East European Politics (3-5) *Ramet* Selected concepts and methodologies useful for the analysis of politics and social structure in the socialist countries of east-central and southeastern Europe. Offered jointly with SISRE 504. Prerequisite: permission of instructor. (Offered alternate years.)

POL S 538 Government and Politics in the Middle East and North Africa (3) *Sheikholeslami* Political change in the area within the context of comparative politics; breakdown of traditional political systems; new range of choice expressed in competing ideologies; governmental and nongovernmental instrumentation of change; and problems of international relations and regional conflict and integration.

POL S 540 Problems in South Asian Politics (3) *Brass* Research problems in contemporary Indian politics.

POL S 541 The Soviet Political System (4) *Reshetar* Critical appraisal of the principal research methods, theories, and types of literature dealing with the government and politics of the Soviet Union. Prerequisite: permission of instructor.

POL S 543 Seminar on British Government (3) Advanced studies in British parliamentary government.

POL S 544 Problems in Comparative Government (3, max. 9) Selected problems in the comparative analysis of political institutions, organizations, and systems.

POL S 545 Seminar on Japanese Government and Diplomacy (3, max. 6) *Hellmann*

POL S 546 Seminar on Problems of Soviet Politics (3) *Reshetar* Selected problems of Soviet domestic politics. Prerequisite: 541 or permission of instructor.

POL S 548 Comparative Political Parties (3) *Brass* Role of political parties in the modern state. Similarities and differences in origins and development of political parties and functions they perform, both in established democracies and in developing countries.

POL S 549 Problems of Political Development (5) Comparison of aspects of political change and development in both contemporary and historical developing societies. Constitutes second quarter of core course sequence in comparative politics.

POL S 550, 551 American Politics I, II (5,5) Core course in American government and politics. Systematic survey of the literature. 550 focuses on national politics, 551 on subnational politics. Prerequisites: undergraduate courses in American government and politics.

POL S 553 Public Opinion (3) *Bennett* Selected problems in opinion formation, characteristics, and role of public opinion in policy-making process. Prerequisite: 452.

POL S 554 Legislative Politics (3, max. 6) Selected problems in legislative processes and leadership, state and national.

POL S 562, 563, 564 Public Law (3,3,3) *Scheingold* Constitutional and legal concepts governing governmental authority and institutions and the conduct of governmental activities.

POL S 566 Problems in Comparative Legal Institutions (3) *Lev* Social science inquiry in comparative legal institutions. Worldwide scope, with attention to both theory of law in society and development and practice of legal institutions.

POL S 567 Public Policy, Administration, and Political Theory (3) *Levi* Meaning of democracy in the context of American public policies and administration. Perspective of individual and group participation in the policy process, individual's role in organizations, functions of the public servant in the making of policy decisions, and realities of policy formulation in relation to political values. Offered jointly with PB AF 556.

POL S 570 Public Policy and Administration (3) *Kroll, Miller* Interaction between the bureaucracy and those institutions, organizations, and groups involved in the policy process. Analyses of current policy problems. Offered jointly with PB AF 501.

POL S 571 The Administrator and the Policy Process (3) *Kroll, Miller* Context of public administration from the perspective of the administrator. Case and research materials; field inquiries and interviews. Roles and functions of the administrator, particularly in relation to the process of implementing, making, and changing public policy. Offered jointly with PB AF 502.

POL S 575 Public Policy Processes (3) Political science frameworks, approaches, and theories concerning development and implementation of public policies within American political systems. Governmental behaviors and processes, including rational, political, and bureaucratic models of governmental decision making; agenda-building processes; and normative perspectives concerning role of governmental entities.

POL S 579 Comparative Administrative Systems (3) *Kroll* Methodological problems of research in comparative administration. Theoretical and substantive aspects of administrative systems in urban-industrial and developing nations. Offered jointly with PB AF 551.

POL S 584 Approaches to Subnational Government (3) Analysis of current approaches and concepts in the study of subnational government—urban, state, and regional public organization.

POL S 585, 586 Local, State, and Regional Politics and Administration (3,3) Exploration and analysis of political and organizational behavior at the local, state, and regional levels of government, with emphasis upon methodology and field research.

POL S 587 Politics of Urban Reform (3) *Olson* Interpretations of urban reformers at turn of this century and during 1960s and 1970s. Historical and political science literature on the subject. Prerequisites: graduate student standing and permission.

POL S 589 Special Topics in Political Economy (3, max. 9) Evaluating research in political economy as well as developing research problems. Topics vary with instructor and with current problems in the literature. Prerequisites: 406, 416, ECON 400, and permission of instructor.

POL S 590 Seminar in Political Behavior (3, max. 6) *Bennett, Gore, Matthews* Analysis of behavioral research in selected fields of political science.

POL S 591 Philosophy of Political Research (3) Philosophic issues in empirical research in political science, such as the logic of inquiry, the role of theory, problems of concept formation, the notion of causality, and the utility and limitations of quantification. Prerequisites: 490 or equivalent and graduate standing.

POL S 592-593 Research Practicum I, II (3-3) Directed design and execution of an empirical research project over a two-quarter period. Weekly seminar meetings and reports. Prerequisites: advanced graduate standing, 490 or equivalent, and permission of instructor.

POL S 595 Seminar in Political Psychology (3) Fields of psychology and their applications to political analysis. Established and emerging theoretical orientations in political psychology, drawing upon cognitive, sociopsychological, and psychoanalytic perspectives to account for a variety of political phenomena, such as individual and mass political action, small-group behavior, and performance of organizations. Prerequisite: some undergraduate background in psychology.

POL S 597 College Teaching of Political Science (1) Survey of approaches, methods, and problems associated with teaching political science at the college level. Prerequisite: appointment as a teaching assistant in the Department of Political Science.

POL S 600 Independent Study or Research (*)

POL S 700 Master's Thesis (*)

POL S 800 Doctoral Dissertation (*)

Psychology

119 Guthrie

Psychology involves the scientific study of behavior and its causes and the understanding of human behavior in a variety of settings. Psychology is studied either as a natural science, which stresses physical and biological causes of behavior, or as a social science, which stresses the effects of the social setting on human behavior. Major areas of emphasis are human cognition, animal behavior, physiological and sensory bases of behavior, quantitative techniques, personality and clinical psychology, developmental psychology, and social psychology. The department does not have formal programs in educational, school, or counseling psychology (see the College of Education section of this catalog), engineering psychology, or industrial psychology.

Undergraduate Program

Bachelor of Science Degree

Intended to prepare students for doctoral programs in experimental psychology (e.g., clinical, human experimental, social, animal behavior). Emphasizes a strong natural science and mathematics background, research experience, and high grade-point average.

Major Requirements: 55 credits in psychology courses—PSYCH 101 or 102, 209, 217, 218, 231 or 361, 232 or 233, 3 credits of 499, plus 10 credits each in social science psychology and in natural science psychology (listed below), and electives to total 55 credits; 33-34 additional credits in other disciplines, to include MATH 105 and 124 (or 156 and 157), 5 credits in physics or chemistry, 5 credits in physical anthropology, GENET 351 (or 451), 10 credits in biology or zoology; 3.00 overall grade-point average in all courses completed at the University and 3.30 grade-point average in all psychology courses. Transfer students must meet all above requirements, but need complete only 15 credits in psychology at this university. Social science psychology—PSYCH 205, 210, 250, 257, 260, 304, 305, 306, 345, 355, 405, 410, 414, 415, 440, 442, 443, 444, 445, 446, 447, 449, 457, 489, 490, and 495. Natural science psychology—200, 222, 322, 357, 400, 403, 406, 407, 409, 411, 412, 413, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 427, 429, 430, 434, 435, 441, 461, 462, 463, 465, 468, and 475. (Note: The foregoing "social science" and "natural science" psychology courses should not be confused with the College of Arts and Sciences "distribution" requirements, which are listed separately.)

Bachelor of Arts Degree

The B.A. degree program is intended to prepare students for employment at the baccalaureate level and for graduate study in applied areas (e.g., counseling psychology, social work, business administration, public affairs). The program emphasizes supplementary course work in other departments and fieldwork.

Major Requirements: 50 credits in psychology courses—PSYCH 101 or 102, 209, 213 (or 217, 218), 231 or 232 or 233 or 361, and electives to total 50 credits (497 recommended); 1½ years of high school algebra or equivalent is a prerequisite to PSYCH 213, but is not a required course; 2.00 grade-point average in all psychology courses. Transfer students must meet all above requirements, but they need complete only 15 credits in psychology at this university.

A student may earn either a Bachelor of Science or a Bachelor of Arts degree in psychology, but not both.

Graduate Program

Graduate work in psychology is organized primarily as preparation for the Doctor of Philosophy degree. The optional Master of Science degree is taken by some doctoral students in the course of their work toward the doctorate.

For graduate instruction, the department is organized into several content areas: animal behavior, physiological, human experimental, quantitative, developmental, clinical (general, child, and psychophysiology), social, and personality.

The program in clinical psychology is accredited by the American Psychological Association and provides scientific and professional training. Specialized training is provided in child-clinical and community-minority psychology and behavioral medicine.

The Physiology-Psychology Group of the Graduate School, composed of faculty from the departments of Psychology and of Physiology and Biophysics, offers an interdisciplinary program leading to the Doctor of Philosophy degree in physiology-psychology.

Master of Science Degree (Optional)

Graduation Requirements: Completion of first-year graduate program (same as for Doctor of Philosophy degree) and an appropriate research program, including a research thesis. Foreign-language study is not required.

Doctor of Philosophy Degree

Graduation Requirements: Completion of breadth requirements in four of the content areas (listed above), experimental design, minor and major area requirements, independent research, General Examination, dissertation, and Final Examination. Minimum 3.00 grade-point average overall must be maintained; 3.00 grade-point average required for all courses used to satisfy breadth and minor requirements. *First-year requirements:* Demonstrate competence in statistics and experimental design; complete two of the area breadth requirements; complete at least 3 credits of independent predoctoral research and report that research at the department's annual Research Festival.

Special Research Facilities

Facilities for research and graduate instruction include: teaching laboratories; machine, electronic, and carpentry shops; microprocessor room; animal vivarium; darkroom; remote-access console to computer center; and approximately sixty small, specialized laboratory research rooms.

Admissions Qualifications

Undergraduate degree in psychology is not required; some preparation in biological or social sciences is strongly advised. Applicants are judged on a number of criteria, often including their academic and research backgrounds, Graduate Record Examination aptitude scores, and written evaluations submitted by former professors or supervisors. Students with little training in psychology may be required to complete preliminary work in undergraduate courses. Admission of new students usually occurs in Autumn Quarter only.

Assistantships, Fellowships, or Traineeship Opportunities

Research and teaching assistantships are available to qualified graduate students. Additional traineeships and fellowships are also available.

Correspondence and Information

Graduate Program Coordinator
122 Guthrie, NI-25

Faculty

Chairperson

Stephen C. Woods

Professors

Attneave, Carolyn L.,* Ph.D., 1952, Stanford; family counseling, therapy and research, psychological problems of the American Indian.

Barash, David P.,* Ph.D., 1970, Wisconsin; sociobiology, behavioral ethology, animal behavior and evolution.

Beach, Lee Roy,* Ph.D., 1961, Colorado; decision processes, cognition.

Becker, Joseph,* (Psychiatry and Behavioral Sciences),† Ph.D., 1958, Duke; clinical personality psychopathology, depression.

Bolles, Robert C.,* Ph.D., 1956, California (Berkeley); animal learning and motivation, behavior theory, history.

Butterfield, Earl C.*‡ (Education), Ph.D., 1963, Peabody (Vanderbilt); cognitive development, metacognition.

Carr, John E.,* (Psychiatry and Behavioral Sciences);† Ph.D., 1963, Syracuse; phobic disorders, therapy outcome.

Chapman, C. Richard,*‡ (Psychiatry and Behavioral Sciences, Anesthesiology), Ph.D., 1969, Denver; human pain measurement, psychophysiology, sensation and perception, chronic pain.

Edwards, Allen L. (Emeritus), Ph.D., 1940, Northwestern; personality assessment and measurement, attitudes, statistics and experimental design.

Fiedler, Fred E.,* Ph.D., 1949, Chicago; leadership and group effectiveness; social, industrial, and organizational psychology.

Fields, Paul E. (Emeritus), Ph.D., 1930, Ohio State; teaching of psychology, psychology examinations.

Horst, A. Paul (Emeritus), Ph.D., 1931, Chicago; prediction of personal adjustment factor analysis measurement techniques.

Hunt, Earl B.,* Ph.D., 1960, Yale; cognition, individual differences in cognition, human information processing, artificial intelligence.

Lockard, Joan S.,* (Neurological Surgery);† Ph.D., 1963; Wisconsin; primate social behavior, animal behavior, sociobiology, human ethology, neurobehavior.

Loftus, Elizabeth F.,* Ph.D., 1970, Stanford; cognition, long-term memory, eye-witness testimony, psychology and law.

Loftus, Geoffrey R.,* Ph.D., 1971, Stanford; perception, memory, cognitive processes, information processing, computer control of experimentation.

Loucks, Roger B. (Emeritus), Ph.D., 1930, Minnesota; neurophysiology, conditioning and learning, experimental methods.

Lumsdaine, Arthur A. (Emeritus), (Education),† Ph.D., 1949, Stanford; opinion and attitude change, communication, evaluation of social and educational programs, poverty and affluence, political behavior and conflict resolution.

Lunneborg, Patricia W.,* Ph.D., 1962, Texas; growth of abilities in college students, adult vocational development, test construction in occupational choice.

Marlatt, G. Alan,* Ph.D., 1968, Indiana; cognitive-behavior therapy and assessment, addictive behaviors, meditation, psychotherapy.

Mitchell, Terence R.,* (Management and Organization),† Ph.D., 1969, Illinois; organizational behavior, leadership, group processes, motivation.

Nelson, Thomas O., Ph.D.,* 1970, Illinois; human memory, metacognition, research methodology, philosophy of science.

Robinson, Nancy M.,*‡ (Psychiatry and Behavioral Sciences), Ph.D., 1958, Stanford; mental retardation, accelerated development.

Sackett, Gene P.,* Ph.D., 1963, Claremont; primate behavior, early experience and development.

Sarason, Irwin G.,* Ph.D., 1955, Indiana; personality, stress, anxiety, social support.

Sax, Gilbert,* (Education),† Ph.D., 1958, Southern California; measurement, evaluation, research design, statistics.

Simpson, John B.,* Ph.D., 1973, Northwestern; neural and endocrine controls of body fluid homeostasis, behavioral endocrinology.

Smith, Moncrieff H.,* Ph.D., 1947, Stanford; psychophysics, pathology of human memory, biological motivation.

Smith, Ronald E.,* Ph.D., 1968, Southern Illinois; clinical, personality, sport psychology.

Stotland, Ezra (Emeritus), Ph.D., 1953, Michigan; empathy, criminal justice, stress.

Strother, Charles R. (Emeritus), (Psychiatry and Behavioral Sciences),† Ph.D., 1935, Iowa; mental retardation, psychopathology, speech pathology.

Teller, Davida Y.,* (Physiology and Biophysics),† Ph.D., 1965, California (Berkeley); vision, visual development in infants.

Townes, Brenda D.,*‡ (Psychiatry and Behavioral Sciences), Ph.D., 1970, Washington; clinical neuropsychology, birth-planning decisions.

Woodburne, Lloyd S. (Emeritus), Ph.D., 1932, Michigan; neural basis of behavior, neurophysiology of learning.

Woods, Stephen C.,* Ph.D., 1970, Washington; physiological and conditioned drug effects, neural control of endocrine system.

Associate Professors

Beecher, Michael D.,* Ph.D., 1970, Boston; sociobiology, animal communication, zoo animal behavior.

Bernstein, Ilene L.,* Ph.D., 1972, California (Los Angeles); biological basis of development, physiological and conditioning factors affecting regulation of food intake.

Boothe, Ronald G.* (Research), Ph.D., 1974, Washington; behavioral and neuroanatomical development of vision in primates.

Broedel, John W.,* (Education),† Ed.D., 1958, Illinois; counseling, early adulthood, object relationship theory.

Culbert, Sidney S. (Emeritus), Ph.D., 1950, Washington; perception, psycholinguistics, intercultural communication.

Dale, Philip S.,* Ph.D., 1968, Michigan; language and cognitive development, psycholinguistics.

Davidson, Andrew R.,* Ph.D., 1974, Illinois; attitude theory and measurement, cross-cultural and population psychology, survey methodology.

Diaz, Jaime,* Ph.D., 1975, California (Los Angeles); brain development, developmental psychopharmacology.

Dobson, M. Velma* (Research), Ph.D., 1975, Brown; laboratory and clinical techniques for vision assessment in infants and young children.

Doerr, Hans O.,* (Psychiatry and Behavioral Science),† Ph.D., 1965, Florida State; psychophysiology of central and autonomic nervous systems, neuropsychology.

Douglas, Robert J.,* Ph.D., 1964, Michigan; neuropsychology of learning and memory, aging and inhibition.

Greenberg, Mark T.,* Ph.D., 1978, Virginia; infant and preschool social and cognitive development of profoundly deaf, child-clinical and pediatric psychology.

Heathers, Louise B. (Emeritus), Ph.D., 1940, Yale; counseling, tests and measurement.

Jacobson, Neil S.,* Ph.D., 1977, North Carolina; behavior marital therapy, depression, family therapy.

Keating, John P.,* Ph.D., 1972, Ohio State; communication media and attitude change, value formation and systems, environmental psychology, psychology and religion, emergency behavior.

Kenney, Nancy J.,* (Women Studies),† Ph.D., 1974, Virginia; neural and endocrine controls of food and fluid intake, physiological basis of motivation.

Kohlenberg, Robert J.,* Ph.D., 1968, California (Los Angeles); clinical behavior modification, learning, clinical psychophysiology, behavioral medicine.

Linehan, Marsha M.,* Ph.D., 1971, Loyola (Chicago); behavior assessment and therapy, suicide and parasuicide, assertion training, behavior therapy with women.

Lunneborg, Clifford E.,* (Statistics),† Ph.D., 1959, Washington; psychometrics, multivariate models, individual differences in cognition.

Pagano, Robert R.,* Ph.D., 1966, Yale; stress management, clinical psychophysiology, instrumentation.

Perry, Martha A.,* Ph.D., 1970, Syracuse; child-clinical, child abuse, child assessment, mental retardation, development of attitudes toward the handicapped.

Rose, Richard M.,* Ph.D., 1964, Pennsylvania; stochastic models, psychophysics, sleep.

Steele, Claude M.,* Ph.D., 1971, Ohio State; social causes and effects of alcoholism, name-calling, attribution, self-esteem therapy.

Vitaliano, Peter P.,*‡ (Psychiatry and Behavioral Sciences), Ph.D., 1975, Syracuse; psychiatric epidemiology and psychometrics, aging, stress, statistical application to clinical and applied data in behavioral sciences.

Wise, James A.,*‡ (Architecture), Ph.D., 1970, Washington; decision theory, environmental psychology, design methodologies, applications of decision theoretic models to environmental design evaluation.

Assistant Professors

Buck, Steven L.* (Research), Ph.D., 1976, California (San Diego); human visual psychophysics, perception, human and animal learning.

Fenner, Robert H.,‡ (Education), Ph.D., 1965, Colorado; individual and group psychotherapy, personality theory, counseling.

Fischer, Eric A.,* Ph.D., 1979, California (Berkeley); behavioral ecology and evolution, evolutionary ecology of sexual patterns.

Friedrich, William N.,* Ph.D., 1980, North Dakota; child-clinical, family systems and therapy, child abuse, impact of illness in children, pediatric psychology.

Robinson, Elizabeth A.,* Ph.D., 1977, South Carolina; child-clinical, personality, family interaction.

Samson, Herman H.* (Research), Ph.D., 1968, Waterloo; behavioral pharmacology, addictive processes.

Lecturer

Vance, Ellen B., Ph.D., 1975, Washington; clinical diagnosis and therapy, women in transition, forensic evaluation, interface of psychology and law research, group approaches to clinical problems.

Course Descriptions

Courses for Undergraduates

PSYCH 101 Psychology as a Social Science (5) AWSpS *Beach, Keating, R. Smith* Research theories and observations of human behavior: individual differences, personality, development, motivations, social behavior, deviant behavior, genetics and physiology of behavior, learning and cognitive processes, and sensory and perceptual processes. Social problems and research psychologists' efforts to help characterize and solve them. Not open for credit to students who have taken 100.

PSYCH 102 Psychology as a Natural Science (5) AWSpS *Bernstein, Sackett, Simpson, Woods* Behavior from a natural science viewpoint: components and mechanisms of behavior; evolution, genetics, and physiology of behavior, learning processes, motivation, individual differences, development, social behavior, and sensory, perceptual, and cognitive processes. Not open for credit to students who have taken 100.

PSYCH 200 Comparative Animal Behavior (5) AWSpS *Barash, Beecher, Fischer* Research methods and findings of comparative animal behavior and their importance to an understanding of human behavior; rationale for study of behavioral differences and similarities between animal species, behavior viewed as part of the adaptation of each species to its natural habitat. Recommended: 102 or BIOL 210.

PSYCH 205 Introduction to Personality and Individual Differences (4) AWSpS *Linehan, Marlatt, E. Robinson* Basic concepts, methods, and background for more intensive study. Prerequisite: 101 or 102, or equivalent.

PSYCH 209 Fundamentals of Psychological Research (4) AWSpS *Nelson* Psychological research methodology and techniques. Topics include hypothesis testing, influence of paradigms, experimental design, techniques of scientific writing, research techniques, ethical issues in psychological research, bias and expectation problems. Required for all psychology majors. Prerequisite: 101 or 102 or equivalent.

PSYCH 210 Psychological Aspects of Human Sexuality (3) AWSpS Psychological factors that affect sexual attitudes, sexual behavior, and sexual satisfaction: empirical evidence (e.g., survey data, experimental findings) and major theoretical approaches.

PSYCH 213 Elementary Psychological Statistics (6) AWSpS *Fischer, C. Lunneborg, Pagano* Description and reporting of data; probability theory. Psychological hypotheses; statement, testing, and evaluation in terms of numerical outcomes; calculation and interpretation of more commonly used statistical tests. Required for majors registered in psychology Bachelor of Arts degree program. Prerequisites: 209 and 1½ years of high school algebra or permission of instructor.

PSYCH 217 Introduction to Probability and Statistics for Psychology (4) AWSpS *G. Loftus, Rose, M. H. Smith* Probability theory as a model for scientific inference. Probabilistic variables and experimental outcomes, conditional probability, binomial and related distributions, experiments as samples, statistics and sampling distributions, the normal distribution, problems of estimation from experiments. Prerequisites: 209 and MATH 157 or 124, or permission of instructor.

PSYCH 218 Statistical Inference in Psychological Research (4) AWSp *G. Loftus, Rose, M. H. Smith* Hypothesis testing and its probabilistic and statistical basis. Development and application of statistical inference techniques employed in psychological research: t-test, analysis of variance, correlation and regression, and nonparametric statistics. Nature and control of experimental and inferential error in research. Required for majors in the psychology Bachelor of Science degree program or in the psychology honors or distinction programs. Prerequisite: 217.

PSYCH 222 Survey of Physiological Psychology (3) AWS *Diaz, Douglas, Simpson* The brain and how it works. Learning, memory, sleep, the senses, and the emotions. For students who do not intend to specialize in physiological psychology. Prerequisite: major standing in a biological science or either 101 or 102.

PSYCH 231 Laboratory in Human Performance (3) AWSpS *G. Loftus* Selected aspects of human learning, perception, and performance. Prerequisites: 209 and 213 or 217.

PSYCH 232 Laboratory in Animal Learning (3) AWSpS Selected aspects of animal learning emphasizing operant techniques with the rat. Prerequisite: 209.

PSYCH 233 Laboratory in Animal Behavior (5) AWSp *Barash* Experience with a variety of animal species and experimental procedures and instrumentation. Prerequisites: 101 or 102, 209, and 200 or BIOL 212, or equivalents.

PSYCH 250 Racism and Minority Groups (4) Problems of racism and their effects upon minority groups, with emphasis on the conditions related to the development of mental health. Emphasis on the situation of the Black, Chicano, American Indian, and Asian groups.

PSYCH 257 Psychology of Sex Differences (5) A *Kenney* Major psychological theories of sex-role development; biological and environmental influences that determine and maintain sex differences in behavior; roles in children, sex differences in aggression, cognitive abilities, achievement motivation, affiliation, and sexuality. Offered jointly with WOMEN 257. Recommended: 101 or 102. Not open for credit to students who have taken GIS 244.

PSYCH 260 Psychological Aspects of Poverty and Affluence (4) *Lumsdaine* Experience of poverty in various United States and world situations; psychological and socioeconomic causes of poverty; attitudes and motives of both the poor and the more affluent; psychological and socioeconomic factors in world hunger and poverty in developing nations. Recommended: 101 or 345.

PSYCH 304 Issues and Concepts in Community Psychology (4) *P. Lunneborg* Community mental health, epidemiology, program evaluation, and social ecology; research, theory, and practice in community settings; the influence of community-environmental factors in individual functioning and their utilization to promote mental health. Prerequisite: 10 credits in psychology.

PSYCH 305 Deviant Personality (5) AWSpS *Jacobson, Kohlenberg, I. Sarason* Psychopathology; analysis of forms, nature, and causes of disorders of behavior and personality. Prerequisite: 10 credits in psychology, including 101 or 102, or equivalent.

PSYCH 306 Developmental Psychology (5) AWSpS *Dale, Greenberg* Analysis of psychological development of the child in relation to biological, physical, and sociological antecedent conditions from infancy to adolescence. Prerequisite: 101 or 102, or equivalent.

PSYCH 322 Introduction to Drugs and Behavior (3) A *Diaz* Basic concepts of drug action emphasizing the behavioral consequences of the intake of a variety of drugs. Prerequisite: 222.

PSYCH 345 Social Psychology (5) AWSpS *Davidson, Steele* Effects of the social environment upon the formation of individual attitudes, values, and beliefs, and upon individual and group behavior; major theoretical approaches; field and experimental research findings. Prerequisite: 101 or 102, or equivalent.

PSYCH 350 Honors Research Seminar in Psychology (2-, max. 5) AWSp *Teller* Presentations by professors and advanced honors or distinction students concerning the rationale, methodology, and progress of their research projects. Required quarterly for all junior honors and distinction candidates in conjunction with 498 and 499. Prerequisites: 231 and 232 or 233, or equivalents, and permission of departmental honors adviser.

PSYCH 355 Survey of Cognitive Psychology (5) AW *Hunt, E. Loftus* Current theory and research in perception, attention, memory and learning, attitudes, thinking and decision making, and language. For the student who wishes a survey or who intends additional work in any of the above content areas. Prerequisite: 10 credits in psychology, including an introductory course.

PSYCH 357 Psychobiology of Women (5) W *Kenney* Physiological and psychological aspects of women's lives; determinants of biological sex; physiological and psychological events of

puberty; menopause; sexuality; contraception; pregnancy, childbirth, and lactation; role of culture in determining psychological response to physiological events. Not open for credit to students who have taken GIS 357. Offered jointly with WOMEN 357.Prerequisite: 257 or WOMEN 257 or permission of instructor.

PSYCH 361 Laboratory in Social Psychology (5) *Keating* Practice and discussion of methods of systematic observation, content analysis, laboratory and field experimental manipulation in social psychology; individual research projects. Prerequisites: 209, 213 or 217, 345, and major standing.

PSYCH 400 Learning (5) Sp *Bolles, M. H. Smith* Experimental research and basic theories primarily in animal learning. Prerequisite: 101 or 102.

PSYCH 403 Motivation (5) WSp *Bolles, M. H. Smith* Theory and research on reinforcement, punishment, frustration, preference, instinctual mechanisms, and other factors controlling animal behavior. Prerequisite: 101 or 102.

PSYCH 405 Advanced Personality: Theory and Research (5) *I. Sarason* Intensive survey of theoretical concepts and detailed review of experimental methods and experiments in the field of personality. Prerequisite: 205 or equivalent.

PSYCH 406 Instrumentation for Behavioral Scientists (5) *Pagano* Intensive laboratory for basic and advanced training in complex electronic instrumentation in current use; psychophysiological recording and biofeedback employing research-caliber equipment; basic electricity, test instruments (oscilloscope and digital multimeter), power supplies, amplifiers, digital logic (TTL), and psychophysiological recording. Prerequisites: senior standing, high school physics, and permission of instructor.

PSYCH 407 History of Psychology (5) W *Bolles* Historical and theoretical background of the basic assumptions of modern psychology, including such doctrines as behaviorism, determinism, and associationism and the scientists who developed them. Prerequisite: 400 or equivalent.

PSYCH 409 Sociobiology (4) WSp *Barash, Beecher, Fischer* Biological bases of social behavior, emphasizing evolution as a paradigm: individual *vs.* group selection, kin selection, altruism, group versus individual living, mating systems, parental care of offspring, and competitive strategies. Offered jointly with ZOOL 409. Prerequisites: 200 or BIOL 211 and 212, or equivalent.

PSYCH 410 Deviant Development (5) *Attneave* Developmental deviations, sensory-motor handicaps, mental retardation, brain injury and emotional disturbances. Particularly for students interested in advanced work in clinical psychology or special education. Prerequisites: 305 and 306, or equivalents.

PSYCH 411 Perceptual Development (5) Sp *Teller* Origins of perception in human infancy and childhood, development of visual acuity, color vision, form perception; auditory capabilities and speech sounds; perception of three-dimensional space; origins of perceptual deficits. Includes relevant animal research data. Prerequisite: upper-division or graduate standing.

PSYCH 412 Behavior Genetics (5) Empirical research with animals and humans. Basic transmission genetics, evolutionary theory, population genetics, and quantitative models; human behavior genetics, normal and abnormal social behavior, intellectual performance, sex differences, prenatal diagnosis and genetic counseling, and ethical considerations in behavior genetic research. Prerequisite: GENET 351 or 451 or equivalent.

PSYCH 413 Developmental Psychobiology (3) W *Bernstein* Neural basis of behavioral development in normal and abnormal manifestations; relationship between structure and function in the nervous system; brain development and effects of prenatal and postnatal experiences on the brain and behavior. Prerequisite: 222 or 421 or 422 or equivalent.

PSYCH 414 Cognitive Development (5) ASp *Daly* Key theoretical approaches to cognitive development from infancy through adolescence. Object permanence, language development, imitation, logical reasoning, moral development, intelligence and educational implications. Prerequisite: 306.

PSYCH 415 Socialization of the Child (5) *Greenberg* Socialization theory and research; infant social relationships; development of aggressive and altruistic behaviors; sex-role development; moral development; parent and adult influences; peer influences; media influences; social class and cultural influences. Prerequisite: 306.

PSYCH 416 Animal Behavior (5) A,W or Sp *Fischer* Analysis of laboratory experiments, field investigations, and current theory of the behavior of animals from protozoa to man; theoretical accounts of selected problems. Prerequisite: 200 or 233 or 10 credits in biology or zoology.

PSYCH 417 Human Behavior as a Natural Science (5) W *Lockard* Analysis of animal social systems in comparative perspective; communication systems and adaptive significance of the social structure; human social behavior from an ethological viewpoint. Prerequisite: 200 or 409 or 416, or ZOOL 409.

PSYCH 418 Primate Social Behavior (5) Sp *Lockard* Social structures and behaviors of New and Old World primates. Prerequisite: 200 or 409 or 416, or ZOOL 409, or equivalents.

PSYCH 419 Behavioral Studies of Zoo Animals (4, max. 8) AWSpS *Beecher* Observational studies of behavior of zoo animals to expand basic knowledge of animal behavior and research methodology with discussions and tours focusing on zoo philosophy and operations. Offered in cooperation with Woodland Park Zoo. Prerequisites: 200 and permission of instructor.

PSYCH 420 Drugs and Behavior (3) W *Diaz* Animal and clinical research on the behavioral consequences of drug intake. Prerequisite: 322 or permission of instructor.

PSYCH 421 Neural Basis of Behavior (5) ASp *Diaz, Simpson* Anatomical and physiological principles and resultant behavior involved in the integrative action of the nervous system. Prerequisites: 101 or 102, and 10 credits in biology or zoology.

PSYCH 422 Physiological Psychology (5) WSp *Douglas* Physiological mechanisms in behavior, including those basic to emotion, fatigue and sleep, learning, and memory. Prerequisite: 101 or 102, or equivalent.

PSYCH 423 Sensory Basis of Behavior (5) Sp Sensory and perceptual phenomena; sensory equipment; theories of sense-organ function. Prerequisites: 101 or 102 or some physical or biological science background.

PSYCH 424 Vision and Its Physiological Basis (5) A *Teller* Phenomena of human vision: spectral sensitivity, color vision, acuity and spatial vision, light and dark adaptation, and binocular vision. Correlation of human visual functioning with known optical, biochemical, physiological, and anatomical substrates. Offered jointly with P BIO 424. Recommended: some background in physical or biological science.

PSYCH 425 Surgical and Histological Techniques (5) Sp *Woods* Practicum in basic and advanced surgical and histological techniques used in psychophysiological experimentation. Prerequisites: 421 and permission of instructor.

PSYCH 427 Behavioral Endocrinology (5) W *Woods* The endocrine system and how its secretions influence and are influenced by behavior; relationships between the nervous and endocrine systems. Prerequisites: 421 and two quarters of zoology, or permission of instructor.

PSYCH 429 Brain Anatomy for the Behavioral Scientist (1) ASp *Diaz* Detailed review of the neuroanatomical features of the sheep brain with laboratory demonstrations. Prerequisites: 421 or equivalent, or concurrent registration in 421, and permission of instructor.

PSYCH 430 Problems of Measurement in Psychology (5) *C. Lunneborg* Selection or development of instruments for the appraisal of individual or group differences in ability, achievement, interest, or opinion. Prerequisite: 213 or 217.

PSYCH 434, 435 Laboratory in Vision (2,3) Techniques of research in visual psychophysics: alignment and calibration of basic optical systems; replication of some classical vision experiments and/or design and completion of original vision experiments. Prerequisites: 424 and permission of instructor for 434; 434 and permission of instructor for 435.

PSYCH 440 Environmental Psychology (3) W *Keating* Research and methods of environmental psychology; development of research strategies to study psychological implications of environmental issues. Prerequisites: 101 or 102, and 345, or equivalent.

PSYCH 441 Perceptual Processes (5) Ways in which experience is organized; experimental and theoretical treatment of perceptual aspects of sensory modalities; relations between physical and psychological dimensions, nonstimulus determiners of the perceived world, and mediational feedback. Prerequisite: 101 or 102, or equivalent.

PSYCH 442 Measurement and Design in Attitude Research (5) A or W *Davidson* Major problems of research design and measurement in studies of attitude formation and change; design of procedures for laboratory and field experiments employing both traditional and more recent approaches to measurement of attitudes, beliefs, etc. An attitude-measurement or -change project required. Prerequisites: 213 or 218, and 345, or equivalents.

PSYCH 443 Evaluation of Social Programs: Psychological Perspectives (3) W *Davidson* Major issues involved in the evaluation of social programs from the areas of mental health, education, law and justice, and family planning: formulation of program goals, selection of research designs, measurement of outcomes, and interpretation and utilization of research findings. Prerequisites: 213 or 217; upper-division and graduate students only.

PSYCH 444 Attitude Change and Persuasive Communication (3) *Lumsdaine* Factors that influence attitude change; message variables in persuasive communications and experiments to measure their effects on opinions, attitudes, and associated behavior. Development of skills to interpret, criticize, and apply experimental results. Prerequisites: 345 and 209 or 213, or equivalents.

PSYCH 445 Theories of Social Psychology (5) W *Steele* Evaluation of the major theories of human social behavior supported by the empirical literature; theories of social cognition and thought; major theories of social interaction, group processes, and social learning. Prerequisites: 345 or equivalent.

PSYCH 446 Objective Assessment of Personality (3) A *R. Smith* Methods and techniques of observing and measuring personality variables. Problems of research design in personality and social psychology. Extra credit may be earned for research activity by registering concurrently in 499 with the permission of the instructor. Prerequisite: elementary statistics or permission of instructor.

PSYCH 447 Psychology of Language (5) Psychological principles applied to linguistic development and organization; language in both its stimulus and response aspects. Prerequisite: 101 or 102, or equivalent.

PSYCH 448 Seminar in Psychology (1-15) AWSpS Selected research topics of contemporary interest. May be repeated for credit. Quarterly listings of specific offerings are available at departmental advisory office. Prerequisites: major standing and permission of instructor.

PSYCH 449 Organizational and Industrial Psychology (3) W *Fiedler* Research and methods in industrial-social psychology; application of social psychology to the behavior of individuals in large organizations and their subunits. Prerequisite: one course in elementary statistics or equivalent.

PSYCH 450- Honors Research Seminar in Psychology (2-, max. 6) AWSp *Teller* Design, execution, and writing of honors thesis, supervised by faculty sponsor and departmental honors adviser. Required quarterly for all senior honors and distinction candidates in conjunction with 498 and 499. Prerequisites: 231 or 361 and 232 or 233, or equivalents, three quarters of 350, and permission of departmental honors adviser.

PSYCH 457 Language Development (4) A or Sp *Dale* First-language acquisition and use by children. Emphasis on theoretical issues and research techniques. Offered jointly with LING 447. Prerequisite: 306 or LING 400.

PSYCH 461 Human Learning (5) Current theoretical and experimental literature.

PSYCH 462 Human Memory (5) *Nelson* Current theoretical and experimental literature.

PSYCH 463 The Pathology of Human Memory (5) Sp *M. H. Smith* Effects of brain damage on human memory; comparison of observed kinds of losses with current theories of memory: amnesia and other impairment of intellectual functions (aphasia, agnosia, apraxia) as they relate to memory. Prerequisite: 421; recommended: 461 or 462.

PSYCH 465 Intelligence in Psychology (3) *Hunt, C. Lunneborg* Historical and contemporary treatments of the concept of intelligence by psychology; evolution and validity of techniques for assessment; biological and environmental issues in assessment; intelligence and personality; experimental and psychometric indicators of the future role of intelligence in psychology. Prerequisite: 15 credits in psychology, including one statistics course.

PSYCH 466 Information Processing (4) *Hunt* Human thought as a phenomenon to be described by formal models. Current theories and experimental studies of rational information processing; emphasis on how man notices, recognizes, remembers, and recalls information used in rational problem solving; theoretical models of attention, memory, and recall; cognitive models of rational problem solving. Prerequisite: 231 or 355, or equivalent.

PSYCH 475 Computing in Behavioral Sciences (5) *Hunt, G. Loftus* Application of computers to research problems in the behavioral and social sciences; functional and performance characteristics of batch processing, interactive and control systems; computing languages; methods of data processing, control of experiments, and automated instruction. Prerequisites: upper-division or graduate standing in behavioral or social sciences, some knowledge of statistics and computer programming, or permission of instructor.

PSYCH 489 Clinical Psychology (3) *Attneave* Basic issues, methods, and research: professional issues, psychological assessment, and approaches to psychotherapy and behavioral change. Prerequisites: 205 and 305, and upper-division major standing.

PSYCH 490 Stress Management (3) W or Sp,S *Pagano* Nature of stress, physiological responses to stress and relaxation, stress and physical illness, techniques of stress management with training in relaxation and cognitive restructuring skills. Prerequisites: 101 or 102 and 213 or 218, or equivalents.

PSYCH 495 Law and Social Science (4) Sp *Loh* Uses and limits of social science in the law-making process on appeal and the fact-finding process at trial. Critical perspectives on the role of social science, especially social psychology, in adjudication. Instruction by use of case method, socratic questioning, and discussion. Readings in judicial opinions, jurisprudential essays, and empirical research reports. Offered jointly with LAW 495. Prerequisite: upper-division or graduate standing.

PSYCH 497 Undergraduate Fieldwork (1-3, max. 18) AWSpS *P. Lunneborg* Individual consultation with faculty member and supervised practicum experience in a broad range of community settings and agencies dealing with psychological problems. An overall maximum of 18 credits in 497, 498, and 499 may apply toward a baccalaureate degree. Prerequisites: junior or senior major standing and permission of instructor.

PSYCH 498 Readings in Psychology (1-3, max. 18) AWSpS Readings in special interest areas under supervision of departmental faculty. Discussion of reading in conference with the instructor. An overall maximum of 18 credits in 497, 498, and 499 may apply toward a baccalaureate degree. Prerequisite: permission of a supervising psychology faculty member.

PSYCH 499 Undergraduate Research (1-3, max. 18) AWSpS Design and completion of individual research projects. An overall maximum of 18 credits in 497, 498, and 499 may apply toward a baccalaureate degree. Prerequisites: 213 or 217, and permission of a supervising psychology faculty member.

Courses for Graduates Only

PSYCH 503 Advanced Social Psychology (4) A *Fiedler* Evaluation of current theories and research in social psychology, including attitude and opinion research; interpersonal perception and social relations; small-group and leadership processes; attribution theory. Prerequisites: 213, 345, or equivalents; open to advanced undergraduates with permission of instructor.

PSYCH 504 Biological Basis of Development (4) A *Bernstein* Embryological, genetic, physiological, and evolutionary perspectives of human development; biological development in infancy; sensory development and its influence on the development of perception; primate models for human development. First quarter of a three-quarter proseminar required for graduate majors in developmental psychology. Prerequisite: graduate standing or permission of instructor.

PSYCH 505 Cognitive and Linguistic Development (4) W *Dale* Biological, Piagetian, and information-processing perspectives on cognitive and language development through the lifespan. Second quarter of a three-quarter proseminar, required for graduate majors in developmental psychology. Prerequisite: graduate standing or permission of instructor.

PSYCH 506 Personality and Social Development (4) Sp *Greenberg* Theories and empirical literature in personality and social development throughout infancy, childhood, and adulthood. Third quarter of a three-quarter proseminar required for graduate majors in developmental psychology. Prerequisite: graduate standing or permission of instructor.

PSYCH 507 Developmental Psychology: Historical and Philosophical Perspectives (4) *Dale* Origins and development of developmental psychology and the philosophy of science. Prerequisite: graduate standing in psychology or permission of instructor.

PSYCH 508 Research Methods in Social Psychology (3) Sp *Steele* Examination and evaluation of research problems most typically encountered by social psychologists, and various types of research settings, factors relevant to the validity of experiments. Prerequisite: 514 or equivalent.

PSYCH 509 Leadership and Organizational Effectiveness (3) Sp *Fiedler* Current leadership and management theory: leadership selection, training, and implications for the effective management of groups and organizations. Prerequisites: one undergraduate course in statistics; advanced undergraduates with permission of instructor.

PSYCH 510 Advanced Attitude Change Theory (3) *Lumsdaine* Theoretical and experimental work dealing with major concepts and hypotheses about factors influencing attitude and associated behavioral change. Critical evaluation of theories in the light of current research. Prerequisites: 503 or 444, and 508 or 442, or equivalents.

PSYCH 511 Personality Research (3) *I. Sarason* Review of major areas of personality research, their methodologies, and their relationships to theoretical formulations and issues. Prerequisite: graduate major standing or permission of instructor.

PSYCH 513 Probability Theory and Nonparametric Statistics (4) A *Nelson, Rose* Basic concepts of measurement and probability as applied to design of psychological experiments. Statistical tests appropriate for simple experimental designs using ordinal, nominal, or interval data. Required for all first-year graduate students in psychology; may be challenged by examination at beginning of each academic year. Prerequisite: graduate standing or permission of instructor.

PSYCH 514, 515 Experimental Design (3,3) W,Sp *Hunt, Jacobson, G. Loftus, C. Lunneborg, Nelson, Rose* Design of experiments and analysis of experimental data in the behavioral sciences. 514 required of all first-year graduate majors. Prerequisites: elementary statistics and 513, or permission of instructor for 514; 514 for 515.

PSYCH 516 Introduction to Theory of Educational and Psychological Tests (3) A *Sax* Theory of measurement; examination of assumptions involved in test theory, errors of measurement, factors affecting reliability and validity, and problems of weighting. Taught with EDPSY 592. Prerequisites: 213 or 217, and permission of instructor.

PSYCH 517 Psychophysics and Fundamental Measurement (3) Sp *Rose* Application of mathematics (drawn from set theory, finite mathematics, and probability theory) in the areas of measurement and psychophysics. Open to undergraduates with permission of instructor. Prerequisite: 514 or equivalent.

PSYCH 518 Single Subject Design and Research (3) Sp *Kohlenberg* Single subject designs (reversal, multiple baseline, changing criterion), and their application to clinical cases. Prerequisite: graduate major standing in clinical psychology or permission of instructor.

PSYCH 519 Statistical Methods in Longitudinal Research (3) Sp *Greenberg, Sackett* Those aspects of statistics and experimental design unique to, or heavily used in, developmental research; behavioral observation methods, analysis of variance and nonparametric techniques, and time series analysis methods. Prerequisites: 514 or equivalent, and graduate standing.

PSYCH 522 Cognitive Perception (3) *G. Loftus* Current topics in perception, psychophysics, sensory memory, pattern recognition, letter and word perception, and visual masking. Prerequisites: 441 and 517, or permission of instructor.

PSYCH 523 Cognition (4) *Hunt* Problem solving, concept learning, individual differences in cognition, attention, and pattern recognition; computer simulation and mathematical models of cognitive phenomena. Prerequisites: graduate standing and completion of departmental mathematical and statistical requirement through 514.

PSYCH 524 Cognitive Approaches to Human Memory (4) *Nelson* Theories and behavioral data base of perceptual memory; short-term memory; acquisition, organization, and retention of information in long-term memory; relation between reinforcement and memory. Prerequisites: 462 and 522, or equivalents.

PSYCH 525 Assessment of Intelligence (5) A *Vance* Nature of intelligence issues in assessment of intelligence, test construction and evaluation of the adequacy of tests, training in administration, scoring, and interpretation of individual intelligence tests. Prerequisite: graduate major standing in clinical or child-clinical psychology, or minor standing in child-clinical psychology.

PSYCH 526 Psychological Assessment of Children (5) W *Perry* Assessment techniques appropriate to children, including those for infants, special problems of preschool and school-age children; projective tests, family interviews, and target observational assessment; training in administration of selected techniques. Prerequisites: 525 and permission of instructor.

PSYCH 527 Psychological Assessment of Adults (3) W *Broedel* Training in adult assessment and development of skills in administration, scoring, and interpretation of the Rorschach, TAT, and draw-a-person tests. Prerequisites: 525 and permission of instructor.

PSYCH 528 Decision Processes (3) A *Beach* Literature on predecisional diagnosis of environmental states relevant to subsequent decisions; models for decisions and relevant evidence for decisions. Open to undergraduates with permission of instructor. Prerequisite: 218 or equivalent.

PSYCH 534 Foundations of Psychological Research (3) *Nelson* Interpretation of psychological research results, related issues from the philosophy of science, and nonstatistical pitfalls in psychological research. Prerequisite: 513.

PSYCH 535 Approaches to Psychological Assessment (4) Sp *Friedrich* Problem-solving approach to psychological assessment; review of psychological tests and procedures and presentation of approaches to their clinical interpretation and use. Required for all graduate students majoring in clinical and child-clinical psychology. Prerequisite: graduate major standing in clinical psychology.

PSYCH 536 Behavioral Assessment (4) *Linehan* Research, theory, and technique in behavioral assessment. Emphasis on assessing for change and relationship between assessment and therapy. Interviewing, observational techniques, self-monitoring, simulated environments, and physiological, self-report, and imaginal procedures. Prerequisites: clinical psychology graduate standing and permission of instructor.

PSYCH 538 Systems of Psychotherapy (3) A *Marlatt* Theory and research of major systems of psychotherapy, including the psychodynamic, behavioral, cognitive, and humanistic/transpersonal schools as an introduction to subsequent practica in clinical psychology. Required for all graduate students majoring in clinical psychology. Prerequisites: graduate major standing in clinical psychology and permission of instructor.

PSYCH 539 Interviewing and Case Formulation (2, max. 6) W *Becker, Carlin, Thorpe* Emphasis on learning interviewing skills and content to administer such recent psychodiagnostic procedures as DSM III and the research diagnostic criteria. Case formulation and presentation and treatment planning . For graduate students in psychology, nursing, social work, and anthropology, and for advanced medical students. Offered jointly with PBSCI 539.

The content of each graduate seminar (numbered 540 through 560) offered by the department changes from quarter to quarter. A list of offerings is published each quarter and can be obtained from the Department of Psychology.

PSYCH 540 Seminar in Clinical Psychology (2) *Attneave, Becker, Broedel, Friedrich, Jacobson, Kohlenberg, Linehan, Marlatt, Perry, E. Robinson, Sarason, R. Smith* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 541 Seminar in Cognitive Processes (2) *Hunt, E. Loftus, G. Loftus, Nelson* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 542 Seminar in Animal Behavior (2) *Barash, Beecher, Fischer, Lockard* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 543 Seminar in Developmental Psychology (2) *Greenberg, P. Lunneborg* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 544 Seminar in Experimental Psychology (2) May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 546 Seminar in Learning (2) *Bolles* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 547 Seminar in Motivation (2) *Bolles* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 548 Seminar in Perceptual Processes (2) May be repeated for credit. Prerequisites: 441 and permission of instructor.

PSYCH 549 Seminar in Physiological Psychology (2) *Diaz, Douglas, Kenney, Samson, Simpson, M. H. Smith, Teller, Woods* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 550 Seminar in Psycholinguistics (2) *Dale* May be repeated for credit. Prerequisites: 447 and permission of instructor.

PSYCH 551 Seminar in Psychophysics (2) *Teller* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 552 Seminar in Quantitative Techniques (2) *Hunt, C. Lunneborg, Nelson, Rose* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 553 Seminar in Social Psychology (2) *Davidson, Fiedler, Keating, Steele* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 554 Seminar in Decision Processes (2) *Beach* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 559 Seminar in Current Research in Vision (1) AWSpS *Teller* May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 560 Seminar (*) AWSp May be repeated for credit. Prerequisite: permission of instructor.

PSYCH 567 Syntactic and Semantic Development (3) A *Dale* Selected topics of child language (e.g., cognitive basis of language, early semantic systems, development in language-handicapped children). Topics vary. Offered jointly with LING 567. Prerequisites: one course in child language development and permission of instructor.

PSYCH 570 Child Clinical Psychology (4) A *Perry* Issues and content of child clinical psychology, integration of field experiences with content and research, promotion of student's beginning work in research. Prerequisite: graduate major or minor standing in child-clinical psychology.

PSYCH 571 Child Psychopathology and Behavior Change (5) W *Friedrich* Major theories and research literature of childhood disorders. Principal treatment modalities appropriate to children and families. Required for all graduate students majoring in child clinical psychology. Prerequisite: graduate standing in psychology or permission of instructor.

PSYCH 572 Approaches to Child Treatment (4) Sp *E. Robinson* Major approaches to child psychotherapy, including specific applications, issues in treatment, and research. Includes case assignment and supervision. Prerequisites: 526 and graduate major standing in child-clinical psychology, or permission of instructor.

PSYCH 575 The Family Process (3) *Attneave* Structures, relationships, and interactions within the family. Follows a developmental sequence based on the human life cycle, with two or more generations in synchrony. Prerequisites: second-year graduate major standing in clinical psychology and permission of instructor.

PSYCH 576 Intervention Techniques With Families (3) *Attneave* Theory and practice of principal methods of therapeutic intervention with families. Attention to clinical problems arising in a family context and use of family members and processes by the clinician. Prerequisites: 592 and 593 or equivalent and permission of instructor.

PSYCH 577 Theory and Application of Social Network Intervention (3) Sp *Attneave* Interdisciplinary analysis of social networks and community mental health applications; natural support systems, cross-cultural implications and clinical interventions; practical considerations of program support and development; ethical issues; research design and participation. Prerequisites: advanced graduate standing in psychology or related disciplines; permission of instructor. Recommended: some background in family therapy.

PSYCH 578 Affective Disorders: Theory and Research (2) *Becker* Causes, sustainers, correlates, and consequences of affective disorders, including biological and psychosocial factors. Offered jointly with PBSCI 578. Prerequisite: graduate or professional student standing or permission of instructor. Recommended: graduate course in psychopathology and personality.

PSYCH 579 Treatment of Affective Disorders: Methods and Evaluation (2) *Becker* Differential diagnosis of depression and depressive subtypes; emphasis on psychodynamic, cognitive-behavioral, and combined forms of psychological treatment of less severely incapacitated patients; biological approaches (i.e., antidepressant drugs, electroconvulsive therapy, etc.) as alternative or adjunctive treatments in severe, psychotic, and endogenous-like depressions. Offered jointly with PBSCI 579. Prerequisites: 578, graduate or professional student standing or permission of instructor. Recommended: graduate course in psychopathology and personality.

PSYCH 585 Research in Psychotherapy (5) *Marlatt* Research in psychotherapy, including process and outcome. Experience in research design. Prerequisites: graduate major standing and permission of instructor.

PSYCH 590 Practicum in Psychological Assessment (2) Sp *Friedrich* Demonstration and practice of selected psychological test procedures and interviewing skills. Concurrent registration in 535 required. Required for all first-year graduate students majoring in clinical and child-clinical psychology. Prerequisites: graduate major standing in clinical or child-clinical psychology and permission of instructor.

PSYCH 591 Issues in Clinical Psychology (1, max. 3) AWSp *E. Robinson, R. E. Smith* Personal and professional issues in clinical psychology. Required for all first-year graduate students majoring in clinical and child-clinical psychology. Prerequisite: graduate major standing in clinical psychology.

PSYCH 592, 593 Clinical Methods (1-6, max. 6; 1-6, max. 6) AWSpS,AWSpS *Friedrich, E. Robinson, R. E. Smith, Vance* Advanced training in the application of psychological assessment and behavior change methods. Required for all second-year graduate majors in clinical psychology. Must be taken in sequence. Prerequisites: 591, graduate major standing, and permission of instructor.

PSYCH 594 Advanced Personality Theory (5) A *Linehan* Broad range of personality theories and conceptual models of behavioral functioning with emphasis on application to the development, maintenance, and change of behavior. Required of all graduate students majoring in clinical psychology. Prerequisites: 405 and permission of instructor.

PSYCH 595 Behavior Disorders (5) W *I. Sarason* Major types of behavior disorders, with emphasis on clinical manifestations, relevant research, and theoretical perspectives. Required for all graduate students majoring in clinical psychology. Prerequisite: graduate major standing in clinical psychology or permission of instructor.

PSYCH 596 Psychology of Behavior Change (5) Sp *Jacobson, Kohlenberg* Behavioral theory and behavioral approaches to treatment. Prerequisites: 595 and permission of instructor.

PSYCH 597 Fieldwork in Clinical Psychology (1-5, max. 36) AWSpS *Attneave, Becker, Broedel, Friedrich, Jacobson, Kohlenberg, Linehan, Marlatt, Perry, E. A. Robinson, N. M. Robinson, I. Sarason, R. Smith, Vance* Prerequisites: second-year graduate major standing and permission of departmental faculty.

PSYCH 598 Advanced Clinical Practicum (4) AWSpS *Friedrich, Jacobson, Kohlenberg, Perry, E. Robinson, I. Sarason* Supervised psychotherapy involving several individual clients. Separate consultations with instructor for intensive supervision of each case. Occasional meetings in small groups of instructors and students to discuss case material. Assigned readings appropriate to each case with opportunities to discuss these with instructor. Prerequisites: clinical psychology graduate standing and permission of instructor.

PSYCH 599 Readings in Psychology (*) AWSpS Selected topics. Prerequisite: permission of a supervising psychology faculty member.

PSYCH 600 Independent Study or Research (*) AWSpS

PSYCH 700 Master's Thesis (*) AWSpS

PSYCH 800 Doctoral Dissertation (*) AWSpS

Romance Languages and Literature

C104 Padelford

The department offers a program designed to develop competence in the reading, speaking, and writing of the Romance languages (French, Spanish, Italian, Portuguese, Catalan, Provençal, Romanian) and to study Romance literatures, culture, and linguistics.

Undergraduate Program

Bachelor of Arts Degree

MAJOR REQUIREMENTS

French: 59 credits beyond FREN 203. Required courses at the 300 level: FREN 301, 302, 303; 304, 305, 306; 350, 351, 352. Four approved electives in French at the 400 level: any four courses numbered 400-499 (except courses in translation) and ROM 401 may be used to satisfy this requirement. The department does not accept transfer courses at the 400 level or courses in translation.

Spanish: 56 credits in courses at the 300 and 400 levels, including SPAN 301, 302, 304, 305, 306, 307; 350, 351, 352; 25 credits, none of which may be transfer credits, of courses numbered 400 or higher.

Italian: 50 credits in courses at the 300 and 400 levels, including ITAL 301, 302, 303; 6 credits of 327; 401; 404, 405, 406; 15 additional credits in literature courses at the 400 level.

Romance Linguistics: For admission, two college years (or equivalent) of study in each of two Romance languages. For graduation: 20 credits in third-year language courses in two Romance languages (recommended distribution: 10 credits each); 15 credits in literature, including a complete survey sequence at the 300 level; two 400-level courses in language structure; ROM 401 and 402; SPAN or FREN 474; a senior essay (2 credits). Recommended electives: general linguistics courses. Majors must begin course work in Romance and general linguistics by start of junior year.

Graduate Program

W. Victor Wortley, Graduate Program Coordinator

The Department of Romance Languages and Literature offers programs of graduate study leading to the degrees of Master of Arts and Doctor of Philosophy. Students may specialize in French, Italian, or Spanish languages and literature or in Romance linguistics.

The Master of Arts degree may be with thesis or without thesis and may have either of two main areas of specialization: language and literature or Romance linguistics.

Doctoral programs are offered in the following fields of specialization: Romance literature, Romance linguistics, and French or Spanish language and literature. Students specializing in a single Romance literature devote at least two-thirds of their course work to the field of specialization. In all programs, some training in basic principles of the nature of language and in bibliographic method is required.

The doctoral program in Romance literature allows a flexible combination of two or more Romance literatures. At least half the post-M.A. credits must constitute a major area within one of the departmental literary sections: French, Spanish, or Italian.

In collaboration with the University of Hawaii—Hilo, the department publishes *Papers in Romance*, an interdisciplinary scholarly journal devoted to Romance literature, civilization, and linguistics. Advanced graduate students collaborate with the faculty in editing this journal.

Special Requirements

Information on special requirements for the various degree programs is available upon request from the office of the graduate program coordinator.

Financial Aid

The department awards annually a number of teaching assistantships. The assistant normally participates in teaching three classes during the academic year. Each class is limited to approximately twenty-five students and meets five hours a week for the ten weeks of the quarter. The supervisors of language instruction meet with the assistants separately and in groups to discuss matters of teaching.

Correspondence and Information

Graduate Program Coordinator
C109 Padelford, GN-60

Faculty

Chairperson

Victor E. Hanzeli

Professors

Christofides, Constantine G.,* (Art History, Comparative Literature),† Ph.D., 1956, Michigan; seventeenth-century French literature; Romanesque art.

Contreras, Heles,‡ Ph.D., 1961, Indiana; Romance linguistics.

Creore, Alvin (Emeritus), Ph.D., Johns Hopkins; sixteenth-century poetry, phonetics, *chanson.*

Friedman, Lionel J.,* Ph.D., 1950, Harvard; medieval French literature.

Hanzeli, Victor E.,* Ph.D., 1961, Indiana; Romance linguistics and eighteenth-century French literature.

Keller, Abraham C.,* Ph.D., 1946, California (Berkeley); sixteenth-century French literature.

Klausenburger, Jurgen,* Ph.D., 1969, Michigan; Romance linguistics.

Leiner, Jacqueline (Emeritus), (Comparative Literature),† Dr. es Lettres, 1969, Strasbourg (Germany); modern French literature.

Nostrand, Howard L. (Emeritus), Docteur, 1934, Paris; French culture and civilization.

Pace, Antonio (Emeritus), Ph.D., 1943, Princeton; Italian language and literature.

Penuelas, Marcelino C.,* Ph.D., 1949, Madrid; eighteenth-century Spanish literature, contemporary Spanish literature.

Predmore, Michael P.,* Ph.D., 1964, Wisconsin; twentieth-century Spanish poetry, literary criticism.

Salinero, Fernando G.,* Ph.D., 1963, Madrid; medieval Spanish literature.

Saporta, Sol,* (Linguistics),† Ph.D., 1955, Illinois; Romance linguistics.

Wilson, Clotilde M. (Emeritus), Ph.D., 1931, Washington; French language and literature.

Wilson, William C. (Emeritus), Ph.D., 1928, Washington; Spanish language and literature.

Associate Professors

Anderson, Farris F.,* Ph.D., 1968, Wisconsin; nineteenth- and twentieth-century Spanish literature.

Dale, Robert C.,* Ph.D., 1963, Wisconsin; nineteenth-century French literature; cinema.

Ellrich, Robert J.,* (Comparative Literature),† Ph.D., 1960, Harvard; eighteenth-century French literature.

Friedrich, Pia,* Ph.D., 1946, Universita degli Studi (Italy); pedagogy and twentieth-century Italian literature.

Petersen, Suzanne H.,* Ph.D., 1976, Wisconsin; medieval Spanish literature.

Shipley, George A.,* Ph.D., 1968, Harvard; Spanish Golden Age.

Simpson, Lurline V. (Emeritus), Ph.D., 1949, Washington; French language and literature.

Vargas-Baron, Anibal (Emeritus), Ph.D., 1943, Washington; Spanish language and literature.

Wortley, W. Victor,* Ph.D., 1964, Oregon; seventeenth-century French theatre and prose (nonfiction).

Yarbro-Bejarano, Yvonne M.,* (Comparative Literature),† Ph.D., 1976, Harvard; sixteenth- and seventeenth-century literature of Spain.

Assistant Professors

Collins, Douglas P.,* Ph.D., 1978, Missouri; twentieth-century French literature.

Cosse, Romulo,* Ph.D., 1966, Institute de Profesores "Artigas" (Uruguay); Spanish languages and Latin America literature.

Flores, Lauro H.,* Ph.D., 1980, California (San Diego); Chicano literature, contemporary Latin-American literature (narrative).

Lecturer

Dillman, Karin J., Ph.D., 1983, California (San Diego); French language and nineteenth-century poetry.

Course Descriptions

Courses in English translation appear at the end of the listing of courses for undergraduates.

Courses for Undergraduates

Romance Literature

ROMAN 200 Classics in Romance Literature (5) *Ellrich* Representative masterpieces from Italian, Spanish, and French literature in English translation.

Romance Linguistics and Literature, General and Comparative

ROM 401 Introduction to Romance Linguistics (5) *Hanzeli, Klausenburger* Descriptive analysis of the phonological, morphological, and syntactical structures of the modern Romance languages. Prerequisite: the equivalent of two college years of a Romance language, or permission of instructor.

ROM 402 Introduction to Romance Linguistics (5) *Klausenburger* Comparative historical survey of the development of the principal Romance tongues. Prerequisite: 401 or permission of instructor.

ROM 490 Senior Essay (2) *Hanzeli, Klausenburger* Essay on linguistic problem of student's choice written with faculty consultant.

ROM 499 Special Topics (1-5, max. 10) AWSpS Prerequisites: permission of instructor and undergraduate or graduate program adviser.

French

FREN 101, 102, 103 Elementary (5,5,5) AW,AWSp,AWSp Methods and objectives are primarily oral-aural. Oral practice in the language laboratory is required. Prerequisite for 102: 101 or college equivalent, or placement; for 103: 102 or equivalent, or placement.

FREN 105 Elementary Reading (5) Prepares graduate students for the language reading examination. Credit granted only to students who have received no previous credit in French. Students receiving credit in 105 may not later register for credit in 101. Offered through Independent Study by Correspondence only. Prerequisite: graduate standing or permission of instructor.

FREN 107 First-Year Reading (5) AS *Friedman* Development of vocabulary and skill in rapid reading of literary French. Cursory presentation of French grammar in English. Students receiving credit for 107 may subsequently earn credit for 100-level French courses involving other skills.

FREN 201, 202, 203 Intermediate (5,5,5) AW,AWSp, AWSp Systematic review of French grammar. Intensive practice in writing and conversation. Readings in literature, culture, and the sciences. Prerequisites: 103 or college equivalent or placement for 201; 201 or college equivalent or placement for 202; 202 or college equivalent or placement for 203.

FREN 207 Second-Year Reading (5) W *Friedman* Intermediate vocabulary building and reading of literary texts. Students receiving credit for 207 may subsequently earn credit for lower-numbered French courses involving other skills. Prerequisite: 107 or 103.

FREN 237 Conversational French (2-8, max. 8) For participants in the Foreign Study Program. Prerequisites: 103 or college equivalent and permission of Foreign Study Office.

FREN 241 Intensive (10) A Equivalent of 103 *and* 201. Review of basic grammar and development of speaking and reading skills. Students who have received credit for 103 or 201 may not receive credit for 241. Prerequisite: 102, or three years of high school French, or permission of instructor.

FREN 242 Intensive (10) A Equivalent of 202 *and* 203. Review of basic grammar and development of speaking and reading skills. Students who have received credit for 202 or 203 may not receive credit for 242. Prerequisite: 201 or equivalent or 241.

FREN 297 French Civilization (3 or 6) For participants in the Foreign Study Program. Literary tradition, social and cultural values as reflected in literature. Paper (in English) and higher degree of participation for 6 credits. In English. Prerequisites: two years of college French and permission of Foreign Study Office.

FREN 301, 302, 303 Advanced French (5,5,5) Prerequisites: 203 or college equivalent or placement for 301; 301 for 302; 302 for 303.

FREN 304 Survey of French Literature: Origins to 1600 (5) A *Ellrich* Thematic and formal developments in literature of the period with emphasis on movements and texts in relation to cultural background. Desirable preparation: at least one course in either the 301, 302, 303 series or the 350, 351, 352 series.

FREN 305 Survey of French Literature: 1600-1789 (5) W Emphasis on literary movements and texts in relation to cultural background. Desirable preparation: at least one course in either the 301, 302, 303 series or the 350, 351, 352 series.

FREN 306 Survey of French Literature: 1789 to the Present (5) Sp Development of modern literature through its most important writers and movements. Desirable preparation: at least one course in either the 301, 302, 303 series or the 350, 351, 352 series.

FREN 307 Third-year Reading (5) Sp *Friedman* Advanced vocabulary building and reading of literary texts. Students receiving credit for 307 may subsequently earn credit for lower-division French courses involving other skills. Prerequisite: 207 or 203.

FREN 308 Composition (3-5, max. 10) S For participants in the Foreign Study Program. Compositions on topical subjects of intermediate difficulty relating to the civilization of the French-speaking countries of Europe. Grammar review as needed. Prerequisites: 203 or college equivalent and permission of Foreign Study Office.

FREN 327 Advanced Conversation (2, max. 8) AWSp Not open to students whose native language is French. Prerequisite: 203 or college equivalent or placement.

FREN 337 Conversational French (2-8, max. 8) For participants in the Foreign Study Program. Prerequisite: 203 or college equivalent.

FREN 350 Drama (3) W Generic study of French drama. Prerequisite: 203 or college equivalent or placement.

FREN 351 Poetry (3) A Generic study of French poetry. Prerequisite: 203 or college equivalent.

FREN 352 Fiction (3) Sp Generic study of French fiction. Prerequisite: 203 or college equivalent.

FREN 378 The Making of Contemporary France, Studied in French (5) Study of the historical origins and subsequent development of contemporary problems and characteristics of French government and politics, economy, and society. Prerequisite: 203 or equivalent.

FREN 390 Supervised Study (2-6, max. 20) Prerequisites: permission of the instructor and the undergraduate French adviser.

FREN 397 French Civilization (3 or 6) S For participants in the Foreign Study Program. Literary tradition, social and cultural values as reflected in literature. Paper (in French) and higher degree of participation for 6 credits. In French. Prerequisites: two years of college-level French and permission of Foreign Study Office.

FREN 400 The Syntactic Structure of French (5) *Hanzeli, Klausenburger* Scientific study of the syntax of French: phrase structures and transformations (emphasis on passives, relativization, pronominalization, reflexive structures). Prerequisites: ROM 401 or LING 200 or 400, and two years of college-level French.

FREN 401 The Morphological Structure of French (5) *Hanzeli, Klausenburger* Linguistic study of French morphology. Prerequisite: ROM 401 or LING 400.

FREN 402 The Phonological Structure of French (5) *Hanzeli* Scientific study of the French sound system with special emphasis on "lower level" phonetic rules, with integral values. Focus on data from standard French as well as socioeconomic and geographic variations. Prerequisites: ROM 401 or LING 200 or 400, and two years of college-level French.

FREN 403 Background of Modern French (5) *Klausenburger* Linguistic analysis of the important developments in the history of the French language from its Latin origin to contemporary speech. Prerequisite: the equivalent of two college years of French.

FREN 404 Old French (5) *Friedman* Designed for acquisition of reading facility in Old French through intensive study of selected texts. Prerequisite: ROM 401 or permission of instructor.

Most of the following 400-level courses require as prerequisites FREN 303; 304, 305, 306; 350, 351, 352. See adviser for exceptions.

FREN 410 French Literature of the Sixteenth Century: Prose (5) *Keller* Sixteenth-century literature, with emphasis on cultural and intellectual background. Prerequisites: See note above.

FREN 411 French Renaissance: Poetry (5) Sixteenth-century literature with emphasis on poetry and the general artistic ambiance. Prerequisites: See note above.

FREN 412 Baroque Literature (5) AWSpS The whole phenomenon of baroque literature, including prose, poetry, and theater. Prerequisites: See note above.

FREN 413 French Literature of the Seventeenth Century: Classicism (5) *Wortley* Seventeenth-century literature, with emphasis on the development of classicism. Prerequisites: See note above.

FREN 414 French Literature of the Eighteenth Century: Enlightenment (5) *Ellrich, Hanzeli* Eighteenth-century literature, with emphasis on the development of the Enlightenment ideology. Prerequisites: See note above.

FREN 415 French Literature of the Eighteenth Century: Post-Enlightenment (5) *Ellrich* Eighteenth-century literature, with emphasis on the "dark side of the Enlightenment" and nascent romanticism. Prerequisites: See note above.

FREN 416 French Literature of the Nineteenth Century: Romanticism (5) *Collins* Nineteenth-century literature, with emphasis on romanticism and the early manifestations of realism. Prerequisites: See note above.

FREN 418 French Literature of the Early Twentieth Century (5) *Collins, Leiner* Twentieth-century literature, with emphasis on the period 1900-1939. Prerequisites: See note above.

FREN 419 French Literature Since World War II (5) *Collins, Leiner* Twentieth-century literature, with emphasis on the period 1939 to the present. Prerequisites: See note above.

FREN 421 Fiction: 1660-1800 (5) *Ellrich* Prerequisites: See note above.

FREN 424 Fiction: 1800-1850 (5) *Dale* Prerequisites: See note above.

FREN 425 Fiction: 1850-1900 (5) *Dale* Prerequisites: See note above.

FREN 427 Fiction: Twentieth Century (5) *Collins, Leiner* Prerequisites: See note above.

FREN 444 Poetry: Romantic (5) Prerequisites: See note above.

FREN 445 Poetry: Parnassian and Symbolist (5) *Collins, Leiner* Prerequisites: See note above.

FREN 446 Poetry: Twentieth Century (5) Prerequisites: See note above.

FREN 451 History and Literature of the French Religious Wars (5) *Griffiths, Keller* Major political, social, and religious movements and events of, and related to, the French religious wars of 1560 to the end of the century, along with the treatment of these in the prose, poetry, and drama of the period. For students receiving French credit, readings must be done in French. Prerequisites: See note above.

FREN 454 Nonfiction of the Classic Period (5) *Keller, Wortley* Prerequisites: See note above.

FREN 457 Twentieth-Century Nonfiction (5) *Collins* Prerequisites: See note above.

FREN 461 Seventeenth-Century Drama (5) *Wortley* Prerequisites: See note above.

FREN 463 Nineteenth-Century Drama (5) *Collins* Prerequisites: See note above.

FREN 465 Twentieth-Century Drama (5) *Collins* Prerequisites: See note above.

FREN 470 Cinema (5) *Dale* Major films and figures of French cinema from the beginnings to the present. Prerequisites: See note above.

FREN 474 Linguistics and the Teaching of French (5) *Hanzeli* Areas of linguistics that can be particularly helpful to the French teacher. Prerequisites: See note above.

FREN 490 Honors Seminar (2-5, max. 10) AWSp Prerequisites: See note above.

FREN 496 Poetry and Song as Elements in French Civilization (5) *Creore* Relationship of poetry and music as expressed in the *chanson* in several periods of French culture. Emphasis on twentieth-century poet-composer-performers. Attention given to the medieval troubadours and to poet-musician collaboration in the Renaissance and later periods. Prerequisites: See note above.

FREN 499 Special Topics (1-5, max. 10) Topics to meet special needs. Prerequisites: See note above.

Italian

ITAL 101, 102, 103 Elementary (5,5,5) A,W,Sp Methods and objectives are primarily oral-aural. Language laboratory is required. Prerequisites: 101 or college equivalent or placement for 102; 102 or college equivalent or placement for 103.

ITAL 107 Reading (5) ASp Intensive study of selections from literary texts, essays, and newspaper articles, with attention to elements of grammar. Students receiving credit for 107 may subsequently earn credit for 100-level Italian courses involving other skills.

ITAL 201, 202, 203 Intermediate (5,5,5) A,W,Sp Intensive speaking, reading, and writing. Functional review of grammar. Prerequisites: 103 or college equivalent or placement for 201; 201 or college equivalent or placement for 202; 202 or college equivalent or placement for 203.

ITAL 301, 302 Advanced Syntax and Composition (3,3) A,W Prerequisites: 203 or college equivalent or placement for 301; 301 for 302.

ITAL 303 Italian Stylistics (3) Sp Functional grammar review; creative written and oral composition and reading, with special attention to problems of style. Prerequisite: 302.

ITAL 327 Advanced Conversation (2, max. 8) Not open to students whose native language is Italian. Prerequisite: 203 or college equivalent or placement.

ITAL 390 Supervised Study (2-6, max. 20) AWSp Prerequisites: permission of the instructor and the undergraduate Italian adviser.

ITAL 401 The Development of the Italian Language (5) *Klausenburger* Historical survey of Italian phonology, morphology, and syntax. Prerequisites: 301, 302, 303, or LING 400, or ROM 401, or permission of instructor.

ITAL 404, 405, 406 Survey of Italian Literature (5,5,5) A,W,Sp Prerequisite: 203 or college equivalent or placement test.

ITAL 413 Literature of the Renaissance: Quattrocento (5) The early Renaissance. Humanism; writings of Lorenzo de' Medici, Poliziano, Belcari, Alberti, Masuccio, Sannazzaro, Pulci, Bolardo. Prerequisites: 404, 405, 406.

ITAL 414 Literature of the Renaissance: Cinquecento (5) The high Renaissance. Bembo and the Petrarchans, Machiavelli, Guicciardini, Castiglione, Ariosto, Guarini, Tasso. Prerequisites: 404, 405, 406.

ITAL 423, 424 Eighteenth-Century Italian Literature (5,5) 423: poetry: the Arcadian movement, Parini, Monti, Foscolo. 424: drama: Metastasio, Goldoni, Alfieri. Prerequisites: 404, 405, 406.

ITAL 450 Verismo (5) *Friedrich* The development of Verismo with extensive readings from its main exponents—Capuana, Verga, Serao, Deledda, Fucini, and d'Annunzio. Prerequisites: 404, 405, 406.

ITAL 465 Contemporary Italian Narrative (5) *Friedrich* Critical reading of selected modern exponents of the short story and novel. Prerequisites: 404, 405, 406, or equivalent.

ITAL 490 Proseminar in Italian Literature (3-5) *Friedrich* Intended to help the student achieve a mature critical mastery of Italian literature. Required of Italian majors; others by permission of instructor.

ITAL 499 Special Topics (1-5, max. 10) Topics to meet special needs. Prerequisites: permission of the instructor and the undergraduate or graduate program adviser.

Portuguese

PORT 101, 102, 103 Elementary (5,5,5) A,W,Sp Methods and objectives are primarily oral-aural. Language laboratory is required. Prerequisites: 101 or college equivalent or placement for 102; 102 or college equivalent or placement for 103.

PORT 150 Accelerated (5) For graduate students in Spanish who wish to develop a rapid command of Portuguese primarily for reading purposes. Prerequisite: graduate standing in Spanish or permission of instructor.

PORT 201, 202, 203 Intermediate (5,5,5) A,W,Sp Modern texts, compositions, conversation, and functional grammar. Prerequisites: 103 or equivalent or permission of instructor for 201; 201 for 202; 202 for 203.

PORT 301, 302 Advanced Syntax and Composition (3,3) A,W Students with advanced standing in Spanish courses may apply to instructor for permission to enter 301 after 103. Prerequisites: 203 or equivalent, or permission of instructor for 301; 301 for 302.

PORT 303 Portuguese Stylistics (3) Sp Functional grammar review; creative written and oral composition and reading with special attention to problems of style. Prerequisite: 302 or permission of instructor.

PORT 327 Advanced Conversation (2, max. 8) Prerequisite: 203 or equivalent or permission of instructor.

PORT 390 Supervised Study (2-5, max. 20) AWSp Prerequisites: permission of instructor and undergraduate Portuguese adviser.

Romanian

RMN 401, 402, 403 Elementary Romanian (5,5,5) A,W,Sp 401, 402: comprehensive introduction to both spoken and literary Romanian. 403: designed to increase the student's vocabulary and enhance knowledge of grammar through the reading of short fictional material in modern Romanian. Offered jointly with ROMN 401, 402, 403.

RMN 404, 405, 406 Advanced Romanian (5,5,5) Continuation of 401, 402, 403. Offered jointly with ROMN 404, 405, 406. Prerequisite: 403 or permission of instructor.

RMN 420, 421 Structure of Romanian (3,3) Descriptive analysis of the phonological, morphological, syntactical, and lexical structures of modern Romanian. Prerequisite: ROM 401 or permission of instructor.

Spanish

SPAN 101, 102, 103 Elementary (5,5,5) AW,AWSp,AWSp Methods and objectives are primarily oral-aural. Language laboratory is required. Prerequisites: 101 or college equivalent or placement for 102; 102 or college equivalent or placement for 103.

SPAN 104 Spanish Grammar—Intensive (5) Thorough review of the basics of Spanish grammar. Not open to students who have taken 102 or 103. Prerequisite: one year preuniversity Spanish, or 101, or permission of instructor.

SPAN 128 Spanish for the Elementary School (5) *Friedrich* Practice in the basic language skills is combined with the demonstration and analysis of methods and techniques appropriate to FLES. Offered jointly with EDC&I 132.

SPAN 201, 202, 203 Intermediate (5,5,5) AWSp,AWSp, AWSp Intensive practice in speaking, reading, and writing. Review of Spanish grammar. Oral practice based on selected pieces of Spanish literature. Prerequisites: 103 or college equivalent or placement for 201; 201 or college equivalent or placement for 202; 202 or college equivalent or placement for 203.

SPAN 204 Intensive Spanish Review—Intermediate (5) Intensive review of grammar, reading composition, and oral/aural skills. For highly motivated students with at least one year college Spanish, or equivalent. Synthesis of 201, 202, 203, and preparation for third-year work in language and literature. Prerequisites: 103, 104, or 201; or four years of high school Spanish.

SPAN 231 Chicano Expressive Culture (3) WSp *Flores* The folk and popular traditions of people of Mexican culture, both within the present borders of Mexico and in the United States.

SPAN 301, 302 Advanced Syntax and Composition (5,5) AW,WSp Prerequisites: 203 for 301; 301 for 302.

SPAN 304 Survey of Spanish Literature: 1140-1498 (3) A Masterpieces of Spanish literature from origins to 1498. Prerequisites: 203; completion of, or concurrent enrollment in, 350, 351, or 352.

SPAN 305 Survey of Spanish Literature: 1498-1681 (3) W Prerequisites: 203; completion of, or concurrent enrollment in, 350, 351, or 352.

SPAN 306 Survey of Spanish Literature: 1681 to the Present (3) Sp Prerequisites: 203; completion of, or concurrent enrollment in, 350, 351, or 352.

SPAN 307 Introduction to Latin American Literature (3) Study of selected works of twentieth-century Latin American literature and their sociohistorical context. Development of reading and writing skills. Prerequisites: 203; completion of, or concurrent enrollment in, 350, 351, or 352.

SPAN 327 Advanced Conversation (2, max. 8) Not open to students whose native language is Spanish. Prerequisite: 203 or equivalent or placement. No credit toward Spanish major.

SPAN 331 Themes in Mexican-American Studies (5) *Flores* Examination of significant historical and cultural themes of the Mexican-American experience. Prerequisite: speaking knowledge of Spanish.

SPAN 337 Conversational Spanish (2 or 4 or 6) For participants in the Foreign Study Program. Prerequisites: 203 or equivalent and permission of Foreign Study Office.

SPAN 348 Commercial Spanish (3) *Penuelas* Intensive practice and basic theory of Spanish commercial correspondence; fundamentals of advertising, foreign trade, and business transactions in the Spanish-speaking countries (Latin America and Spain). Prerequisite: 302.

SPAN 350 Drama (3) Generic study of Spanish drama. Prerequisites: 203 or college equivalent or placement.

SPAN 351 Poetry (3) Generic study of Spanish poetry. Prerequisite: 203 or college equivalent or placement.

SPAN 352 Fiction (3)W Generic study of Spanish fiction. Prerequisite: 203 or college equivalent or placement.

SPAN 390 Supervised Study (2-6, max. 20) Prerequisites: permission of the instructor and undergraduate Spanish adviser.

SPAN 400 The Structure of Modern Spanish (5) W *Contreras, Saporta* Analysis of the spoken language from a linguistic point of view; phonological, morphological, and syntactic analysis. Prerequisite: 302 or graduate standing.

SPAN 401 The Evolution of the Spanish Language (5) *Salinero* Historical survey of Spanish phonology, morphology, and syntax, from Latin origins to the modern language. Prerequisite: 302.

SPAN 406 Advanced Spanish Syntax (5) *Anderson* Problems of Spanish syntax. Difference between the structures of Spanish and English; techniques for the effective teaching of Spanish. Prerequisite: 302.

SPAN 407 The Spanish of Latin America (5) *Contreras* Introduction to the dialectal variants of Latin-American Spanish through the reading of dialectological studies and selected literary works. Prerequisite: 302 or graduate standing.

SPAN 409 Advanced Phonetics (5) *Salinero* Analysis of sounds: training in pronunciation, intonation, and close transcription of Spanish language in its modalities. Prerequisite: 302 or graduate standing.

SPAN 410 Spanish Medieval Literature: Tenth Through Fourteenth Centuries (5) *Petersen* The first of a two-quarter advanced survey of Spanish and comparative literature. The literary forms of the Iberian Peninsula from the tenth to the fourteenth centuries. Taught in Spanish. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 411 Spanish Medieval Literature: Fifteenth Century (5) *Petersen* Principal literary forms of the fifteenth century. Taught in Spanish. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 412 Spanish Literature: Sixteenth Century (5) *Shipley* Golden Age and Age of Conflict. Key texts from all genres, as well as their sociohistorical contexts. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 413 Spanish Literature: Seventeenth Century (5) *Shipley, Yarbro* Golden Age and Age of Conflict. Key texts from all genres, as well as their sociohistorical contexts. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 414 Spanish Literature: Eighteenth Century (5) A *Anderson, Penuelas, Predmore* Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 415 Spanish Literature: Nineteenth Century (5) W *Anderson, Penuelas* Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 416 Spanish Literature: 1900-1936 (5) Sp Spanish literature of the twentieth century prior to the Civil War (1900-1936). Concentration on Generations of 1898 and 1927. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 417 Spanish Literature From 1940 to the Present (5) *Anderson, Penuelas* Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 420 Spanish Poetry: Origins Through the Fifteenth Century (5) Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 423 Spanish Poetry: The Golden Age, Sixteenth Through Seventeenth Centuries (5) *Shipley* Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 424, 425, 426 Hispanic Poetry (5,5,5) *Predmore* Modern lyric poetry of the Hispanic world. The period studied extends from 1870 to 1936 and deals with thirteen major poets, from Becquer to Hernandez. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 433 Golden Age Prose (5) *Shipley* Representative, and outstanding, prose works of sixteenth- and seventeenth-century Spain. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 436 Spanish Novel of the Nineteenth Century (5) *Anderson, Penuelas* Representative works of Galdós, Clarín, Pereda, Valera, and Blasco Ibáñez. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 437 Spanish Novel: 1900-1936 (5) *Penuelas* Spanish novel from the generation of 1898 to the beginning of the Civil War (1936). Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 438 Spanish Novel: 1939 to the Present (5) *Penuelas* Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352. (Offered alternate years.)

SPAN 440 Spanish Drama: 1150-1600 (5) From the beginning to Lope de Vega. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 441 Spanish Drama: 1600-1635 (5) Spanish theatre of the seventeenth century, with emphasis on Lope de Vega. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 445 The Modern Theatre in Spain, 1700-1900 (5) *Anderson* Literature and historical context of Spain's theatre in the eighteenth and nineteenth centuries. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 446 The Modern Theatre in Spain, 1900-1936 (5) *Anderson* Major currents and literature of Spain's theatre in this century, up to the Spanish Civil War in 1936. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 447 Spanish Theatre Since the Civil War (5) *Anderson* Works of Spain's major dramatists of the postwar period: Special attention given to the social and political context of the theatre in Spain under the Franco regime. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 449 Spanish Drama and Play Production (5, max. 10) *Anderson* Prerequisite: permission of instructor.

SPAN 453 Cervantes and His Times (5) *Salinero* Study of Cervantes and his moment in Spanish history, with special attention to his cultural and artistic environment. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 461 Cultural Background of Latin American Literature (5) Survey of ideas and art forms and their relationship to literature in four periods: pre-Columbian, colonial, early independence, and twentieth century. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 462 Spanish Civilization (5) *Salinero* Summary of the development of Spanish society and art forms as a background to Spain's literature, from early times to 1900. Taught in Spanish. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 465 Contemporary Chicano Literature (5) Examination of one or more problems, themes, and/or figures in the developing body of Chicano literature. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 466 Chicano Literature: Fiction (5) Nineteenth- and early twentieth-century fiction, as well as contemporary works, are examined in attempts to trace the development of Chicano fiction in the proper historical trajectory. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 470 Latin American Literature of the Conquest and the Colonial Period (5) Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 471 Latin American Literature: 1810-1916 (5) Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 472 Contemporary Latin American Literature (5) Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 473 Latin American Fiction: Nineteenth Century (5, max. 15) Study of prose fiction in Latin America in the nineteenth century. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 474 Latin American Fiction: Twentieth Century (5) Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 475 Latin American Poetry: Colonial Through Nineteenth Century (5) Poetic movements of the seventeenth, eighteenth, and nineteenth centuries in Spanish American, Renaissance, baroque, neoclassicism, romanticism, and modernism. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 476 Contemporary Latin American Poetry (5) Evolution of Latin American poetry, from postmodernism and vanguardism to the most recent poetic expression: Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 477 Latin American Essay (5) Literary expression of ideas in Latin American countries, nineteenth and twentieth centuries. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 478 Modern Latin American Theater (5) W Study of the origin, development, and achievements of Latin American theater with an overview of its history prior to the twentieth century. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 490 Honors Seminar (2-5, max. 10) AWSp Special studies in Spanish literature. Required of candidates for Honors and Distinction in Spanish. Open to others by permission of Spanish honors adviser.

SPAN 491 Individual Authors and Special Topics in Spanish Literature (5, max. 10) Focus on an individual Spanish author or a special problem in Spanish literature. Prerequisites: 302, 304, 305, 306, 307, 350, 351, 352.

SPAN 495 Study in Spain (12) *Anderson* One-quarter study group in Spain. Course content varies from year to year. Consult the Department of Romance Languages and Literature for availability and further requirements.

SPAN 499 Special Topics (1-5, max. 10) Topics to meet special needs. Prerequisites: permission of instructor and undergraduate adviser or graduate program coordinator.

ENGLISH TRANSLATION

These courses are recommended as appropriate supporting studies for students majoring in other departments. Courses in English translation are not applicable toward undergraduate or graduate major programs in the Department of Romance Languages and Literature. Majors may take any of these courses for credit as one of their electives.

French

FREN 458 French Art and Literature: Period Studies (5) Comparative studies of theme and technique in art and literature to illustrate major concerns of a particular period as expressed in these two media. Prerequisite: background in French literature or art history (the appropriate 300-level course in art history or the appropriate 400-level survey course in French literature).

FREN 481 Twentieth-Century French Novel in English (5)

FREN 482 French Poetry From Baudelaire to the Present in English (5) Analysis in English of the major trends and movements in modern French poetry with representative works, from Baudelaire to the poets of the 1950s.

FREN 483 Trends in Twentieth-Century Theatre in English (5) Study of the evolution of the French theatre from the turn of the century to the present. Special emphasis is given the French theatrical scene since World War II.

FREN 484 Rabelais and Montaigne in English (5) *Keller* Reading and discussion of selected passages from the works of Rabelais and the essays of Montaigne. Background information through informal lectures and outside reading on the two figures as illustrative of the Renaissance in France.

FREN 485 Racine and Molière in English (5) *Wortley*

FREN 486 Literature of the Enlightenment in English (5) *Ellrich, Hanzell*

FREN 487 Nineteenth-Century Fiction in English (5) *Dale*

FREN 488 Women in French Literature in English (5) *Leiner* Masterpieces of French literature are read in an attempt to understand French attitudes toward women. From the sixteenth century, with a concentration on the twentieth century.

Italian

ITAL 318 Italian Literature in English (5)

ITAL 319 The Italian Short Story in English (5) *Friedrich* The short story from the *Novellino* and Boccaccio to modern masters of the form. The translations are studied both as examples of narrative technique and as reflections of particular moments in Italian cultural history. Prerequisite: at least sophomore standing.

ITAL 384 Renaissance Literature of Italy in English (3)

ITAL 481 The *Divine Comedy* in English (5) Studies of Dante's *Divine Comedy* in English translation, with consideration of its background and influence.

ITAL 482 The *Decameron* in English (5) *Friedrich* An integral reading of the *Decameron*, with some consideration of its place in world literature and as an expression of the culture of its time. Prerequisite: upper-division standing.

Spanish

SPAN 317 Spanish Masterworks in English Translation (5) W *Shipley* Spanish literary masterpieces of the twelfth to sixteenth centuries, in English translation, with consideration of their background and influence. (Offered alternate years.)

SPAN 318 Spanish Masterworks in English Translation (5) Sp *Shipley* Spanish literary masterpieces of the seventeenth to twentieth centuries, in English translation, with consideration of their background and influence. (Offered alternate years.)

Courses for Graduates Only

Romance Literature

ROMAN 600 Independent Study or Research (*)

ROMAN 700 Master's Thesis (*) AWSp

ROMAN 800 Doctoral Dissertation (*)

Romance Linguistics and Literature, General and Comparative

ROM 505, 506 Advanced Romance Linguistics (5,5) *Klausenburger* Advanced problems in the phonological, morphological, and syntactical analysis of the Romance languages. Descriptive, comparative, and historical considerations. Prerequisites: FREN 401, 402, or SPAN 400, or FREN or SPAN 541, 542.

ROM 521, 522 Seminar in Romance Linguistics (5,5) *Contreras, Hanzell, Klausenburger* Specific problems in linguistic analysis of the Romance languages. Prerequisites: 401, 402.

ROM 531 Problems in Romance Linguistics (2-5, max. 15) *Hanzell, Klausenburger, Saporta* Group seminars, or individual conferences, are scheduled under this number to meet special needs. Prerequisite: permission of graduate program coordinator.

ROM 551 Romance Linguistics: History, Methodology, and Bibliography (5) A *Hanzell, Klausenburger* For new graduate students in the Romance linguistics program. History of Romance linguistics and linguistic science in the nineteenth and twentieth centuries as it relates to Romance studies. Comparative and descriptive methods used in contemporary scholarship. Prerequisite: 401 or LING 200 or equivalent.

ROM 590 Special Seminar and Conference (1-10, max. 20) Group seminars, or individual conferences, are scheduled under this number to meet special needs. Prerequisite: permission of graduate program coordinator.

ROM 600 Independent Study or Research (*)

French

FREN 515 French Literature of the High Middle Ages (5, max. 10) *Friedman* Old French literature, from the beginning to 1315. Prerequisite: permission of instructor.

FREN 516 Middle French Literature (5, max. 10) W *Friedman* French literature from 1315 to 1500. Prerequisite: permission of instructor.

FREN 520 Renaissance Prose: Rabelais (5) *Keller*

FREN 521 Renaissance Prose: Montaigne (5) *Keller*

FREN 523 Studies in Fiction: 1660-1800 (5, max. 10) *Ellrich*

FREN 525 Studies in Fiction: 1850-1900 (5, max. 10) *Dale, Leiner*

FREN 526 Studies in Fiction: 1900-1950 (5, max. 10) *Collins, Leiner*

FREN 530 Studies in Renaissance Poetry (5, max. 10) *Creore, Keller*

FREN 532 Studies in Nineteenth-Century Poetry (5, max. 10)

FREN 534 Studies in Twentieth-Century Poetry (5, max. 10)

FREN 541, 542 History of the French Language (5,5) *Klausenburger* Survey of the phonological, morphological, and syntactical development of the French language from its origins to the present.

FREN 555 French Nonfiction (5, max. 10) *Ellrich*

FREN 561 Studies in Seventeenth-Century Drama (5, max. 10) *Wortley*

FREN 565 Studies in French Drama (5, max. 10) Sp Studies in French drama, sixteenth to twentieth centuries.

FREN 570 Seminar in Cinema (5, max. 10) *Dale* Prerequisite: permission of instructor.

FREN 575 Literary Criticism (5)

FREN 576 Critical Methodology (4) A *Collins* Basic scholarly tools of bibliography; historical review of literary doctrine; an introduction to critical methodology. Prerequisite: graduate standing.

FREN 577 Modern Critical Methods (4) W *Collins* Modern critical methodology and theory. Prerequisite: graduate standing.

FREN 590 Special Seminar and Conference (1-10, max. 30) AWSp Group seminars, or individual conferences, are scheduled under this number to meet special needs. Prerequisite: permission of the graduate program coordinator.

FREN 591 Literary Problems: Middle Ages (5, max. 10)

FREN 592 Literary Problems: Renaissance (5, max. 10)

FREN 593 Literary Problems: Seventeenth Century (5, max. 10)

FREN 594 Literary Problems: Eighteenth Century (5, max. 10)

FREN 595 Literary Problems: Nineteenth Century (5, max. 10)

FREN 596 Literary Problems: Twentieth Century (5, max. 10)

FREN 600 Independent Study or Research (*) AWSp

Italian

ITAL 514 Dante (3)

ITAL 570 Seminar in Cinema (5) *Dale* Studies in various areas of Italian cinema, concentrating on major directors, critics, and movements. Prerequisite: permission of instructor.

ITAL 590 Special Seminar and Conference (1-10, max. 30) AWSp Group seminars, or individual conferences, are scheduled under this number to meet special needs. Prerequisite: permission of graduate program coordinator.

ITAL 591 Literary Problems: Middle Ages and Fourteenth Century (5, max. 10)

ITAL 592 Literary Problems: Renaissance (5, max. 10)

ITAL 593 Literary Problems: Baroque (5, max. 10)

ITAL 594 Literary Problems: Eighteenth Century (5, max. 10)

ITAL 595 Literary Problems: Nineteenth Century (5, max. 10)

ITAL 596 Literary Problems: Twentieth Century (5, max. 10)

ITAL 600 Independent Study or Research (*) AWSp

Portuguese

PORT 590 Special Seminar and Conference (1-9, max. 30) AWSp Group seminars or individual conferences are scheduled under this number to meet special needs. Prerequisite: permission of graduate program coordinator.

Provençal

PROV 534 Provençal Language and Literature (5)

Spanish

SPAN 500 Seminar in Spanish Linguistics (3) Sp *Contreras* Problems in the phonological and grammatical analysis of modern Spanish. Prerequisite: 400.

SPAN 501 Graduate Study of Hispanic Literature (3) Close studies of literary texts exemplifying a variety of practical critical methods.

SPAN 521, 522 The Renaissance in Spain (5,5) *Shipley* Literary creation and the cultural, social, historical context of Spanish literature from *La Celestina* through the sixteenth century. Extensive study of secondary materials, intensive analysis of representative literary texts.

SPAN 541, 542 History of the Spanish Language (5,5) W,Sp *Salinero* Summary of the evolution of Spanish language from the fragmentation of Peninsular Romance to *Cantar de Mío Cid*. The main work consists of analysis of early Castilian texts.

SPAN 561 Spanish-American Novel From 1940 to the Present (5)

SPAN 571 The Modern Essay in Spanish America (5)

SPAN 572 Twentieth-Century Spanish Poetry (5, max. 10) *Predmore*

SPAN 573 Twentieth-Century Spanish-American Poetry (5, max. 10)

SPAN 575 Literary Criticism (5) *Penuelas*

SPAN 590 Special Seminar and Conference (1-10, max. 30) AWSp Group seminars, or individual conferences, are scheduled under this number to meet special needs. Prerequisite: permission of the graduate program coordinator.

SPAN 591 Literary Problems: Middle Ages (5, max. 10)

SPAN 592 Literary Problems: Renaissance (5, max. 10)

SPAN 593 Literary Problems: Golden Age (5, max. 10)

SPAN 594 Literary Problems: Eighteenth Century (5, max. 10)

SPAN 595 Literary Problems: Nineteenth Century (5, max. 10)

SPAN 596 Literary Problems: Twentieth Century (5, max. 10)

SPAN 597 Literary Problems: Spanish-American Colonial Literature (5, max. 10)

SPAN 598 Literary Problems: Latin America (5, max. 10)

SPAN 600 Independent Study or Research (*) AWSp

Russian and East European Studies

See International Studies.

Scandinavian Languages and Literature

C8H Padelford

The Department of Scandinavian Languages and Literature is concerned with the study of languages, literatures, and cultures of Denmark, Iceland, Norway, and Sweden. Emphasis is placed both on contemporary literature and culture and on their historical development. Although most courses designed for majors are taught in the original languages, a broad spectrum of courses designed primarily for nonmajors is offered in English.

Undergraduate Program

Bachelor of Arts Degree

Major Requirements—Danish, Norwegian, or Swedish: At least 50 credits, of which 25 are in upper-division courses, with emphasis on one major language (Danish, Norwegian, or Swedish). The 50 credits include 27 credits in first-, second-, and third-year language training; choice of literature courses in the original language; one course in Scandinavian history on the 300 level and one course in history of Scandinavian languages or Scandinavian linguistics. *Scandinavian Studies:* 55 credits, including two years in one Scandinavian language. Emphasis is on Scandinavian history and politics, theater and film, folklore and mythology, and linguistics. An adviser should be consulted for planning of individual programs.

Graduate Program

Patricia L. Conroy, Graduate Program Coordinator

The Department of Scandinavian Languages and Literature offers graduate programs of study leading to the Master of Arts and Doctor of Philosophy degrees. For the M.A. degree; the emphasis may be placed on Old Scandinavian (Old Norse), Danish, Norwegian, or Swedish. Each aspirant for the Ph.D., degree must complete one year's study of Old Icelandic and concentrate his or her studies primarily within one of four areas: Danish language and literature, Norwegian language and literature, Swedish language and literature, or Scandinavian philology and linguistics.

For the graduate student the programs in Scandinavian languages and literature open up several interesting areas of study: medieval, with extensive study of Old Scandinavian languages and literature, particularly Old Icelandic, and modern, including the eighteenth century, represented by writers such as Holberg and Bellman; romanticism; Ibsen, Strindberg, and their contemporaries; and the twentieth century, represented by such figures, as Dinesen, Hamsun, and Lagerkvist. Major attention is paid to the history of the Scandinavian languages, prose fiction, drama, and poetry. Opportunities for supervised study also exist in such areas as Scandinavian history and cinema, Scandinavian folklore and mythology. Opportunities for comparative literature study also exist.

Master of Arts Degree

Admission Requirement: Bachelor of Arts degree with major in Danish, Norwegian, Swedish, or equivalent background.

Graduation Requirements: A minimum of 36 credits in courses or seminars in Scandinavian and related subjects approved by the department, of which at least 20 credits must be in courses numbered 500 and above; reading knowledge of French or German (another non-Scandinavian language may be substituted with faculty approval); written and oral examination; option between thesis and nonthesis program.

Doctor of Philosophy Degree

Admission Requirement: Master of Arts degree with major in Scandinavian languages and literature or equivalent background.

Graduation Requirements: 72 credits in courses or seminars in Scandinavian languages and literature and related subjects approved by the department; a reading knowledge of French and German (other non-Scandinavian languages may be substituted with faculty approval); General Examination for admission to candidacy; an acceptable dissertation; a Final Examination on the dissertation.

Financial Aid

Teaching assistantships in Danish, Norwegian, and Swedish usually are available.

Correspondence and Information

Graduate Program Coordinator
C8L Padelford, GN-70

Faculty

Chairperson

Sven H. Rossel

Professors

Arestad, Sverre (Emeritus), Ph.D., 1938, Washington; Scandinavian language and literature.

Rossel, Sven H.,* (Comparative Literature),† Ph.D., 1968, Copenhagen; Danish, medieval literature, European preromanticism, romanticism; European symbolism, comparative literature.

Steene, Birgitta K.,* (Comparative Literature),† Ph.D., 1960, Washington; Scandinavian drama, Scandinavian film, comparative literature.

Associate Professors

Conroy, Patricia L.,* Ph.D., 1974, California (Berkeley); Scandinavian philology, medieval literature.

Sehmsdorf, Henning K.,* (Comparative Literature),† Ph.D., 1968, Chicago; Norwegian-Scandinavian folklore and mythology, comparative literature.

Sjavik, Jan I.,* Ph.D., 1979, Harvard; Scandinavian novel and literary theory.

Warme, Lars G.,* Ph.D., 1974, California (Berkeley); Swedish, modern Scandinavian novel, comparative literature.

Assistant Professors

Leiren, Terje I.,* (History), Ph.D., 1978, North Texas State; Scandinavian history and immigration research specialty in nineteenth- and twentieth-century Norwegian political and intellectual history.

Sundelius, Bengt, Ph.D., 1976, Denver; Scandinavian politics, international relations, Swedish.

Course Descriptions

Courses for Undergraduates

Danish

DAN 101-102, 103 Elementary Danish (5-5,5) A,W,Sp Fundamentals of oral and written Danish.

DAN 300, 301, 302 Studies in Danish Language and Literature (5, max. 10 each) A,W,Sp *Conroy, Rossel* Special emphasis on expanding the speaking, reading, and writing skills obtained in 101-102, 103. Fictional texts, of varying degrees of difficulty, chosen from different genres and periods in Danish literary history. Prerequisites: 101-102, 103 for 300; 300 for 301; 301 for 302.

DAN 490 Supervised Reading (*, max. 10) AWSp *Conroy, Rossel* Readings in a selected area of Danish language, literature, or related fields. Prerequisite: permission of adviser.

Norwegian

NORW 101-102, 103 Elementary Norwegian (5-5,5) AW,WSp,SpA Fundamentals of oral and written Norwegian.

NORW 201, 202, 203 Second-Year Norwegian (5,5,5) A,W,Sp *Leiren, Sehmsdorf, Sjåvik* Intensive practice in speaking, reading, and writing. Functional review of grammar. Prerequisites: 101, 102, 103.

NORW 300 The Norwegian Contemporary Novel (3) A *Sehmsdorf, Sjåvik* Prerequisite: 203 or equivalent.

NORW 301 The Plays of Henrik Ibsen (3) *Sehmsdorf, Sjåvik* Study of selected plays by Ibsen. Prerequisite: two years of Norwegian or equivalent, or permission of instructor.

NORW 302 Drama After Ibsen (3) Sp *Sehmsdorf, Sjåvik* Prerequisite: 203 or equivalent.

NORW 303, 304, 305 Advanced Norwegian Conversation and Composition (2, max. 4; 2, max. 4; 2, max. 4) A,W,Sp *Leiren, Sehmsdorf, Sjåvik* Prerequisite: 203 or equivalent.

NORW 350 The Norwegian Short Story (3) *Sehmsdorf, Sjåvik* Generic study of the Norwegian short story. Prerequisite: 203 or permission of adviser.

NORW 351 Norwegian Romanticism (3) *Sehmsdorf, Sjåvik* Historical study of Norway's cultural and, specifically, literary renewal from 1814 to approximately 1865. Prerequisite: 203 or permission of adviser.

NORW 352 New Norwegian Writers (3) *Sehmsdorf, Sjåvik* Fiction and poetry in *Nynorsk* by Duun, Vesaas, Garborg, and others. Prerequisites: two Norwegian courses on the 300 level and permission of adviser.

NORW 490 Supervised Reading (*, max. 10) AWSp *Leiren, Sehmsdorf, Sjåvik* Readings in a selected area of Norwegian language, literature, or related fields. Prerequisite: 302 or permission of adviser.

Swedish

SWED 101-102, 103 Elementary Swedish (5-5,5) AW, WSp,SpA Fundamentals of oral and written Swedish.

SWED 201, 202, 203 Second-year Swedish (5,5,5) A, W,Sp *Steene, Sundelius, Warme* Intensive practice in speaking, reading, and writing. Functional review of grammar. Prerequisites: 101, 102, 103.

SWED 300 Swedish Women Writers (3) A *Steene, Warme* Readings from works by Swedish women writers. Recommended: one Swedish 200-level course.

SWED 301 Swedish Poetry After 1940 (3) W *Warme* Poems by such poets as Karl Vennberg, Erik Lindegren, Werner Aspenstrom, Thomas Transtromer, and Harry Martinson. Prerequisite: 203 or equivalent.

SWED 302 The Swedish Contemporary Novel (3) Sp *Warme* Selected works by Delblanc, Gyllensten, Sara Lidman, and others. Prerequisite: 301 or equivalent.

SWED 303, 304, 305 Advanced Swedish Conversation and Composition (2, max. 4; 2, max. 4; 2, max. 4) A,W,Sp *Sundelius, Warme* Third-year conversation and composition, based on readings in Swedish newspapers and journals. Prerequisite: 203 or equivalent.

SWED 350 Selected Swedish Prose and Fiction (3) A *Steene, Warme* Essays, articles, and works of fiction reflecting social and literary concerns in twentieth-century Sweden. Prerequisite: 203 or permission of instructor.

SWED 351 The Swedish Novel Before 1940 (3) W *Steene, Warme* Selected works by S. Lagerlöf, Hj. Söderberg, Hj. Bergman, and others. Reading in the original. Prerequisite: 350.

SWED 352 Strindberg and His Works (3) Sp *Steene, Warme* Representative short stories, dramas, autobiographical works, poems, and one novel.

SWED 490 Supervised Reading (*, max. 12) AWSp *Steene, Sundelius, Warme* Readings in a selected area of Swedish language, literature, or related fields. Prerequisite: 302 or permission of instructor.

Scandinavian Courses in English

SCAND 100 Introduction to Scandinavian Culture (2 or 2½) AWSpS *Conroy, Leiren, Steene, Sundelius* The Scandinavian experience from the Viking age to the present day; the background for contemporary Scandinavian democracy, with major emphasis on the cultural, political, and religious development of the Scandinavian countries. 2½ credits available Summer Quarter only.

SCAND 232 Hans Christian Andersen and the Fairy Tale (3) Sp *Conroy, Rossel* Andersen and his tales, with particular emphasis on what they have to say about man and his world.

SCAND 251 Holberg and His Comedies in English (2) *Rossel* Holberg and his major dramas, with attention to the comic tradition in the Scandinavian theatre.

SCAND 309 Sagas of the Vikings (2 or 2½) SpS *Conroy* Icelandic family sagas in the context of thirteenth-century society. 2½ credits available Summer Quarter only.

SCAND 312 Masterpieces of Scandinavian Literature (3) *Rossel, Sehmsdorf, Sjåvik, Steene, Warme* Major works of Scandinavian literature read in English translation: Ibsen, Strindberg, Kierkegaard, Dinesen, Hamsun, Undset, Laxness, Lagerlof, and Lagerkvist.

SCAND 330 Scandinavian Mythology (2½ or 3) AS *Sehmsdorf* Introduction to the study of the mythology of Germanic, and especially the Scandinavian, peoples. Emphasis on the source material, particularly the *Poetic Edda* and *Prose Edda*; also historical and archaeological material. 2½ credits available Summer Quarter only.

SCAND 332 The Scandinavian Folktale (3) A *Sehmsdorf* The Scandinavian folktale and legend as oral literature and as expression of popular beliefs.

SCAND 335 Scandinavian Children's Literature (3) *Steene* Scandinavian children's literature from the authored fairy-tale to the stories of such writers as Hans Christian Andersen, Elsa Beskow, Astrid Lindgren, Maria Gripe, and Tove Jansson.

SCAND 360 Scandinavian Cinema (3 or 5) *Steene* Major Scandinavian films and film directors from the 1920s to the present. Prerequisite: 100 or major standing in the Department of Scandinavian Languages and Literature.

SCAND 365 Kierkegaard and the Existentialist Tradition (3) Kierkegaard's works. Impact of existentialism on Scandinavian literature, with attention to such authors as Ibsen, Kielland, Lagerkvist, E. Johnson, Dinesen, M. A. Hansen, and Ingmar Bergman.

SCAND 370 The Vikings (3) A *Leiren* Vikings at home in Scandinavia and abroad, with particular emphasis on their activities as revealed in archaeological finds and in historical and literary sources. Offered jointly with HSTEU 370.

SCAND 380 History of Scandinavia to 1521 (3) W *Leiren* Scandinavian history from the Viking Age to 1521, with emphasis on the efforts at unification between Iceland, Denmark, Finland, Norway, and Sweden and their relationship to the European continent. Offered jointly with HSTEU 380.

SCAND 381 History of Scandinavia to 1809 (3) Sp *Leiren* Scandinavian history from 1521 to 1809 with emphasis on the Lutheran Reformation, the Thirty Years War, and the Napoleonic wars. Offered jointly with HSTEU 381.

SCAND 382 History of Scandinavia From 1809 to the Present (3) A *Leiren* Scandinavian history from 1809 to the present with major emphasis on the political, social, cultural, and economic development of the Scandinavian countries. Offered jointly with HSTEU 382.

SCAND 383 Scandinavian Immigrant in History and Literature (3) *Leiren, Sjåvik, Warme* History and literature of Scandinavian emigration to North America, including immigrant life and culture, community structures and traditions, and the literature about, and by, Scandinavian emigrants.

SCAND 385 The Scandinavian Welfare State (3) *Leiren, Sundelius* Social, political, and economic aspects of the Scandinavian welfare state.

SCAND 450 Scandinavian Literary History (3) *Conroy, Rossel, Sehmsdorf, Sjåvik, Steene, Warme* Survey of Scandinavian literary history. Prerequisite: two years of a Scandinavian language or permission of instructor.

SCAND 455 Introduction to Scandinavian Linguistics (3) *Conroy* Descriptive analysis of the phonological, morphological, and syntactical structures of the modern Scandinavian languages. Prerequisite: equivalent of two college years of a Scandinavian language.

SCAND 460 History of the Scandinavian Languages (5) *Conroy* Development of languages from common Scandinavian to contemporary Danish, Norwegian, Swedish, Faroese, and Icelandic. Prerequisite: two years of a Scandinavian language or permission of instructor.

SCAND 480 Ibsen and His Major Plays in English (2 or 2½) AS *Steen* 2½ credits available Summer Quarter only.

SCAND 481 Strindberg and His Major Plays in English (2 or 2½) WS *Steene* 2½ credits available Summer Quarter only.

SCAND 484 The Films of Ingmar Bergman (5) A *Steene* Major films of Ingmar Bergman. Open to majors and nonmajors. Recommended: 360 and 481.

SCAND 490 Special Topics (1-5, max. 15) AWSpS Special topics in Scandinavian art, literature, culture, and history. Course offerings based on instructor's specialty and student demand.

SCAND 498 Senior Essay (5) Undergraduate research and the writing of a senior essay in Scandinavian area studies. Prerequisite: permission of instructor.

SCAND 499 Independent Study or Research (1-5, max. 10) Independent study or research in Scandinavian area studies. May be done in a Scandinavian language or in English. Prerequisite: permission of instructor.

Courses for Graduates Only

Scandinavian Courses in English

SCAND 500, 501, 502 Old Icelandic (3,3,3) A,W,Sp *Conroy*

SCAND 503 Scandinavian Literature: Methodology (3) A *Sehmsdorf, Sjåvik* Bibliographical resources for Scandinavian literature; concepts and methods of literary scholarship (linguistics, textual criticism, literary history, literary criticism); various approaches to literary criticism.

SCAND 504 Contemporary Literary Theory (3) W *Sehmsdorf, Sjåvik* Contemporary literary theory and its application to Scandinavian texts. Prerequisite: graduate student standing or permission of instructor.

SCAND 506 Studies in Scandinavian Drama: Ibsen (3) A *Steene* Selective reading in Ibsen's dramas in the original. Prerequisite: baccalaureate degree in Scandinavian or equivalent.

SCAND 508 The Nineteenth-Century Scandinavian Novel (3) A *Rossel, Warme*

SCAND 509 The Twentieth-Century Scandinavian Novel (3) W *Rossel, Warme*

SCAND 510 Studies in Scandinavian Drama: Strindberg (3) A *Steene* Selective reading in Strindberg's dramatic production in the original. Prerequisite: baccalaureate degree in Scandinavian or equivalent.

SCAND 513 Scandinavian Linguistics (3) *Conroy* Selected topics in Scandinavian linguistics.

SCAND 519 Recent Scandinavian Drama (3) *Steene* Seminar on Scandinavian drama since Ibsen and Strindberg. Considers such playwrights as Par Lagerkvist, Stig Dagerman, Nordahl Grieg, Soya, Munk, and Kjeld Abel.

SCAND 520 Modern Scandinavian Poetry (3) *Rossel, Warme* Seminar on the poetry from 1880 to 1930.

SCAND 521 Recent Scandinavian Poetry (3) Sp *Rossel, Steene, Warme* Seminar on recent and contemporary poetry from 1930 to the present.

SCAND 522 Scandinavian Romanticism (3) *Rossel, Sehmsdorf* Backgrounds: German idealism; organicist concept of history and esthetics; the poet as visionary genius; revolutionary tendencies and political conservatism; folklore and mythology. Genres: lyrical poetry, national epic, the beginnings of the novel and drama.

SCAND 523 Scandinavian Literature and Film (3) Sp *Steene* Study of the film adaptations by Sjostrom and Stiller of the works of Selma Lagerlof; a consideration of the film adaptations by Carl Dreyer of such works as Kaj Munk's *Ordet* and HJ. Soderberg's *Gertrud*; Alf Sjoberg's version of Strindberg's *Miss Julie*.

SCAND 524 Scandinavian Emigration: History and Literature (3) Sp *Leiren* The forces behind Scandinavian emigration to the United States, the structure of Scandinavian communities in certain parts of America, and the literature by, and about, Scandinavian emigrants.

SCAND 530, 531 Medieval Scandinavian Literature (3,3) S,Sp *Conroy, Rossel* The study of the main genres in the vernacular, with primary emphasis on the ballads and West Norse poetry and prose.

SCAND 541 Scandinavian Mythology (3) Sp *Sehmsdorf* Seminar on the historical development and special problems in Scandinavian mythology.

SCAND 542 Scandinavian Folklore I: Folk Beliefs (3) A *Sehmsdorf* Popular beliefs about the soul, the dead, magic, witchcraft, nature spirits, the agricultural year, as expressed in the oral traditions and customs of Scandinavia.

SCAND 543 Scandinavian Folklore II: Folk Literature (3) W *Sehmsdorf* Various forms of Scandinavian folk literature: legends, fictional folktales, proverbs, riddles, folk song, and ballad.

SCAND 590 Special Topics in Scandinavian Literature (1-5, max. 12) AWSp

SCAND 600 Independent Study or Research (*) AWSp

SCAND 700 Master's Thesis (*) AWSp

SCAND 800 Doctoral Dissertation (*)

Slavic Languages and Literature

111 Thomson

The Department of Slavic Languages and Literature offers instruction in the principal eastern European languages and literatures and in Slavic linguistics, working closely with the Henry M. Jackson School of International Studies. Languages include Bulgarian, Czech, Polish, Romanian, Russian, Serbo-Croatian, and Ukrainian.

Undergraduate Program

The department sponsors the Russian House, where students are provided with an opportunity to enhance their knowledge of Russian in a Russian-speaking environment.

Bachelor of Arts Degree

RUSSIAN LITERATURE AND LINGUISTICS OPTIONS

Major Requirements: RUSS 301, 302, 303, or the equivalent; RUSS 401, 402, 403, or the equivalent; RUSS 321, 322, 323; 15 credits from approved electives within the department.

RUSSIAN LANGUAGE AND HISTORY OPTION

Major Requirements: RUSS 301, 302, 303, or the equivalent; RUSS 401, 402, 403, or the equivalent; RUSS 321, 322, 323; HSTAM 443, HSTEU 444, 445.

EAST EUROPEAN LANGUAGES OPTION

Major Requirements: Two years of a principal eastern European language, or the equivalent; one year of an additional eastern European language or RUSS 201, 202, 203, or the equivalent; course work in the literatures of the cultures involved, and in Slavic philology; senior research project.

Graduate Program

The Department of Slavic Languages and Literature offers a complete program of courses and seminars leading to the Master of Arts and Doctor of Philosophy degrees in Russian and East European literatures or Slavic linguistics with a strong component of advanced language study.

The department realizes that the professional objectives of the graduate students are varied; programs of study are, therefore, planned by each student individually with a supervisory committee. Languages taught in the department include Bulgarian, Czech, Old Church Slavonic, Polish, Romanian, Russian, Serbo-Croatian, and Ukrainian.

The graduate program is organized to permit completion of the master's degree in four or five quarters and the doctoral degree in three additional years. The duration of each program, however, will depend on the extent of the student's preparation upon entrance into the program.

Research Facilities

The Suzzallo Library holdings include some 150,000 titles in the languages of eastern Europe. While the majority of these titles are in Russian, the collection is well provided with resources in Bulgarian, Czech, Hungarian, Polish, Romanian, and Serbo-Croatian languages and literatures.

Admission Qualifications

For the Master of Arts program: Bachelor of Arts degree with major in Russian or eastern European languages and literatures or equivalent background.

For the Doctor of Philosophy program: Master of Arts degree with major in a Slavic literature or linguistics.

Assistantship Opportunities

The department regularly offers a number of teaching assistantships. In conjunction with the Henry M. Jackson School of International Studies, students in the department are eligible for several other types of fellowships.

Correspondence and Information

Graduate Program Coordinator
111 Thomson, DR-30

Faculty

Chairperson

Davor Kapetanic

Professors

Haney, Jack V.,* (International Studies),† D.Phil., 1970, Oxford; medieval Russian literature.

Kapetanic, Davor,* (International Studies),† D.Sc., 1972, Zagreb; Serbo-Croatian language and literature, Slavic literary theory.

Mickiesen, Lew R.,* (International Studies, Linguistics),† Ph.D., 1951, Harvard; Slavic linguistics.

Associate Professors

Augerot, James E.,* (International Studies),† Ph.D., 1968, Washington; Slavic linguistics, Romanian, Bulgarian.

Coats, Herbert S.,* (International Studies),† Ph.D., 1970, Illinois; Slavic linguistics, Russian phonology, Russian syntax, Slavic accentuation.

Gershevsky, Noah D. (Emeritus), B.S., 1930, Montana School of Mines; Russian language.

Gribanovsky, Paul V. (Emeritus), Ph.D., 1968, Washington; Russian language and literature.

Konick, Willis A.,* (Comparative Literature, International Studies),† Ph.D., 1964, Washington; Russian literature.

Kramer, Karl D.,* (Comparative Literature, International Studies),† Ph.D., 1964, Washington; Russian literature.

Swayze, E. Harold,* (International Studies),† Ph.D., 1959, Harvard; Soviet Russian literature.

West, James D.,* (International Studies),† Ph.D., 1970, Cambridge; modern Russian literature.

Assistant Professor

Niemczyk, Barbara A. (Acting), (International Studies),† M. Phil., 1977, Yale; Polish and Russian language and literature.

Lecturers

Gross, Vladimir, M.A., 1965, Washington; Russian language.

Holdsworth, Nora G., B.A., 1965; Washington; Russian language.

Pahn, Vadim O. (Emeritus), B.S., 1938, British Columbia; Russian language.

Polack, Zoya M., M.A., 1975, Washington; Russian and Ukrainian language.

Course Descriptions

Courses for Undergraduates

LANGUAGE COURSES

Bulgarian

BULGR 401, 402, 403 Elementary Bulgarian (5,5,5) A,W,Sp 401, 402: introduction to Bulgarian phonology and grammar in terms of the modern spoken language. Writing conventions of literary Bulgarian. 403: reading of modern texts to increase command of grammar and vocabulary.

BULGR 404, 405, 406 Advanced Bulgarian (5,5,5) A,W,Sp Continuation of 401, 402, 403. Selected readings in Bulgarian literature, history, and culture. Reinforces and extends basic knowledge of Bulgarian grammar and vocabulary. Prerequisites: 403 for 404; 404 for 405; 405 for 406 or permission of instructor.

Czech

CZECH 401, 402, 403 Elementary Czech (5,5,5) A,W,Sp 401, 402: introduction to spoken and written Czech. 403: modern Czech prose, leading to a command of the language as a research tool and providing an adequate basis for further study.

CZECH 404, 405, 406 Advanced Czech (5,5,5) A,W,Sp Continuation of 401, 402, 403. Selected readings from the main works of Czech authors of the nineteenth and twentieth centuries. Reinforces and extends basic knowledge of Czech grammar and vocabulary. Prerequisites: 403 for 404; 404 for 405; 405 for 406, or permission of instructor.

Polish

POLSH 401, 402, 403 Elementary Polish (5,5,5) A,W,Sp 401, 402: Cover principal morphological and syntactic features of the Polish language through the medium of a basic vocabulary. 403: designed to enlarge general vocabulary by the reading of short texts selected from Polish authors of the nineteenth and twentieth centuries.

POLSH 404, 405, 406 Advanced Polish (5,5,5) A,W,Sp Continuation of 401, 402, 403. Selected readings of the main works from nineteenth and twentieth centuries. Reinforces basic knowledge of vocabulary, grammatical patterns, and conversation. Prerequisites: 403 for 404; 404 for 405; 405 for 406, or permission of instructor.

Romanian

ROMN 401, 402, 403 Elementary Romanian (5,5,5) A,W,Sp 401, 402: comprehensive introduction to spoken and literary Romanian. 403: designed to increase vocabulary and enhance knowledge of grammar through readings in modern Romanian. Offered jointly with RMN 401, 402, 403.

ROMN 404, 405, 406 Advanced Romanian (5,5,5) A,W,Sp Continuation of 401, 402, 403. Introduction to Romanian literature, history, and culture through selected readings. Reinforces and extends basic knowledge of grammar and vocabulary. Offered jointly with RMN 404, 405, 406. Prerequisites: 403 for 404; 404 for 405; 405 for 406, or permission of instructor.

Russian

RUSS 101, 102 First-Year Russian (5,5) A,W Introduction to Russian. Emphasis on oral communication with limited vocabulary. Basic grammar; some reading. Conducted in Russian except for periodic lectures on pronunciation, grammar, and writing (see also 110).

RUSS 103 First-Year Russian (5) Sp Continued extensive oral practice with short readings and compositions. Prerequisite: 102 or 110 or permission of instructor.

RUSS 110 Accelerated Russian (10) A Equivalent to 101, 102. Meets two hours daily. For students who wish to study Russian at a more intensive pace.

RUSS 115 Accelerated Russian (10) W Continuation of 110. Equivalent to 103 and 201. Meets two hours daily. Prerequisite: 102, 110, or permission of instructor.

RUSS 150 Intensive First-Year Russian (15) S Covers material of 101, 102, 103 in one quarter. For students who want to acquire rapidly a considerable proficiency. Meets three to four hours daily. For continuation, see 250 or 201, 202, 203.

RUSS 201 Second-Year Russian (5) A Complete review of Russian grammar with continuing oral practice and elementary composition. Prerequisite: 150 or 103, or permission of instructor.

RUSS 202, 203 Second-Year Russian (5,5) W,Sp Reading and composition with careful attention to word derivation and vocabulary development. Prerequisite: 201 or 115, or permission of instructor.

RUSS 210 Accelerated Russian (10) Sp Continuation of 115. Covers material of 202, 203 in one quarter. Meets two hours daily. Prerequisite: 201 or 115, or permission of instructor.

RUSS 221, 222, 223 Russian for Reading and Research (5,5,5) A,W,Sp Provides students with no previous knowledge of Russian the essentials of grammar needed to read expository prose. 223: students assigned readings based on interests. Aural-oral and writing skills receive some attention.

RUSS 250 Intensive Second-Year Russian (15) S Continuation of 150. For Summer Quarter students who wish to complete a second 15 credits of Russian. Prerequisite: 150, 103, or permission of instructor.

RUSS 301, 302, 303 Intermediate Russian (5,5,5) A,W,Sp Extensive practice in spoken and written Russian based on prose readings. Intensive review and supplementation of strategic grammatical concepts. One hour of grammar per week conducted in Russian and English, four hours per week of conversation in Russian. Prerequisite: 203, 210 or 250 or permission of instructor.

RUSS 304 Reading and Translation (1, max. 3) Translation techniques with emphasis on development of vocabulary and reading skills. Primarily for Russian regional studies majors. Prerequisite: 203 or 210, or permission of instructor.

RUSS 331, 332, 333 Intermediate Russian for Reading and Translation (5,5,5) A,W,Sp For those with some knowledge of Russian fundamentals wishing a greater facility in reading and translation from Russian to English. Primarily readings from a variety of sources. For students with varied backgrounds working at different levels of competence. Need not be taken in sequence. Prerequisites: 203, 210, 223, 250, or permission of instructor.

RUSS 350 Intensive Third-Year Russian (15) S Covers 301, 302, 303 in one quarter. For those desiring intensive review and supplementation of structural knowledge of Russian. Prerequisite: 210, 250, or 203, or permission of instructor.

RUSS 351 Intermediate Russian Phonetics (3) A Systematic exploration and analysis of the Russian sound system, including phonetic transcription and intonational patterns. Instruction in correcting individual pronunciation errors. Conducted partly in Russian. Prerequisite: 203, 210, or 250.

RUSS 352 Intermediate Russian Morphology (3) W Examination of Russian morphology with emphasis on topics that help to prepare the student for advanced courses in Russian. Conducted partly in Russian. Prerequisite: 203, 210, or 250.

RUSS 381 Phonetics in Leningrad (2-5) AWSpS Systematic analysis of the Russian sound system as well as intonational patterns. Practical reading exercises. Special attention to correcting individual pronunciation errors. (2 credits for Summer Quarter program, 5 credits for semester program.) Prerequisite: 203 for Summer Quarter, 303 for semester.

RUSS 382 Advanced Syntax and Composition in Leningrad (2-5) AWSpS Class lectures on Russian syntactic structures. Oral drilling and written exercises and compositions. (2 credits are offered for the six-week Summer Quarter program, 5 credits for the fourteen-week semester program.) Prerequisite: 203 for Summer Quarter, 303 for semester.

RUSS 383 Conversation in Leningrad (4-8) AWSpS Designed to increase active vocabulary, to further the student's control of idiomatic Russian, and to develop oral skills. (4 credits are offered for the six-week Summer Quarter program, 8 credits for the fourteen-week semester program.) Prerequisite: 203 for Summer Quarter, 303 for semester.

RUSS 384 Soviet Culture in Leningrad (4-8) AWSpS Lectures on education, history, economics, law, the arts, ethnography, architecture; complemented by visits to places of cultural and historical interest and meetings with Soviet groups. 4 credits for summer program, 6 for semester program. Prerequisite: 203 for Summer Quarter, 303 for semester.

RUSS 401, 402, 403 Advanced Russian (5,5,5) A,W,Sp Class conversation and composition based on reading. Prerequisites: 303 for 401; 401 for 402; 402 for 403; or permission of instructor.

RUSS 404 Russian Literary Translation (5) Intensive practical work in the translation of Russian literary texts. Specific problems associated with the translation of particular kinds of texts. Prerequisite: 303 or 350.

RUSS 441 The Language of Russian Culture (3-5, max. 15) Improves language skills, especially vocabulary, while probing specific lexical areas that reveal cultural traits and habits of the Russian speaker. Seven to ten topics, from games to grammar to music, each developed by a specialist. Prerequisite: 301 or 350, or the equivalent, which may be taken concurrently.

RUSS 450 Intensive Fourth-Year Russian (15) S Intensive practice in conversation, composition, and reading. Equivalent to 401, 402, 403. Prerequisite: 303, 350, or permission of instructor.

RUSS 451, 452 Structure of Russian (5,5) A,W Descriptive analysis of contemporary standard Russian. Detailed phonetic transcription, discussion of major Great Russian dialects as well as variations in popular speech, examination of common roots and productive derivational elements in Russian words, and elementary principles of syntax. Prerequisites: 303 or equivalent for 451; 451 for 452; or permission of instructor.

RUSS 455 Practicum in Russian Phonetics (2) Individualized instruction to correct difficulties in pronunciation; practical work on the phonetics of rapid speech. Taught jointly by a linguist and a native speaker of Russian. Prerequisite: 351 or equivalent.

RUSS 461, 463 Advanced Russian Reading Skills (5,5) Discussion in Russian of a variety of literary texts with goal of expanding reading skills. 461 concentrates on artistic literary texts (both poetry and prose); 463 directed toward texts from the general humanities and social sciences, including journalism. Both are appropriate for students of Russian language, literature, or area studies.

RUSS 499 Directed Study or Research (1-5, max. 15) Individual study of topics to meet specific needs. By arrangement with the instructor and the Department of Slavic Languages and Literature office. Prerequisite: permission of instructor and undergraduate adviser.

Serbo-Croatian

SER C 401, 402, 403 Elementary Serbo-Croatian (5,5,5) A,W,Sp 401, 402: comprehensive introduction to spoken and written literary Serbo-Croatian. 403: designed to increase vocabulary and enhance knowledge of grammar through the reading of short stories in the modern literary idiom.

SER C 404, 405, 406 Advanced Serbo-Croatian (5,5,5) A,W,Sp Continuation of 401, 402, 403; reinforces basic grasp of language and enlarges both vocabulary and command of grammatical patterns. Prerequisites: 403 for 404; 404 for 405; 405 for 406, or permission of instructor.

Slavic

SLAV 351 History of the Slavic Languages (5) Sp External and internal history of Slavic literary languages from the beginnings to the present time, including the development of writing systems, external attempts at reform, and the development of vocabulary.

SLAV 499 Directed Study or Research (1-5, max. 15) Individual study of topics to meet specific needs. By arrangement with the instructor and the Department of Slavic Languages and Literature office. Prerequisite: permission of instructor and undergraduate adviser.

Ukrainian

UKR 401, 402, 403 Elementary Ukrainian (5,5,5) Introduction to spoken and written Ukrainian.

LITERATURE COURSES IN ENGLISH

Courses in this section usually do not require prerequisites. The 300-level courses generally deal with particular themes running through a body of literature or involve a comprehensive study of cultural history. The 400-level courses deal with Slavic literatures other than Russian or specific authors and periods in Russian literature. Both levels are primarily for juniors and seniors, but are open to freshmen and sophomores with an interest or background in the subject of the course.

Czech

CZECH 420 Modern Czech Literature in English (5) A Representative works of Czech literature from the 1920s to the present in the context of earlier Czech and general European literary trends. Emphasis on prose and drama of major writers, including Hasek, Capek, Vancura, Skvorecky, Kundera, Vaculik, and Havel.

Polish

POLSH 420 Modern Polish Literature in English (5) W Representative works by leading twentieth-century Polish writers. Presents modern Polish literature in a European context, stressing parallels in philosophy and art. Shows originality of Polish literature through acquaintance with the peculiar historical and political situation of twentieth-century Poland.

Russian

RUSS 321 Russian Literature and Culture to 1800 (5) A Emphasizes literature as an element in Russian culture; but art, architecture, music, philosophy, and popular culture are treated as well. Periods covered include monumental simplicity, ornamentalism, Renaissance, Reformation, baroque, sentimentalism, and classicism.

RUSS 322 Russian Literature and Culture of the Nineteenth Century (5) W Emphasizes literature as an element in Russian culture; but art, architecture, music, and philosophy are also treated. Periods covered include romanticism, realism, and the beginnings of socialist criticism.

RUSS 323 Russian Literature and Culture of the Twentieth Century (5) Sp Emphasizes literature as an element in modern Russian culture, but art, architecture, and music are considered as well. Periods covered include symbolism, revolution, postrevolution, Stalinist, the "thaw," and contemporary.

RUSS 324 Russian Oral Tradition (5) Russian popular tradition, including paganism and its survival into modern times. Genres of the oral tradition, including the folktale, the epic, spiritual and historical songs, and legends. Special attention to modern theories and western European analogues.

RUSS 341 Growing Up Russian: Childhood and Adolescence in Russian Fiction (5) W Examination of the unique character of childhood and adolescent experience as a recurrent theme in the work of major nineteenth- and twentieth-century writers, including Tolstoy, Aksakov, Turgenev, Dostoevsky, Gorky, Bely. For nonmajors only.

RUSS 342 Holy Fools and Madmen: The Theme of Madness in Russian Literature (5) Sp Madness—and its peculiar Russian variant, the holy fool—as a theme in nineteenth- and twentieth-century Russian literature. Works by Pushkin, Gogol, Tolstoy, Dostoevsky, Sologub. For nonmajors only.

RUSS 421 Russian Literature of the Soviet Period in English (5) A Major Russian authors of the twentieth century. Selections from the works of Blok, Mayakovsky, Akhmatova, Babel, Pasternak, Solzhenitsyn, and others.

RUSS 422 Russian Literature in Emigration and Exile (5) Examines writers who have left the Soviet Union since the 1950s or who, though they reside in the USSR, publish through unofficial channels. Discussion of Aksyonov, Sinlavsky, Voinovich, Zinoviev, and others.

RUSS 423 Russian Film and Fiction (5) Sp Thematic and structural interrelationships of narrative in film and fiction in postrevolutionary Russia. Analysis of the work of film directors Eisenstein, Pudovkin, and Vertov and authors Bely, Pilnak, Zamyatin, Fedin, A. Tolstoy, Pasternak, and Solzhenitsyn.

RUSS 426 Pushkin, Gogol, Turgenev in English (5) A Selections include *Eugene Onegin* and *The Queen of Spades* by Pushkin, *Dead Souls* by Gogol, *Fathers and Sons* by Turgenev, and works of one or two of their contemporaries.

RUSS 427 Tolstoy in English (5) W *Konick, Kramer* *War and Peace* and *Anna Karenina* particularly.

RUSS 428 Dostoevsky in English (5) Sp *Konick* *The Possessed* and *The Brothers Karamazov*, among others.

RUSS 429 Chekhov in English (5) A *Kramer* Short stories and plays, as well as works of one or two of Chekhov's contemporaries.

RUSS 490 Studies in Russian Literature (3-5, max. 15) In either Russian or English. Topics vary.

Serbo-Croatian

SER C 420 Yugoslav Literature in Its European Context in English (5) Sp *Kapetanic* Chief works of Yugoslav literature, in English translation. Yugoslav modifications of Renaissance genres as the comedy and pastoral drama; Yugoslav folk poetry and its impact on romantic movement in Europe; Yugoslav participation in general European movements of nineteenth and twentieth centuries; Yugoslav literature in the postwar period and its original and influential position in eastern Europe.

Courses for Graduates Only

Russian

RUSS 501 Russian Language for Graduate Students (2, max. 10) AWSp Develops skills of particular use to graduate students and students seeking employment using Russian language. Emphasis on rapid assimilation of a variety of written materials with sophisticated understanding and maximum retention of vocabulary, and an ability to discuss in Russian the more theoretical and abstract kinds of material. Prerequisites: 403 or equivalent.

RUSS 502 Russian Translation (3) Introduction to the theory of translation; translation to and from Russian of selected prose passages in a variety of styles, with emphasis on idiomatic accuracy and stylistic compatibility. Prerequisite: four quarters of 501, or the equivalent established by a diagnostic test.

RUSS 512 Russian Literary Criticism (3) A study of critical positions, problems, and literary values of major Russian literary critics from Belinski to the present.

RUSS 520 Seminar in Russian Poetry (5) Topics in Russian poetry and poetry criticism to be selected by the instructor and students. Some emphasis on recent theoretical approaches to poetry criticism that are current in the USSR and eastern Europe. For advanced M.A. and Ph.D. students.

RUSS 522 Russian Literature, 1800-1840 (5) Russian poetry and prose in the period 1800-1840. Readings cover prose from Karamzin to early Gogol, poetry from Zhukovsky to Lermontov with special emphasis on Pushkin.

RUSS 524 Russian Literature, 1840-90 (5) Russian poetry and prose in the period 1840 to 1890. Short prose works and excerpts from longer works, by Gogol, Turgenev, Leskov, Saltykov-Shchedrin, Pisemsky, Uspensky, Goncharov, and Dostoevsky; poetry by Tyutchev, Fet, and Nekrasov; plays by Gogol and Ostrovsky; and excerpted contemporary critical writings.

RUSS 525 Russian Literature, 1890-1917 (5) Survey of major trends in Russian literature around the turn of the twentieth century, based on texts and critical readings in Russian. Includes both the prose and the poetry of realists of the late nineteenth century, symbolists, acmeists, and futurists.

RUSS 527 Seminar in Nineteenth-Century Russian Poetry (5) Selected topics in nineteenth-century Russian poetry to be investigated in depth and with some critical sophistication. For Ph.D. and advanced M.A. students.

RUSS 528 Seminar in Nineteenth-Century Russian Prose (5) Topic course devoted to one specific problem or theme in nineteenth-century Russian prose literature, seen in its widest possible dimensions. Students must read, in Russian, the literary works involved and become familiar with the social, historical, and philosophical backgrounds that inspire them.

RUSS 529 Seminar in Early Twentieth-Century Russian Literature (5) One specific problem or theme in twentieth-century Russian poetry and prose, seen in the widest possible dimensions. Students must read, in Russian, the literary works involved and become familiar with the social, historical, and philosophical backgrounds that inspire them.

RUSS 532 Pushkin (5) Reading, in Russian, of the major works of Alexander Pushkin and important critical works on him, and discussion of them in depth. Strongly recommended: 522.

RUSS 533 Chekhov (5) Detailed analysis of the plays and short stories of Anton Chekhov in Russian.

RUSS 534 Dostoevsky (5) Analysis of the works of Fyodor Dostoevsky in Russian.

RUSS 535 Tolstoy (5) Close analysis of one or two works by L. Tolstoy, in Russian.

RUSS 541 Russian Literature, 1917 to Present (5) Study of Russian poetry and prose since 1917. From Blok and Pilnyak to contemporary Soviet and Russian émigré authors.

RUSS 542 Seminar in Contemporary Russian Poetry (5) One specific problem or theme in contemporary Russian poetry, seen in its widest possible dimensions. Students must read, in Russian, the literary works involved and become familiar with the social, historical, and philosophical backgrounds that inspire them.

RUSS 543 Seminar in Contemporary Russian Prose (5) Analysis of Russian prose fiction of the post-1917 period. Selected authors and topics.

RUSS 550 Advanced Russian Morphophonology (3) Review and supplementation of Russian phonological and morphological data, with detailed discussion and evaluation of methods of incorporating these data in scientific grammars. Prerequisite: 452.

RUSS 551 Advanced Russian Syntax (3) Presentation and structural analysis of various simple and complex sentence types in the Russian literary language and an evaluation of ways in which these structures may be economically described in formal grammars. Prerequisite: 550.

RUSS 554 History of the Russian Literary Language (5) Russian literary language from the eleventh through the twentieth centuries, with special attention to syntax and lexicon and to the development of notions of literary styles. Offered in Russian. Four years of Russian language or equivalent recommended.

RUSS 555 History of the Russian Language (4) Brief review of the development of Russian from Indo-European to late Common Slavic, followed by a detailed account of grammatical and lexical developments of literary Russian from the earliest documents to the present. Prerequisite: SLAV 550 or permission of instructor.

RUSS 556 Readings in the History of the Russian Language (4) Reading, translation, and detailed grammatical interpretation of selected texts from various literary genres and periods in the development of the Russian literary language. Prerequisite: 555.

RUSS 565 Russian Eighteenth-Century Literature (5) Discussion of representative works of poetry, prose, fiction, and criticism in the eighteenth century.

RUSS 574 Russian Literature to 1800 (5) Representative works of East Slavic, Muscovite, and Russian literature from the beginnings to 1800. Studies include a varied selection of primary texts. Intended as an introduction to the study of modern literature for beginning graduate students in Russian literature.

RUSS 575 Kievan Literature (5) Analysis of representative works of prose and poetry of Kievan Rus' from the beginning to the end of the fourteenth century.

RUSS 576 Muscovite Literature (5) Analysis of representative works of prose and poetry of the Muscovite period from the end of the fourteenth century to the reign of Peter I.

RUSS 577 Russian Folk Literature (5) Analysis of representative works of the various genres of folk literature, including the *byliny, skazki,* historical and lyrical songs, and the spiritual *stikhi.*

RUSS 578 Studies in Kievan Literature (4) Field course for students with a specialization in Kievan literature. Work with primary sources, textual tradition, and bibliography.

RUSS 579 Studies in Muscovite Literature (4) Field course for students with a specialization in Muscovite literature. Work with primary sources, textual tradition, and bibliography.

RUSS 588 Introduction to Literary Analysis (2) Introduction to study of Russian literature, covering bibliographic materials, major critical problems, terms, schools, and genres.

RUSS 600 Independent Study or Research (*)

Slavic

SLAV 520 Slavic Literary Theory (3) Main works of the Russian, Czechoslovakian, and Polish theorists of the twentieth century, with special emphasis on formalist, structural, and semiotic schools.

SLAV 550 Historical Survey of Common Slavic (5) Slavic languages and their geographical and dialectical distribution; Slavic civilization throughout prehistoric and early historic periods; principal phonological and morphological features of Slavic as a subgroup of the Indo-European family of languages.

SLAV 552 History of the East Slavic Languages (3) Designed to acquaint majors in Slavic linguistics with the details of the historical development of the phonological and morphological structure of the Ukrainian and Byelorussian literary languages. Prerequisite: 550 or permission of instructor.

SLAV 553 History of the West Slavic Languages (3) Designed to acquaint majors in Slavic linguistics with the details of the historical development of the phonological and morphological structure of literary Polish, Czech, Slovak, and Upper and Lower Serbian languages. Prerequisite: 550 or permission of instructor.

SLAV 554 History of the South Slavic Languages (3) Designed to acquaint majors in Slavic linguistics with the details of the historical development of the phonological and morphological structure of the South Slavic languages. Prerequisite: 550.

SLAV 555 Old Church Slavonic (4) Rise and development of earliest Slavic literary language and a descriptive study of its orthography, phonology, morphology, and syntax. Readings from normalized texts.

SLAV 556 Readings in Old Church Slavonic (4) Reading and grammatical interpretation of a selected group of canonical texts, as well as some examples of the various later recensions of Old Church Slavonic. Prerequisite: 555.

SLAV 557 Seminar on Slavic Linguistics (3) Seminar designed to permit the investigation and discussion of special topics in Slavic linguistics. May be repeated for credit.

Slavic Languages and Literature

SLAVC 600 Independent Study or Research (*)

SLAVC 700 Master's Thesis (*)

SLAVC 800 Doctoral Dissertation (*)

Society and Justice

203 Smith

The criminal justice system in our society is studied from a multidisciplinary, liberal arts, research-oriented point of view and is directly observed through field experience. Because students have a wide range of courses from which to choose and because of the content of the seminar, research, and field courses is influenced by individual students' interests, a wide range of student goals can be accommodated.

The program has two, overlapping curricular tracks, one dealing with common (i.e., street) crime, the other dealing with institutionalized crime, which encompasses organized, white-collar, and official crime.

Undergraduate Program

Bachelor of Arts Degree

Admission Requirements: Sophomore standing (45 credits) and interview.

Major Requirements (Common Crime): Five courses in the context in which the criminal justice system operates, to be selected from lists of courses in political science, anthropology, philosophy, psychology, sociology, minority groups; four courses selected from lists dealing with the criminal and social problems with which the system deals; one of several courses giving an overview of the system; two courses on some student-selected aspect of the system; 15 credits dealing with research; two field courses, one involving field experience in the system and the other consisting of following a felony case; a senior seminar.

Major Requirements (Institutionalized Crime): Nine courses to give the students basic knowledge of law, business, government, economics, accounting, and moral-ethical issues. Six courses to introduce the student to white-collar, organized, and official crime; social problems and criminology; the criminal justice system; and government interaction with business. Participation in public agencies, research/investigative training and activity. Seminar.

Faculty

Director

Ezra Stotland

Lecturers

Anderson, Gene S., LL.B., 1962, Illinois; white-collar crime.

Browne, John H., J.D., 1971, Washington; criminal law.

Ehlert, Charles E., LL.B., 1963, Illinois; white-collar crime investigation.

Gould, David D., J.D., 1969, Washington; investigative auditing.

Newcomb, Mary R., Ph.D., 1976, Oregon; research methods.

Redkey, William, J.D., 1977, Puget Sound; organized-crime investigation.

Schram, Donna D., Ph.D., 1970, Washington; criminal justice.

Smith, David H., Ph.D., 1973, Washington; police.

Stotland, Ezra, Ph.D., 1953, Michigan; criminal justice.

Walsh, Marilyn E., Ph.D., 1974, State University of New York (Albany); organized crime.

Course Descriptions

Courses for Undergraduates

SO JU 310 Research in Society and Justice (1-5, max. 15) AWSp *Stotland* Individual research, under supervision, on some aspects of society and justice. Prerequisite: major standing.

SO JU 320- Field Experience in Society and Justice (5-) AWSp Participant observation in some public or private agency relevant to the system of justice. Prerequisite: major standing.

SO JU 321-322 Case Study in the System of Justice (2-3) AWSpS,AWSp Follow a felony case through the agencies of the system of justice. Prerequisite: major standing.

SO JU 400 Seminar in Society and Justice (3, max. 6) AWSp *Stotland* - Aspects of the administration of justice. Prerequisite: major standing.

SO JU 405 Seminar in Institutionalized Crime (2, max. 6) AWSp *Stotland* Examines aspects of institutionalized crime. Prerequisite: senior major standing.

SO JU 410 Legal Aspects of White-Collar Crime (3) A *Anderson* Legal definitions of economic "white-collar" crime; use of sanctions; the corporation and criminal responsibility; economic crime and government. Recommended: POL S 101 or 201 or SOC 110.

SO JU 415 Accounting, Government, and Auditing (5) Sp *Gould* Concepts and principles for the accumulation, processing, and reporting of financial information with emphasis on accounting systems, fund accounting, auditing and criminal investigation of accounting records. Recommended: ACCT 210.

SO JU 418 Methods for Investigating Institutionalized Crime (5) W Investigative research methods in law enforcement, consumer protection, regulatory agencies, private security, the press, and public interest groups. Nature, location, acquisition, documentation, recording, organization, and disssemination of information. Legal ethical, and public policy considerations. Prerequisites: SOC 110, POL S 101 or 102 or equivalent, or permission of director.

SO JU 420 Organized Crime and Criminal Organization (3) Sp *Walsh* Group criminal conduct. Nature, organization, permanency, maintenance, and relative strengths and weaknesses of various types of criminal groups and organizations, from highly structured to fluid and temporary associations. Attention to specific weaknesses of the criminal justice system in coping with such conduct. Prerequisite: SOC 371 or 372 or POL S 464.

SO JU 430 The Police (5) Sp *Smith* Conceptual and empirical issues concerning multifaceted and changing roles of the American police. Prerequisite: POL S 101, 202 or 204; or SOC 110.

SO JU 440 Criminal Law and Procedure (4) W *Browne* Substantive and procedural criminal law for lay persons; analysis of the philosophy behind the law, with an emphasis on due process in adult and juvenile courts; case-analysis teaching technique. Prerequisite: POL S 464 or SOC 373 or permission of instructor.

SO JU 450 Special Topics in Society and Justice (1-5, max. 15) *Stotland* Examination of various current topics or issues concerning the criminal justice system in our society.

SO JU 470 Evaluation Research in Criminal Justice (5) W Social science research methods relevant to criminal justice evaluation and operations research. Ethical considerations, formulation of goals and objectives, problem definition and research design, sources and methods of data collection, descriptive statistics, data interpretation, and utilizations of research results. Prerequisite: major standing or permission of director.

SO JU 499 Readings in Society and Justice (1-5, max. 10) AWSp Individual readings in society and justice. Prerequisite: major standing.

Sociology

202 Savery

The Department of Sociology has a strong commitment to research, publication, and training and has dedicated itself to providing a rich undergraduate program, both for students majoring in sociology and for others who wish to learn about human society and social relations.

Undergraduate Program

Bachelor of Arts Degree

Admission Requirement: 2.00 or better grade-point average.

Major Requirements: (1) 50 credits in sociology with a grade-point average of 2.50 or better for courses taken in the department. At least 25 credits in upper-division sociology courses (300 or above), 15 of which must be at the 400 level, including (3) and (4), below. (2) One or more of the following recommended: SOC 110, 240, 271. (3) One course in sociological theory: SOC 410, 411, 415, or 416. (4) One course in sociological methods: SOC 323 or 320. This requirement must be fulfilled as soon as possible after declaration of a major in sociology. (5) One course designed for sociology majors (SOC 401). Topics will be announced each quarter.

Graduate Program

Sociology seeks to explain population growth and distribution, social interaction, group behavior, deviance, organizations, and social change.

Emphasis is on empirical research aimed at testing theories and generating new principles. Students are trained in problem formulation, research design, data gathering and analysis, and bringing data to bear on significant questions. Instruction is offered in various methods: statistical, survey, computer, demographic and ecological, interaction observation, experimental, case study, and historical. Students learn social research by participating in faculty projects or developing their own studies.

Graduate instruction is offered in the following fields: methodology, theory, social change, demography-ecology, social psychology, the family, organizations, stratification and ethnic relations, and disorganization and deviant behavior.

The graduate program aims at completion of the Master of Arts degree in two calendar years and the Doctor of Philosophy degree in three years beyond the M.A. degree, although not all students finish in this time. A thesis is required for the M.A. degree. For the Ph.D., degree, the student must be certified in general methodology and in a major and a minor substantive area. An approved dissertation is also required.

Special Requirements

Applicants for admission to the Master of Arts program are evaluated on their undergraduate performance, Graduate Record Examination scores, statement of educational plans, and recommendations. For admission to the Ph.D. program, students are expected to have completed an M.A. degree in sociology in this department or elsewhere.

Financial Aid

Fellowships, research assistantships, and teaching assistantships are available to qualified graduate students, including those in their first year of training.

Correspondence and Information

Graduate Program Coordinator
114B Savery, DK-40

Faculty

Chairperson

Frederick L. Campbell

Professors

Barth, Ernest A. T.,* Ph.D., 1956, North Carolina; family, race and ethnic relations, stratification.

Blalock, Hubert M.,* (Political Science), Ph.D., 1954, North Carolina; methodology, theory construction, race relations.

Borgatta, Edgar F.,* Ph.D., 1952, New York; Director, Institute on Aging; social psychology, methodology, aging.

Campbell, Frederick L.,* Ph.D., 1967, Michigan; population and ecology, social organization.

Chirot, Daniel,* (International Studies),† Ph.D., 1973, Columbia; international studies, the Balkans.

Costner, Herbert L.,* Ph.D., 1960, Indiana; Associate Dean, College of Arts and Sciences; methodology, deviant behavior, social control.

Faris, Robert E. L. (Emeritus), Ph.D., 1931, Chicago; sociology.

Gross, Edward,* Ph.D., 1949, Chicago; formal organizations, industrial sociology, symbolic interaction.

Guest, Avery M.,* Ph.D., 1970, Wisconsin; demography, ecology, stratification.

Hechter, Michael,* Ph.D., 1972, Columbia; theory, political sociology, stratification.

Larsen, Otto N. (Emeritus), Ph.D., 1955, Washington; mass communications, public opinion, collective behavior.

Miyamoto, S. Frank (Emeritus), Ph.D., 1950, Chicago; social psychology, collective behavior.

Pullum, Thomas W.,* Ph.D., 1971, Chicago; Director, Center for Studies in Demography and Ecology; demography, methodology.

Roth, Guenther,* Ph.D., 1967, California (Berkeley); theory, political sociology, religion.

Schmitt, David R.,* Ph.D., 1963, Washington (St. Louis); experimental social psychology.

Schmid, Calvin F. (Emeritus), Ph.D, 1930, Pittsburgh; sociology.

Schrag, Clarence C. (Emeritus), Ph.D., 1950, Washington; deviant behavior, social control, methodology.

Stark, Rodney,* Ph.D., 1971, California (Berkeley); theory, religion, deviance.

van den Berghe, Pierre,* (Anthropology), Ph.D., 1960, Harvard; race and ethnic relations, kinship, sociobiology.

Wager, L. Wesley,* Ph.D., 1959, Chicago; organizations/occupations, theory, macrosociology.

Associate Professors

Blumstein, Philip W.,* Ph.D., 1970, Vanderbilt; gender roles, social psychology, symbolic interaction.

Cohen, Joseph (Emeritus), Ph.D., 1936, Michigan; sociology.

Cook, Karen S.,* Ph.D., 1973, Stanford; Director, Center for Studies in Social Psychology; experimental social psychology, complex organizations, medical sociology.

McCann, James C.,* Ph.D., 1972, Brown; methodology, demography.

Schwartz, Pepper J.,* Ph.D., 1974, Yale; family, human sexuality, field methods.

Weis, Joseph,* D.Crim., 1970, California (Berkeley); Director, Center for Law and Justice; deviance, criminology, delinquency.

Assistant Professors

Bridges, George S.,* Ph.D., 1979, Pennsylvania; deviance, crime, law.

Crutchfield, Robert D.,* Ph.D., 1980, Vanderbilt; deviance, crime, social control.

Hachen, David S.,* Ph.D., 1983, Wisconsin; stratification, organization, theory.

Howard, Judith A.,* Ph.D., 1982, Wisconsin; social psychology, gender roles.

Montgomery, Rhonda J. V. (Research), Ph.D., 1980, Minnesota; aging, family.

Yamagishi, Toshio, Ph.D., 1981, Washington; experimental social psychology, methodology, and Japanese society.

Course Descriptions

Courses for Undergraduates

SOC 105 Sociology of Black Americans (5) Evaluates the sociocultural context of the Black person's environment and consequences of interaction with that environment. Offered jointly with AFRAM 105.

SOC 110 Survey of Sociology (5) AWSp Human interaction patterns shaped by ecology, social structure, and culture. Communication, family processes, social differentiation, and formal organization as integrative mechanisms. Deviance, adaptation, social change. Course content may vary, depending upon instructor.

SOC 240 Introduction to Social Psychology (5) AWSp *Howard, Schmitt* Socialization of the individual; social processes; and interactions of persons in groups.

SOC 270 Social Problems (5) AWSp Analysis of the processes of social and personal disorganization and reorganization in relation to poverty, crime, suicide, family disorganization, mental disorders, and similar social problems.

SOC 271 Introduction to the Sociology of Deviance (5) AWSp *Bridges, Crutchfield, Weis* Examination of deviance, deviant behavior, and social control. Deviance as a social process; types of deviant behavior (e.g., suicide, mental illness, drug use, crime, "sexual deviance," delinquency); theories of deviance and deviant behavior; nature and social organization of societal reactions; and social and legal policy issues.

SOC 301 War (5) *Chirot* Origins and conduct of war, readings from anthropology, political science, economics, and history, as well as two novels and some recent articles on the arms-control controversy. Modern forms of warfare, including guerrilla war, world war, and nuclear war. Offered jointly with SIS 301.

SOC 302 Great Issues (5) *Blalock* Major social issues through lectures, panel debates, and readings. Issues vary, but include topics relating to population, environment, energy, welfare, inequality, education, religion, health, and justice. Issues discussed at world, national, community, and individual levels. Focuses on selected social institutions, such as family, business, military, labor, and government.

SOC 320 Introduction to Sociological Research (5) AWSp *Guest, McCann* Basic methods of sociological research. Various research strategies such as participant observation, experimentation, and survey research presented; emphasis may vary across sections. Major problems in research design such as hypothesis formulation, sampling of subject population, data analysis, and report writing. Recommended: introductory course in sociology.

SOC 323 Social Statistics (5) AWSp *Cook, McCann* Methods and sources for quantitative investigation of social science data.

SOC 330 Human Ecology (5) *Campbell* Factors and forces that determine the distribution of people and institutions.

SOC 331 Population and Society (5) *Campbell, Guest* Population growth and distribution, population composition, population theory, urbanization. Determinants and consequences of fertility and mortality trends and migration in economically developed and underdeveloped areas.

SOC 340 Symbolic Interaction (5) W *Blumstein* Role of language and culture in changing the human organism into a socialized human being; interpersonal processes and how they are shaped by the symbolic environment. Prerequisite: introductory course in social psychology.

SOC 345 Collective Behavior (5) Behavior of large numbers in crowds, masses, publics, and social movements where institutional definitions for joint action are minimal and the collectivity seeks to define new patterns of collective action. Prerequisite: 240 or permission of instructor or adviser.

SOC 346 Group Processes (5) *Cook, Schmitt* Systematic analysis of social processes in small groups, including conformity, deviance, cooperation, competition, coalition formation, status and role differentiation, inequity, communication, and authority and power. A variety of methods of research are considered: field studies, field experiments, laboratory studies, and the simulation of social processes. Prerequisite: 240 or equivalent.

SOC 347 Socialization (5) How social systems control the behavior of their constituent groups, and persons, through the socialization process, sanctions, power, allocation of status and rewards.

SOC 348 Social Movements (5) Social movements as collective enterprises to establish new social orders; types, formation, and organization of movements.

SOC 349 Religious Movements: The Sociology of Cults and Sects (3) *Stark* Understanding religion, what it is, and what it does. Examines the formation of new religious movements, cults, and sects, and the conditions under which they succeed or fail. Offered jointly with RELIG 349. Prerequisite: 110.

SOC 350 Contemporary American Institutions (5) *Guest, Wager* Origins and developments of major social institutions. Sociology of economic structure, political organization, religion, education, recreation, and other institutionalized patterns.

SOC 352 The Family (5) *Barth, Schwartz* The family as a social institution; personality development within the family; marriage adjustment; changing family patterns; disorganization and reorganization.

SOC 354 The Comparative Study of Societies (3) *van den Berghe* Entire societies at various levels of technological complexity are compared to explore problems of their development and structural organization. Both historical and contemporary and Western and non-Western societies are examined. Offered jointly with ANTH 354.

SOC 355 Social Change in Latin America (5) *Van Den Berghe* Problems of development and dependency in Latin America. Relations of power and production between social classes and ethnic groups, with special emphasis on Meso-America (Mexico, Guatemala) and the Andes (Peru, Bolivia). Offered jointly with SIS 355. Prerequisite: introductory course in sociology, anthropology, political science, or economics.

SOC 360 Introduction to Social Stratification (5) Social class and social inequality in American society. Status, power, authority, and unequal opportunity are examined in depth, using material from other societies to provide a comparative and historical perspective. Sociological origins of recurrent conflicts involving race, sex, poverty, and political ideology.

SOC 361 Age and Sex Differentiation (3) Physiological and social bases of age and sex differentiation in human societies. The implications of age and sex distinctions for kinship, economic, and political structures. The relationship between age, sex, and other bases of social inequality.

SOC 362 Race Relations (5) Interracial contacts and conflicts. Offered jointly with AFRAM 362.

SOC 363 Comparative Race and Ethnic Relations (3) *van den Berghe* Race and ethnicity are examined as factors of social differentiation in a number of Western and non-Western societies in Europe, Africa, Asia, and the Americas. Recommended: 362.

SOC 364 Women in the Social Structure (5) *Howard* Women's current roles within social institutions, focusing on women's work roles both in the labor force and in the home. Women in political organizations, religion, education, and law. Includes selected groups of women with compounded problems: Black women, lesbians, older women, women on welfare. Examines the structural, ideological, and historical determinants of woman's position. Offered jointly with WOMEN 364.

SOC 365 Urban Community (5) *Barth, Guest* Comparative and analytic study of organization and activities of urban groups.

SOC 366 Bureaucracy in Society (5) A *Gross* The coming of organizational societies; causes of bureaucracy; informal relations and work groups; ideologies; authority and the division of labor; social change in bureaucracies; the "faceless" bureaucrat in relationship to client needs; comparative organizations; complex organizations as settings for research.

SOC 367 Community Power and Urban Life (5) Background on forces influencing the growth of contemporary cities. Major focus on who controls the city and particularly on the policy outcomes of this control as they influence community life. Exploration of a variety of substantive areas, including urban renewal, welfare, and transportation through city case studies. Recommended: 365.

SOC 371 Criminology (5) *Bridges, Crutchfield, Weis* Survey of legal definitions, types of criminal behavior, trends and patterns, recidivism, characteristics of offenders, environmental influences, diagnostic methods, prediction, theories of crime and delinquency prevention, social policy. Recommended: 271.

SOC 372 Introduction to Criminal Justice (5) *Bridges, Weis* Examines roles of police, courts, and corrections in criminal justice. Traces cases from reporting of offense through investigation, detention, charging, prosecution and defense, adjudication, sentencing, and punitive sanctions or correctional treatment. Treatment alternatives. Community corrections. Legislative reforms. Innovations in policy. Recommended: 271.

SOC 373 Social Factors in White Collar Crime (5) W *Weis* Concept and etiology of white collar crime, its forms, costs, victims, and innovative developments. Prospects for theoretical explanations and social control.

SOC 401 Special Topics in Sociology (5, max. 15) AWSp Selected topics of contemporary interest taught by a sociologist active in the field. Topics vary and may be substantive, theoretical, or methodological. Prerequisite: major standing or permission of instructor.

SOC 410 History of Sociological Thought (5) *Campbell, Roth* Contributions of individual theorists (from Comte to the present) to a coherent body of testable hypotheses; emphasis on cumulative development of concepts and principles, emergence of sociology as a science, probable future developments.

SOC 411 Selected Topics in History of Sociological Thought (5) *Campbell, Roth* Specific areas or eras in the history of sociological thought. Emphasis on the development of sociological theory in relation to the intellectual and social setting of the time. Topics change from quarter to quarter. Some topics are: the development of concepts of order in sociological thought; conflict theories; the development of action theory in sociology; German sociology; Marx, Weber, and Simmel.

SOC 414 Theory Construction (5) Logical structure of sociological theories; the role of concepts, relations between variables, and operationalization in constructing and testing theoretical formations. Prerequisite: 20 credits in social sciences.

SOC 415 Theory of Social Organization (5) *Wager* State and usages of theory in social organization; importance of linkage between theory and methodology; major features of social organization demonstrated by intensive examination of representative theories of social organization with particular focus on complex forms.

SOC 416 Sociological Theory (5) W *Hechter* Theories of individual action, social order, and institutional change. Focuses on cumulative development of solutions rather than on works of given theorists. Emphasis on theories of social order. Explores how sociological treatments of these issues compare with those offered by economists and other social scientists.

SOC 419 Fieldwork: Observations and Interviewing (5) *Schwartz* Perspective, logic, and techniques of qualitative social research and analysis. Nature and uses of intensive interviewing, participant observation, and analytic ethnography. Application of field research principles. Research project required in addition to reading and analysis of classic studies. Recommended: 240 or 352.

SOC 420 Methods of Sociological Research (5) General survey of the principal methods of research used in sociology, and of special issues and problems in methodology. Prerequisite: 323 or equivalent.

SOC 422 General Methodological Strategies (3) *Wager* Introduction to the varied strategies of research in sociology. These strategies include laboratory and field experimentation, statistical studies, surveys, field observations, historical and comparative studies, mathematical modeling, and computer simulation. Prerequisite: 323.

SOC 423 Statistical Inference (5) Application of statistical methods to the analysis of sociological data.

SOC 424-425 Applied Social Statistics (3-3) *Blalock, Borgatta* Applications of statistics in sociology and related social sciences. Emphasis on problems of analysis with imperfect data. Theory construction, and reporting results. Probability in statistical inference. Analysis of variance; contingency table analysis, nonparametric procedures; regression analysis in social research. Prerequisites: 323 or 423 for 424-; 424- for -425.

SOC 426 Methodology: Quantitative Techniques in Sociology (3) *McCann* Measures of relationships among variables and among attributes; calculation techniques; application to typical sociological problems; interpretation. Prerequisite: 323 or 423.

SOC 427 Statistical Classification and Measurement (3) *Blalock, Costner* Application of statistical principles and methods to problems of classification and measurement in social research. Prerequisites: 426, 428-429.

SOC 428-429 Principles of Study Design (3-3) *Costner, Pullum* Study design from problem formulation to the analysis and interpretation of data. Prerequisite: 323.

SOC 432 Population and Modernization (3) W Examines role of demographic factors in the process of social modernization and economic growth. The approach is both historical, focusing on populations of developed countries since 1700, and analytic, stressing the attempts made by different disciplines to model demographic relationships, with attention to less-developed regions. Prerequisite: 331 or permission of instructor or adviser.

SOC 433 Demographic Methods (3) W *McCann, Pullum* Basic procedures for measuring human population growth and structure, including rate construction, standardization, and life table analysis. An introduction to population projections, indirect measurement procedures, and the formal analysis of population growth. Prerequisite: 323.

SOC 444 Theory and Research in Social Exchange (3) Drawing upon behavioral psychology, economics, and anthropology, social structure and social process as a form of exchange are examined. Emphasis is placed upon theory formation concerning social power and reward structures that differ sharply from perfectly competitive markets. Prerequisite: 240.

SOC 449 Social Relationships (3) Sp *Blumstein* Concept of social relationships in general. Examines types of relationships (e.g., marriage, friendship, parent-child relationship, and formal hierarchial bureaucratic relationships). Prerequisites: course in social psychology and 352 or equivalent.

SOC 451 Theory and Process of Social Change (5) *Hechter, Wager* Basic trends in American life; frames of reference for analysis of social change; forces causing social change. Prerequisite: 15 credits in social sciences.

SOC 452 Health and Social Behavior (5) Theoretical and methodological aspects of health, disease, and illness as deviant behavior in relation to social (organizational and occupational), ecological, demographic, and cultural determinants of health and health care.

SOC 453 Social Factors in the Family (3) Review and analysis of empirical research in courtship and marriage, marital adjustment, and specific areas of marriage and family life. Prerequisites: 323 and 352.

SOC 454 Social Change in Pre-Industrial Societies (5) *Chirot, Hechter* Theories and evidence concerning social change in preindustrial societies. Topics include: the Neolithic Revolution, rise and fall of classical empires, development of Western European feudalism, and rise of the modern world-system in the sixteenth century. Theories of modernization and development in contemporary developing societies, but not in contemporary developing societies.

SOC 455 Social Change in Industrial Societies (5) *Chirot, Hechter* Theories and evidence concerning social change in industrial societies. Emphasis on Britain, France, and the United States from about 1780 to the present. Topics include: economic development, the development of class consciousness, national development, and imperialism. Texts include nineteenth-century theories of industrialization plus contemporary research on these themes.

SOC 456 Political Sociology (5) *Roth* Bases of political legitimacy; modern and traditional structures of domination: theories of democracy, authoritarianism, and totalitarianism; relationship to social classes, status groups, and economic organization.

SOC 457 Sociology of Religion (5) *Roth* The relations between religion, polity, economy, and social structure; in particular, the political, economic, and social impact of religious beliefs and organizations, as well as the social determination of these beliefs and organizations; the rise of secularism, the rationalization of modern life, and the emergence of political quasi-religions.

SOC 458 Institutional Forms and Processes (5) *Wager* Process of institutionalization and the general nature of institutions; relationship of institutions to persons; institutions and social control; social change and institutional disorganization.

SOC 460 Social Differentiation (5) *Barth* Analysis of societal organization based on sex, age, residence, occupation, community, class, caste, and race.

SOC 463 American Black Communities (3) *Barth* Internal structure of class and caste patterns; resultant personality and institutional development.

SOC 465 Complex Organizations (3) *Cook, Gross, Hachen* Examination of the structure of complex organizations. Attention to developing generalizations applicable to industrial organizations, businesses, hospitals, prisons, labor unions, governments, universities, armies, and similar formally instituted organizations. The major focus is on empirical research, with some attention to methodological problems in studying such organizations. Prerequisite: 15 credits in sociology.

SOC 466 Industrial Sociology (5) *Wager* Changing focus of field; cultural variation, work, and the worker; technology, society, and the evolution of industrial forms; types and forms of industrial organizations; industrial organizations as social and technical systems; issues of control, process, and change; the individual in social and technical systems.

SOC 468 Sociology of Occupations and Professions (5) Frameworks for study of occupations and professions; occupational structure and mobility in American society and relation to adult socialization and career development; occupational and professional associations and society. Prerequisites: 240 and 15 credits in social sciences.

SOC 469 Balkan Societies (3) *Chirot* Examination of the roots of Balkan social problems (economic backwardness, minority-group conflicts, peasant problem), the failure of pre-1945 attempts to solve these problems, and the post-1945 communist attempts at solution. Particular emphasis placed upon Romania and Yugoslavia. Prerequisite: at least one introductory social science course.

SOC 472 Juvenile Delinquency (5) *Crutchfield, Weis* Factors in delinquency, juvenile courts. Programs of treatment and prevention. Recommended: 371 or equivalent.

SOC 473 Corrections (5) *Weis* Analyzes research on diversionary methods and treatment of convicted offenders. Emphasis on program evaluation. Community treatment, fines, restitution; probation, parole, halfway houses, and other alternatives to incarceration; correctional institutions. Organization of state and federal systems. Problems of administration. Subsidies and governmental control. Planning and public participation. Prerequisite: 371 or 372. Recommended: 323.

SOC 481, 482, 483 Issues in Analytic Sociology (3, max. 9; 3, max. 9; 1-3, max. 9) Examination of current issues in sociological analysis. The specific content of the course varies according to recent developments in sociology and according to the interests of the instructor. Any of the sequence may be repeated with permission of instructor.

SOC 484 Family in Later Life (3) Variations in structure and dynamics of the family in later life. Historical trends, marital dynamics, intergenerational relations, extended kinship relations, and social policy. Prerequisite: 352.

SOC 486 Human Family Systems: Biological and Social Aspects (3) W *van den Berghe* Biological bases for human mating and reproduction, and an examination of the range of cross-cultural variability in human systems of kinship and marriage: compare wide range of human and nonhuman species, and between Western and non-Western human societies; interplay of biological, ecological, and sociocultural factors in determining the structure and function of human family systems. Offered jointly with ANTH 486.

SOC 488 Sociological and Psychological Theories of Sexuality (5) Sp *Blumstein, Schwartz* Advanced course on human sexuality covering psychological and sociological theories of sexual identity and life-styles, analysis of present research in sexuality, and generation of new research. Topics include acquisition of sexual identity differences in male and female sexual patterns, sex in relationships, sexual malfunctioning, etc. Paper and research proposal are required. Recommended: 323.

SOC 495 Honors Senior Thesis (5) Preparation of senior honors thesis. Sociology majors only.

SOC 496, 497, 498 Honors Senior Seminar (3 or 5, 3 or 5, 3 or 5) A,W,Sp Exploration of selected sociological problems with emphasis on research experience and the interpretation of data. For sociology majors only, primarily for honors students. Prerequisites: senior standing and permission of instructor.

SOC 499 Undergraduate Independent Study or Research (2-5, max. 15) AWSp Open only to qualified undergraduate students by permission of instructor (see departmental adviser).

Courses for Graduates Only

SOC 510 Seminar in Sociological Theory (3) *Campbell, Roth, Stark* Macrosociological theories; functionalism and neoevolutionism; conflict and consensus approach; comparative strategies; models and long-range theories; ideology and sociology. From Marx and de Tocqueville to contemporary literature.

SOC 513 Demography and Ecology (3) *Guest, McCann, Pullum* Review of selected research problems related to demography and ecology. Provides substantive knowledge of determinants and consequences of population patterns, to delimit areas where current knowledge is deficient; to begin instilling the analytic skills required to advance knowledge in the area.

SOC 514 Current Theories in Social Psychology (3) *Blumstein, Cook, Howard, Schmitt* Broad graduate-level introduction to the theories in the field of social psychology.

SOC 515 Current Research in Social Psychology (3) *Blumstein, Schmitt* Broad graduate-level introduction to the research in the field of social psychology.

SOC 516 Organizations (3) *Cook, Gross, Wager* Broad graduate-level introduction to the theory and research on complex organizations.

SOC 517 Deviance and Social Control (3) *Bridges, Crutchfield, Weis* Survey of current research on deviant behavior and mechanisms of social control; definitions and forms of deviant behavior, causal analysis, and legal or other methods of social control.

SOC 518 Social Stratification (3) *Chirot, Guest* Intensive preparation in theoretical, methodological, and substantive topics in social stratification.

SOC 519 Political Sociology and Social Change (3) *Hechter, Roth* Designed for first-year graduate students as part of the requirements for the M.A. degree. The course is intended to thoroughly familiarize graduate students with basic perspectives in the area of political sociology and social change, which is an examination field for the Ph.D., with some classical works and some exemplary empirical studies of recent date.

SOC 525 Experimental Methods in Social Research (3) Sp *Borgatta, Schmitt, Yamagishi* For graduate students who wish additional understanding of techniques, problems, and issues involved in the design and conduct of experimental social research. Considers strengths and weaknesses of various experimental designs, artifacts and their control, problems in going from the laboratory to the field, and ethical issues. Prerequisites: 424-425 and 428-429, or equivalents.

SOC 526 Causal Approach to Theory Building and Data Analysis (3) *Blalock* Theory construction and testing from a causal models perspective. Path analysis, standardized *vs.* unstandardized measures, feedback models, identification problems, estimation in overidentified models, difference equations, differential equations, stability conditions. Multiplicative models as alternatives to additive ones. Causal approach to measurement error.

SOC 527 Measurement of Basic Sociological Concepts (3) *Blalock* Conceptualization and measurement problems in sociology, using major concepts as illustrations of basic issues. Causal approach to measurement to deal with problems of indirect measurement, cross-level measurement problems, aggregation and disaggregation. Consequences of crude measurement for data analyses. Prerequisite: 424; recommended: 426.

SOC 528 Seminar on Selected Statistical Problems in Social Research (3) *Costner* Prerequisite: 426.

SOC 529 Multiple Indicators in Social Measurement (3) *Costner* Repeated measures, alternate measures and multiple observers in estimating the reliability, assessing the validity, and analyzing conceptual and indicator problems in social measurement. Implications of measurement error for research conclusions. Prerequisites: 424 and 426.

SOC 530 Advanced Human Ecology (3) *Gampbell, Guest*

SOC 531 Demography (3) *Guest, McCann, Pullum* Research problems in population and vital statistics.

SOC 533 Research Methods in Demography (3) *McCann, Pullum* Measures of population composition, fertility, and mortality. Life table analysis, standardization procedures, population projects and estimates.

SOC 539 Selected Topics in Demography and Ecology (3, max. 9) *Pullum* Specialized problems in demography or ecology are covered; for example, migration, fertility, mortality, language, race and ethnic relations, metropolitan community. See quarterly announcement for specific problem to be covered.

SOC 540-541 Proseminar in Social Psychology (3-3) W,Sp Major theoretical perspectives in social psychology for students planning a major or minor in this area. Behaviorism and social exchange, symbolic interaction, and cognitive processes. Theory and illustrative research.

SOC 542 Selected Topics in Group Processes (3) *Cook, Schmitt* Theories, methodology, and studies in the area of small-group research. May be repeated for credit. Prerequisite: permission of instructor for nonmajors.

SOC 544 Seminar on Social Power (3) Examination of basic principles concerning power, influence, and authority in small groups, organizations, and communities. Recommended: 240, 415, and 460.

SOC 545 Methods of Experimental Analysis in Social Research (3) *Borgatta, Schmitt, Yamagishi* Application of the method of experimental analysis to problems in sociology and social psychology.

SOC 546 Seminar on Symbolic Interaction (3) *Blumstein* Focuses on several key areas in, and related to, the symbolic interactionist perspective (e.g., language, the self, the dramaturgic perspective, ethnomethodology, attribution theory, etc.). Prerequisite: permission of instructor for nonmajors.

SOC 548 Seminar in Interpersonal Attraction (3) Nature of interpersonal attraction, the social and psychological factors that underlie it, and the ways in which it is structured in social relationships. Examines various theoretical approaches to attraction and research ranging from initial attraction among strangers to the development of ongoing social relationships. Prerequisite: previous course in social psychology.

SOC 550, 551 Marriage and the Family (3,3) *Barth, Schwartz* Analysis of marriage and family patterns and problems, with initial emphasis on research findings and methods. Individual research on selected projects. Prerequisite: 453 or equivalent.

SOC 555 Methods in Macro, Comparative, and Historical Sociology (3) *Chirot*

SOC 559 Seminar on Gender Roles (3) Theoretical issues concerning gender and society. Current state of empirical knowledge on the sociology of gender and strategies for research. Cross-cultural variations in gender roles, how these develop in people, how gender roles develop in society and their effects on social structure, social institutions, and the effects of gender role interaction. Prerequisite: graduate student standing in a social science. (Offered alternate years.)

SOC 561 Sociology of Health and Illness: An Organizational and Managerial Perspective (3) Critical examination and discussion of sociological approaches—methodological, theoretical, and empirical—in the health-care field. Attention to applied studies in the field and, more broadly, to the implications for decision making from the sociological perspective. Offered jointly with HSERV 554. Prerequisite: HSERV 511 or undergraduate major in sociology, or permission of instructor.

SOC 562 Seminar in Comparative Race Relations (3) *van den Berghe* Cross-cultural approach to race and ethnic relations, including case studies from Africa and Latin America. Prerequisite: graduate standing in social sciences.

SOC 563 Advanced Seminar in Medical Sociology (3) *Cook* Development and testing of theories related to illness behavior, health occupations and professions, and the organization of health services. Emphasis given to provider-patient relationships and the sociology of health-care-delivery organizations. Offered jointly with HSERV 564. Prerequisite: admission to health services doctoral opportunities program or graduate status in sociology, or permission of instructor.

SOC 566, 567 Seminar in Complex Organizations (3,3) *Gross, Wager* Special topic seminars in the field of complex organizations or industrial sociology. Prerequisite: 465 or equivalent.

SOC 568 Women and Technology (3) Comparison of technological rationality with feminist modes of thought. Focus on values that are/could be applied in assessing technologies in order to evaluate their effects. Offered jointly with SMT 568.

SOC 574 Seminar on Methods of Criminological Research (3) *Bridges, Weis* Provides training in the technical analysis of published research in criminology; designs and processes studies in parole prediction, prediction of prison adjustment, and prediction of treatment effect.

SOC 581, 582, 583 Special Topics in Sociology (3,3,3) A,W,Sp Examination of current substantive topics in sociology. Content varies according to recent developments in sociology and the interests of the instructor.

SOC 588 Sociological Aspects of Human Sexuality (3) *Blumstein, Schwartz* Research-oriented seminar. Sociological literature on sexuality. Individual project based on readings and discussions of strategies for studying sexuality. Topics include: cross-cultural perspectives on sexuality, the social scripting of sexual conduct, sex roles, sexual identity, gender identity, sexual life-styles, prostitution, pornography.

SOC 600 Independent Study or Research (*) AWSp

SOC 700 Master's Thesis (*) AWSp

SOC 800 Doctoral Dissertation (*)

South Asian Studies

See International Studies.

Speech and Hearing Sciences

203 Eagleson

The speech and hearing sciences concern the processes and disorders of verbal communication. The undergraduate programs include the study of normal language development, speech acoustics, speech physiology and perception, hearing, the nature of language, speech and hearing disorders in children and adults, and the clinical processes involved in identification, prevention, and remediation of those disorders.

Undergraduate Program

Bachelor of Science Degree

Admission Requirements: 2.50 overall grade-point average. Recommended preparation includes high school physics or equivalent; introductory exposure to human learning, sensory, perceptual, and cognitive processes, general physiology and the physiology of behavior, and college mathematics.

Core requirements for all options: 28 credits in the following courses—SPHSC 201, 250, 302, 303, 307, 310, 311. Students following Options II, III, or IV below must have a 3.00 grade-point average in courses that make up the common core.

OPTION I, GENERAL ACADEMIC

Intended to provide broad perspectives of the field, but not to prepare students for professional careers in the speech and hearing sciences.

Major Requirements: Core requirements listed above; 25 credits in courses dealing with normal and abnormal language, speech, and hearing taken from the following: SPHSC 315, 330, 332, 380, 401, 402, 410, 420, 430, 431, 450, 454, 484, 499.

OPTION II, BASIC SCIENCES

Intended for students who wish to continue graduate study in speech and hearing that leads to university teaching and research careers, but does not include clinical training in audiology or speech pathology.

Major Requirements: Core requirements listed above; 25 credits, including SPHSC 401, 402, 410, 420, 499, and 6 credits in the speech pathology or clinical audiology areas; 16-20 credits outside the department, including a mathematics course that deals with calculus, and one course each in statistics, psychology (learning, memory, or cognition), and human physiology.

OPTION III, CLINICAL SCIENCES—AUDIOLOGY

Intended for students who wish to continue graduate study and to obtain clinical training in audiology.

Major Requirements: Core requirements listed above; 40 credits, including SPHSC 315, 330, 332, 350, 351, 370, 380, 391 (diagnostics and rehabilitation), 401, 420, 431; at least 9 credits outside the department, in psychology (deviant personality, cognitive development, developmental psychology, neural and sensory bases of behavior), educational psychology (behavior management, statistics), or mathematics (elementary functions).

OPTION IV, CLINICAL SCIENCES—SPEECH/LANGUAGE PATHOLOGY

Intended for students who wish to continue graduate study and to obtain clinical training in speech/language pathology.

Major Requirements: Core requirements listed above; 42 credits, including SPHSC 315, 330, 332, 350, 351, 370, 380, 391 (diagnostics) or 451 (audiology), 391 (rehabilitation), 401, 430, 431, 454; two courses outside the department in developmental psychology, deviant personality, or behavior modification.

Graduate Program

The Department of Speech and Hearing Sciences offers the Master of Science degree and the Doctor of Philosophy degree. The program consists of a wide range of course work and seminars providing opportunities for the development of scholarly and professional competence in various areas of specialization: language acquisition; phonetics; speech production and transmission; hearing; speech perception; computer recognition and generation of meaningful speech; and human communication disorders related to language, speech, and hearing and the clinical procedures involved in their identification, prevention, and remediation. To complement departmental curricula in various specialization areas, close interdisciplinary relationships are maintained with other University departments and off-campus centers. Advanced degrees in the speech and hearing sciences equip the student to do research, to teach at the college and university level, and to provide clinical services to the communicatively handicapped.

Special Requirements: Prospective candidates for advanced degrees are expected to have earned a minimum of 50-60 credits in the speech and hearing sciences at the undergraduate level, depending upon the specific area of graduate specialization chosen. The M.S. (thesis) degree requires a minimum of 30 credits of approved course work, plus an acceptable thesis (9 credits). This degree program is recommended for students who plan to continue graduate study for the Ph.D. degree. The M.S. (non-thesis) degree is intended primarily for students who desire careers as speech and hearing clinicians, but who do not intend to continue study for the Ph.D. degree. A minimum of 45 credits are required, of which 23 must be at the 500 level or above in this program. Students also complete the academic and practical experience requirements for the Certificate of Clinical Competence of the American Speech-Language-Hearing Association. These requirements necessitate more than the minimum 45-credit program for most students. A thesis is not required. For the Ph.D. degree, individually tailored programs of study are developed to focus on specialized areas of interest within speech science, experimental and clinical audiology, and speech/language pathology.

Financial Aid

A number of teaching and research assistantships are available for qualified graduate students. In addition, the department has traineeships supported by the Office of Education and the Veterans Administration.

Research Facilities

The department's research laboratories contain sophisticated equipment for the collection and analysis of data related to the study of human communication and its disorders. The University Speech and Hearing Clinic and the Child Development and Mental Retardation Center also provide laboratories to support applied research in communication processes and remedial procedures.

Correspondence and Information

Chairperson
204 Eagleson, JG-15

Faculty

Chairperson

Fred D. Minifie

Professors

Carrell, James A. (Emeritus), Ph.D., 1936, Northwestern; speech pathology, voice disorders.

Kuhl, Patricia R.,* Ph.D., 1973, Minnesota; speech perception.

Miner, Adah L. (Emeritus), Ph.D., 1962, Wisconsin; speech pathology, clinical supervision.

Minifie, Fred D.,* Ph.D., 1963, Iowa; speech science.

Palmer, John M.,* Ph.D., 1952, Michigan; disorders of voice and orofacial deformities.

Prins, David,* Ph.D., 1961, Michigan; stuttering.

Tiffany, William R. (Emeritus), Ph.D., 1951, Iowa; phonetics and speech sciences, clinical evaluation.

Wilson, Wesley R.,* Ph.D., 1969, Washington; audiology, infant assessment and aural rehabilitation.

Yantis, Phillip A.,* Ph.D., 1955, Michigan; audiology, clinical evaluation.

Associate Professors

Beukelman, David R.,*‡ (Rehabilitation Medicine), Ph.D., 1971, Wisconsin; speech/language pathologist.

Carpenter, Robert L.,* Ph.D., 1969, Northwestern; language and language disorders.

Coggins, Truman E.,* Ph.D., 1976, Wisconsin; language disorders in children.

Cooker, Harry S.,* Ph.D., 1963, *Iowa*; speech science.

Dale, Philip S.,*‡ (Psychology), Ph.D., 1968, Michigan; psychologist.

Flowers, Charles A.,* Ph.D., 1972, Iowa; neurogenic disorders.

Reich, Alan R.,* Ph.D., 1975, Iowa; speech physiology and voice disorders.

Thompson, Gary,* Ph.D., 1966, Minnesota; pediatric audiology, clinical evaluation.

Assistant Professors

Burns, Edward M., Ph.D., 1977, Minnesota; psychoacoustics.

Folsom, Richard C.,* Ph.D., 1979, Washington; electrophysiologic audiology.

Mateer, Catherine A.* (Research), Ph.D., 1977, Ontario; neuropsychology and neurolinguistics.

McClean, Michael D.* (Research), Ph.D., 1971, Washington; speech physiology.

Olswang, Lesley B.,* Ph.D., 1978, Washington; language development and disorders.

Stoel-Gammon, Carol,* Ph.D., 1974, Stanford; developmental phonology and phonetics.

Lecturers

Barker, Constance, M.A., 1978, Western Washington; aural rehabilitation.

Branson, Cynthia W., M.A., 1970, Northwestern; language disorders, dysarthria.

Cerf, F. Ann, Ph.D., 1972, Washington; stuttering.

Delisi, Adele O., M.S., 1967, Michigan; speech/language pathology.

Eblen, Linda E., M.A., 1969, Connecticut; speech/language pathology.

Kriegsmann, Elinor A., M.A., 1963, San Francisco State; speech/language pathology.

Lablak, James A., M.A., 1971, Washington; audiology.

Moering, Betty C., M.S.P.A., 1975, Washington; speech/language disorders.

Oblak, Susan B., M.S.P.A., 1973, Washington; communication disorders.

Rosendahl, Pamela D., M.S.P.A., 1975, Washington; speech pathology.

Warren, Jarilyn, M.S.P.A., 1978, Washington; aural rehabilitation.

Willett, Donna K., M.S.P.A., 1972, Washington; communication disorders.

Course Descriptions

Courses for Undergraduates

SPHSC 100 Voice and Articulation Improvement (3) AWSp The nature of the process of voice production and of the sound system of standard American speech. Questions of speech standards, regional and social dialects, and voice quality. Special laboratory work may be available to students with significant voice or pronunciation problems.

SPHSC 104 Human Speech and Hearing Behavior (3) AWSp Man's most clearly human endowment: his capacity for speech production and perception. Speech and hearing mechanisms considered from the point of view of their development, structure, and function, with special reference to current and significant problems and issues, such as the nature of speech learning, and the significance of diversity in patterns of speech production and reception. Not open to speech and hearing sciences majors.

SPHSC 111 The American English Sound System (2, max. 4) AWSpS The phonetic and phonological characteristics of English, its distinctive features, and strategies for dialect change. Applied phonetics for those who wish to change their own speech patterns. Prerequisite: college-level reading knowledge of English.

SPHSC 201 Anatomy of the Speech and Hearing Mechanisms (5) AWSpS *Palmer* Anatomy and functional coordination of those parts of the human body associated with phonation, articulation, resonance, and hearing. Required for majors; open to nonmajors.

SPHSC 250 Introduction to Communication Disorders (3) AWS Normal and disordered oral communication. Includes speech, language, and hearing disorders. Required for majors.

SPHSC 300 Speech Science (5) AWSpS *Cooker* Basic physiological and acoustical attributes of speech. For nonmajors.

SPHSC 302 General Phonetics (4) AWSp *Stoel-Gammon* Applied phonetic analysis and transcription. Applications to the problems of speech improvement, speech disorders, and standard and nonstandard English. Required for majors.

SPHSC 303 Applied Analysis of Language Behavior (3) AW *Stoel-Gammon* Application of linguistic analysis techniques to the language behavior of speech-disordered persons. Required for majors.

SPHSC 307 Speech and Language Development (3) WSp Study of the normal acquisition of speech and language in children. Required for majors. Prerequisite: 250, 302, 303, or permission of instructor.

SPHSC 310 Introduction to Hearing Science (5) AWSpS *Folsom, Wilson* Acoustic properties of simple and complex sounds; description of normal audition; elementary structure and function of the hearing mechanism. Required for majors. Prerequisite: MATH 105 or equivalent.

SPHSC 311 Speech Science: Speech Production (5) AWSp *Cooker, Miniflie, Reich* Physiological, acoustical, and perceptual aspects of speech production. Examples and laboratory work directed toward students with interests in speech pathology and audiology. Required for majors and open only to them. Prerequisites: 201 and 310; 310 may be taken concurrently.

SPHSC 315 Survey of Hearing Impairment (3) ASp *Thompson, Wilson, Yantis* Causes of hearing impairment and their psychological, social, and educational/vocational effects on the individual. Prerequisite: 310.

SPHSC 330 Disorders of Articulation (3) ASp Nature, etiology, and treatment. Prerequisites: 250, 302, and 307.

SPHSC 332 Clinical Processes I: Assessment (3) ASp *Olswang* Principles and procedures for the assessment of speech and language disorders. Prerequisites: 307, 330.

SPHSC 350 Clinical Processes II: Treatment (4) WS *Olswang* Principles and procedures for planning the effective treatment of speech and language disorders. Prerequisites: 330, 332, and permission of undergraduate adviser.

SPHSC 351 Practicum in Speech Pathology (1-4, max. 6) AWSpS Laboratory experience. Students are encouraged to take 4 to 6 credits of 351 over a two- or three-quarter sequence. Prerequisites: 332, 350, and permission of undergraduate adviser.

SPHSC 370 Basic Audiometry (5) WS Theory and practice of the assessment of hearing function, including standard pure-tone audiometry, speech audiometry, and basic impedance audiometry. Prerequisites: 315 and permission of undergraduate adviser.

SPHSC 380 Introduction to Aural Rehabilitation (3) WS Principles and methods of amplification, speech reading, auditory training, and speech conservation. Prerequisites: 315 and permission of undergraduate adviser.

SPHSC 391 Practicum in Audiology (2, max. 10) AWSpS Supervised practicum in audiological assessment (section *A*) and aural rehabilitation (section *B*) of children and adults. Prerequisites: 350 for section *A*; and 351, 380 for section *B*, and permission of undergraduate adviser.

SPHSC 401 Neural Bases of Speech and Language (4) AS *Flowers* Neuroanatomical and neurophysiological bases of motor speech production and language processes. Laboratory. Prerequisite: 201 or permission of instructor.

SPHSC 402 Advanced Phonetic Analysis (2) W Advanced transcriptional and feature analysis of abnormal and nonstandard speech patterns. Prerequisite: 302 or equivalent introductory phonetics course by permission of instructor.

SPHSC 410 Psychology and Physiology of Audition (4) A Physiological and behavioral bases of hearing. Correlation of human hearing with acoustic, anatomic, and physiological factors.

SPHSC 420 Instrumentation for Speech and Hearing Sciences (3) A *Wilson* General problems in design and application of electronic equipment used in the speech and hearing sciences. Laboratory problems and demonstrations.

SPHSC 430 Nature of Stuttering (3) ASp Major theories of stuttering are studied in light of research concerning the characteristics of stutterers and their symptoms. Prerequisite: 250 or permission of instructor.

SPHSC 431 Language Disorders of Children (3) ASp *Carpenter, Coggins* Consideration of descriptions and theories, both historical and contemporary, of disordered language in children and related problems. Prerequisites: 250, 303, and 307.

SPHSC 444 Speech, Language, and Hearing Disorders in the Elderly (3) S *Flowers, Yantis* Speech, language, and hearing changes caused by aging. Communication disorders in the elderly population and their management. Offered for nonmajors, especially students or practitioners involved in the delivery of health care and social services to the elderly.

SPHSC 449 Special Studies in Speech Pathology and Audiology (*) AWSpS Selected special problems in speech pathology and audiology. Prerequisite: permission of instructor.

SPHSC 450 Treatment of Stuttering (3) WS Description and evaluation of therapy systems for children and adults who stutter. Two hours per week of therapy observation are integrated with class material. Prerequisites: 350 and 430, or permission of instructor.

SPHSC 451 Speech Pathology-Audiology Practicum in the Schools (1-10, max. 10) AWSp Special projects in clinical practicum, offered only in the school setting. Provides an opportunity for students to extend practicum experiences in this special environment; does not fulfill requirements for teaching practicum in the College of Education. Prerequisites: 350 and permission of undergraduate adviser.

SPHSC 453 Communication Augmentation for Non-Speaking Individuals (3) WS Communication needs of nonspeaking individuals. Interdisciplinary approaches to the evaluation, selection, and implementation of aided and unaided communication augmentation systems. Offered jointly with REHAB 458. Prerequisite: basic course work in either speech and hearing sciences, physical therapy, occupational therapy, or engineering, or permission of instructor.

SPHSC 454 Voice Disorders (3) WS *Reich* Etiology, evaluation, and treatment. Prerequisites: 201, 250, and 311.

SPHSC 470 Survey of Audiological Assessment (3) S *Yantis* General review of methods, techniques, and instruments used in the measurement of auditory function designed for majors in speech pathology, speech science, and special education. Not open to audiology majors except by permission. Review of research literature. Prerequisite: 370 or permission of instructor.

SPHSC 479 Pediatric Audiology (3) Sp *Thompson* Assessment of auditory disorders in infants and young children. Emphasis on behavioral and electrophysiologic techniques and on the role of the audiologist in the clinical management of the young hearing-impaired child. Prerequisite: 370 or equivalent.

SPHSC 484 Hearing Conservation for Children (3) SpS Planning and execution of identification and educational programs relative to hearing-impaired infants and children of preschool and school ages. Prerequisite: 370 or permission of instructor.

SPHSC 499 Undergraduate Research (1-5, max. 15) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

SPHSC 502 Advanced Anatomy of Speech and Hearing Structures (2) AWSp *Palmer* Directed individual dissection and study of selected anatomic structures of the speech or hearing mechanisms. Prerequisites: 201 and permission of instructor.

SPHSC 503 Current Issues in Speech Science (3, max. 9) Application of experimental methods to research in speech science.

SPHSC 504 Research Methods in Speech and Hearing Science (3) WS *Kuhl, Miniflie* Introduction to empirical methods in the speech and hearing sciences.

SPHSC 505 Clinical Research in Communication Disorders (3) Sp *Olswang* Introduction to clinical research. Methodological issues concerning the evaluation of treatment for speech, hearing, and language disorders. Primary emphasis on time series designs. Prerequisite: 504 or permission of instructor.

SPHSC 510 Physiological Acoustics (3) W Study of pertinent literature and experimental techniques incident to the scientific study of the normal and abnormal auditory system. Prerequisites: 410 and familiarity with algebra and trigonometry. (Offered alternate years.)

SPHSC 511 Psychoacoustics (3) W Review of significant literature and theory pertinent to normal auditory sensitivity, pitch, loudness, and other attributes of auditory sensation. Prerequisites: 410 or permission of instructor, familiarity with intermediate mathematics (MATH 105 or equivalent). (Offered alternate years.)

SPHSC 514 Speech Physiology (4) A *Cooker* Study of the physiological parameters of speech production. Prerequisites: 310, 311, or permission of instructor.

SPHSC 515 Speech Acoustics (4) W *Miniflie* Study of the acoustical correlates of the distinctive parameters of speech. Prerequisites: 310, 311, 514, or permission of instructor.

SPHSC 516 Speech Perception (4) Sp *Kuhl* Study of the perceptual and linguistic parameters of speech perception. Prerequisites: 310, 311, 515, or permission of instructor.

SPHSC 519 Seminar in Speech Science (2, max. 6)

SPHSC 520 Advanced Instrumentation for Speech and Hearing Sciences (3) Sp *Cooker, Wilson* Design and use of electronic and electroacoustic devices in the speech and hearing sciences. Four hours of laboratory required each week. Prerequisite: 420.

SPHSC 530 Maxillofacial Bases of Speech Disorders (3) AS *Palmer* Causation and remediation of speech disorders derived from upper vocal tract defects, including cleft palate and other craniofacial defects. Thorough grounding in vocal tract anatomy and physiology, speech acoustics, and multidiscipline rehabilitation approaches. Recommended: 201 or permission of instructor.

SPHSC 531 Neurogenic Motor Speech Disorders (3) AW *Flowers* The nature of dysarthria and apraxia of speech and the evaluation and treatment of those disorders. Prerequisite: 401 or permission of instructor.

SPHSC 532 Neurogenic Language Disorders (3) WSp *Flowers* Nature of aphasia and other neurogenic language disorders; evaluation and treatment of those disorders. Prerequisite: 401 or permission of instructor.

SPHSC 533 Speech Pathology in a Medical Setting (3) For speech pathology students who intend to work in a hospital. Prerequisites: 531 and 532 or permission of instructor.

SPHSC 536 Evaluation of Communication Disorders in Children (3) ASp Approaches in differential diagnosis of speech and language disorders in children. Prerequisites: 332 and permission of instructor.

SPHSC 551 Advanced Practicum in Speech Pathology Evaluation (1-9, max. 10) AWSpS Laboratory experience in the evaluation of speech and language disorders. Prerequisites: 536 and permission of instructor.

SPHSC 552 Advanced Practicum in Speech Pathology Management (1-9) AWSpS Laboratory experience in the management of speech and language disorders. Prerequisites: 551 and permission of instructor.

SPHSC 555 Preinternship (1-9) AWSpS *Oblak* Practicum in speech pathology or audiology designed to teach the clinical regimen of a participating professional center prior to assuming a full internship assignment. Prerequisite: 150 hours of supervised practicum.

SPHSC 568 Seminar in Language Development and Disorders (2, max. 6) Prerequisites: 307, 431, 562.

SPHSC 569 Seminar in Speech Pathology (2, max. 6)

SPHSC 570-571 Assessment of Auditory Dysfunction I, II (4-4) A,W *Yantis* Utilization of acoustic variables in the evaluation of abnormal hearing. Critical analysis of the literature. Concurrent registration in 591 required. Prerequisite: 370 or equivalent.

SPHSC 572 Impedance Audiometry (3) W *Wilson, Yantis* Instrumentation and approaches to evaluation of auditory function through determination of impedance characteristics, including tympanometry, and detection of the acoustic reflex. Prerequisite: 370 or equivalent. (Also offered alternate Summer quarters.)

SPHSC 573 Electrophysiologic Assessment of Auditory Function (3) A *Folsom* Consideration of electrophysiologic techniques that may be used to evaluate the normal and disordered auditory system. Outside laboratory required. Prerequisite: 310 or permission of instructor.

SPHSC 574 Speech Audiometry (2) W *Yantis* Use of speech stimuli in predicting general communicative functioning and in the behavioral evaluation of the auditory system. Prerequisite: 370. (Offered alternate years.)

SPHSC 575 Medical Background for Audiology (2) Sp *Snyder* Diseases and injuries of the ear resulting in reduced audition. Prerequisite: 571 or permission of instructor.

SPHSC 580 Advanced Aural Rehabilitation (3) Sp Survey and study of the pertinent research literature in speech reading, auditory training, and speech conservation for the auditorily handicapped. Prerequisite: 380 or permission of instructor.

SPHSC 581 Management of Hearing-Impaired Children (3) S Management of hearing-impaired children, including identification of target behaviors and methods for modification such as individualized therapy programs and parent and teacher involvement.

SPHSC 582 Hearing Aid Amplification (4) W Acoustic amplification and methods of determining electroacoustic characteristics. Includes earmold technology. Prerequisites: 370 and 380, or permission of instructor.

SPHSC 583 Hearing Aid Selection (3) Sp *Yantis* Consideration of strategies utilized in selecting acoustic amplification for the hearing impaired, including review of pertinent research literature. Prerequisite: 582 or permission of instructor.

SPHSC 584 Industrial and Community Hearing Conservation (2) W *Yantis* Psychophysiological effects of environmental noise on man. Techniques of noise measurement and attenuation, including the planning of hearing conservation programs in industry and in the community. Prerequisite: 370 or permission of instructor. (Offered alternate years.)

SPHSC 589 Seminar in Audiology (2, max. 6) Prerequisite: permission of instructor.

SPHSC 591 Advanced Practicum in Audiology (2, max. 10) AWSpS Prerequisite: forty hours of practicum.

SPHSC 596 Experimental Design in Speech and Hearing Sciences (3) Sp Applications of basic statistical procedures to investigation of specific problems in the communication sciences. Prerequisites: 504, course in statistics, or permission of instructor. (Offered alternate years.)

SPHSC 599 Research Practicum (*, max. 12) AWSpS Supervised laboratory experience in experimental approach to problems in speech and hearing sciences. Prerequisite: permission of instructor.

SPHSC 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

SPHSC 601 Internship (3-9, max. 9) AWSpS Prerequisite: 150 hours of supervised practicum.

SPHSC 700 Master's Thesis (*) AWSpS

SPHSC 800 Doctoral Dissertation (*) AWSpS

Speech Communication

205 Raitt

Speech communication is the study of the ways people share meanings and make their ideas known to each other in face-to-face interaction. The major in speech communication is designed to enable students to analyze and evaluate their own and others' communication behavior, to understand speech as a form of behavior and a social process, and to become better communicators themselves.

Undergraduate Program

Students in the department begin their study in introductory courses in public speaking, interpersonal communication, and small-group decision making. In advanced courses, students study and analyze specialized forms of communication—persuasion, argumentation, small-group facilitation, and communication in instructional settings and large organizations.

Bachelor of Arts Degree

Admission Requirements: Cumulative grade-point average of 2.60 in all University courses. Students transferring from other schools must present a cumulative grade-point average of 2.60 in all courses taken at institutions previously attended. After two or more quarters at the University, eligibility for admission will be based on University grade-point average. Incoming freshmen may enter the major without meeting any special admission requirements.

Major Requirements: 60 approved credits, including 25 credits selected from SPCH 103, 140, 220, 270, 310, or 373; 400; and 32 credits of approved electives in speech, of which 15 credits must be in courses at the 400 level (excluding 499). A 2.50 grade-point average in all speech courses is required.

Graduate Program

Graduate study in speech communication seeks extended and deepened understanding of rhetorical and communication theory, of the role of speech communication in the life of society and the individual, and of the skills and standards of judgment essential to its critical assessment. Graduate work focuses on research methods and skills to extend knowledge in the department's areas of concentration. Complementary work is available in oral interpretation. Emphasis is placed on the integration of diverse theoretical developments and on the use of both "social scientific" and "humanistic" methods of scholarly inquiry.

The M.A. program with thesis requires at least 31 credits of approved course work and a thesis (9 credits). The M.A. program without thesis: 45 credits and completion of a creative project.

The Ph.D. program (concentrations in rhetoric and public address and interpersonal and small-group communication) usually requires four years beyond the baccalaureate degree. A foreign language is required where needed for research.

Special Research Facilities

Small-group laboratory, data-processing center housing computer facilities and a behavioral observation scoring system, and a terminal linked to the main campus CDC computer system. An instructional resource center provides opportunities for the development of audio, video, and visual support for research projects.

Admission Qualifications

Baccalaureate degree in speech communication or equivalent background.

Financial Assistance

The department annually awards a number of teaching assistantships.

Correspondence and Information

Graduate Program Coordinator
205 Raitt, DL-15

Faculty

Chairperson

Thomas M. Scheidel

Professors

Baskerville, Barnet (Emeritus), Ph.D., 1948, Northwestern; public address, rhetorical criticism.

Bosmajian, Haig A.,* Ph.D., 1959, Stanford; rhetoric, freedom of speech.

Crowell, Laura I. (Emeritus), Ph.D., 1948, Iowa; public address, discussion.

Nilsen, Thomas R. (Emeritus), Ph.D., 1953, Northwestern; contemporary rhetorical theory, ethics of rhetoric.

Scheidel, Thomas M.,* Ph.D., 1958, Washington; communication theory and research, small-group processes.

Associate Professors

Campbell, John A.,* Ph.D., 1968, Pittsburgh; modern rhetorical theory, British public address.

Franzke, Albert L. (Emeritus), M.A., 1923, Lawrence; argumentation, debate.

Klyn, Mark S., Ph.D., 1966, Northwestern; oral interpretation.

Nelson, Oliver W. (Emeritus), Ph.D., 1949, Washington; speech education.

Parks, Malcolm R.,* Ph.D., 1976, Michigan State; communication theory, interpersonal communication, research methods.

Philipsen, Gerry F.,* Ph.D., 1972, Northwestern; ethnography of communication.

Post, Robert M.,* Ph.D., 1961, Ohio; oral interpretation of literature.

Staton-Spicer, Ann Q.,* Ph.D., 1977, Texas; instructional communication.

Stewart, John R.,* Ph.D., 1969, Southern California; philosophy of qualitative research and interpersonal communication.

Assistant Professors

Albrecht, Terrance L.,* Ph.D., 1978, Michigan State; organizational communication, persuasion.

Gaines, Robert N.,* Ph.D., 1982, Iowa; classical rhetorical theory, argumentation.

Warnick, Barbara P.,* Ph.D., 1977, Michigan; rhetorical theory and criticism.

Lecturers

Hogan, Michael (Emeritus), M.A., 1950, Washington; oral interpretation.

Nyquist, Jody D., M.A., 1967, Washington; communication education.

Course Descriptions

Courses for Undergraduates

SPCH 102 Speech, the Individual, and Society (5) AWSp *Parks, Philipsen, Stewart* Provides a basic understanding of human speech communication. Covers three major areas: (1) the nature of human communication, including models, principles, settings; (2) elements of verbal and nonverbal communication; and (3) approaches to, and functions of, human communication including persuasion, interpersonal communication, argument, propaganda, free speech.

SPCH 103 Interpersonal Communication (5) AWSp Emphasizes analyzing and understanding communication variables affecting human relationships, such as person perception, feedback, idea development, nonverbal cues. Focus on informal communication settings.

SPCH 140 Oral Interpretation of Literature (5) AWSp *Post* Analysis and critical study of imaginative literature through the medium of oral performance. Includes verse, prose, and drama.

SPCH 203 Communication in the Classroom (5) AWSp *Staton-Spicer* Theory and practice of interpersonal communication in instructional settings. Designed to prepare prospective teachers to employ communication effectively as a medium of teaching and learning, to create a classroom communication environment in which interaction is open and productive. Recommended for all teacher candidates in any discipline.

SPCH 220 Introduction to Public Speaking (5) AWSp *Campbell* Emphasizes choice and organization of material, sound reasoning, audience analysis, oral style, and delivery. Overview of history of rhetoric. Classroom speeches followed by conferences with instructor.

SPCH 222 Speech Communication in a Free Society (3) W *Bosmajian* Problems and arguments related to freedom of speech; early English writers on freedom of expression; background of freedom of speech in the United States; contemporary freedom of speech issues.

SPCH 235 Parliamentary Procedure (3) A *Bosmajian* Principles and practice: a study of the historical bases and contemporary uses of parliamentary procedure; methods and practice in organizing and conducting public meetings.

SPCH 270 Introduction to Empirical Research in Speech Communication (5) Basic research principles in speech-communication science; survey of substantive research findings. Recommended: any 100- or 200-level speech communication course.

SPCH 301 Interviewing (5) *Nyquist, Warnick* Interviewing principles and practices, with emphasis on information gathering and persuasive interviews. Purposes and types of interviews, structure of interviews, and influence of communication patterns on interview outcomes.

SPCH 305 Perspectives on Language in Speech Communication (5) *Philipsen, Stewart* Study of language and meaning, and survey of several influential modern approaches, including: the semantic, general-semantic, behavioral, and analytic philosophical. Relates theories of language and meaning to the study of speech communication.

SPCH 308 Humanistic Approaches to Interpersonal Communication (5) *Stewart* Exploration of several humanistic approaches to interpersonal speech communication, emphasizing the theorists' philosophical orientations.

SPCH 310 The Rhetorical Tradition in Western Thought (5) A *Gaines* Analysis of the major theories that prescribe and describe the use of symbols to change attitudes and behavior. Principal emphasis is placed upon defining the nature and scope of rhetoric and upon analyzing the art's underlying assumptions about man as a user of symbols. Some background in history, philosophy, and literature is desirable. Recommended: junior standing.

SPCH 320 Public Speaking (5) Practice in preparation and presentation of a variety of types of public speeches based on study of their structure and form; emphasis on organization and delivery. Recommended: 220.

SPCH 329 Rhetoric of Social and Political Movements (5) Sp *Bosmajian* Inquiry into the rhetoric of social and political movements; emphasis on investigation of persuasive discourse; examination of the nonverbal symbols of persuasion.

SPCH 334 Essentials of Argument (5) AWSp Argument as a technique in the investigation of social problems; evidence, proof, refutation, persuasion; training in argumentative speaking.

SPCH 335 Methods of Debate (5) Debate as a method of advocacy, with emphasis on the analysis of value and policy questions. Prerequisite: 220 or 334.

SPCH 341 Oral Interpretation of Children's Literature (3) S *Post* Study and performance of children's literature, emphasizing oral interpretation as a method of teaching literature in the elementary school.

SPCH 349 Readers Theatre (2, max. 10) AWSp *Post* Preparation and public presentation of programs of literary works. Prerequisites: 140 and permission of instructor.

SPCH 368 Small-Group Facilitation (3) Methods for facilitating discussion in small groups formed for the purposes of instruction. Emphasis is on each student's practical application of the insights derived. Prerequisites: permission of instructor, concurrent registration in 369; recommended: 102.

SPCH 369 Small-Group Facilitation Practicum (2) Implementation of the theoretical principles taught in 368. Emphasis on direct application of those principles to an assigned group of students from 102. Prerequisite: concurrent registration in 368.

SPCH 373 Principles of Group Discussion (5) AWSp *Phillipsen, Scheidel* Discussion as an everyday community activity, with emphasis on the informal cooperative decision-making methods of committee, conference, and round-table groups.

SPCH 375 Ethics in Interpersonal and Public Speech Communication (5) W *Nilsen* Ethical problems in interpersonal and public speech communication. Alternative ways of evaluating and responding to moral problems in a variety of communication situations.

SPCH 400 Theoretical Backgrounds in Speech Communication (3) Speech viewed as a form of individual and social behavior, with emphasis on the function of symbols in speech communication in informal and societal settings. The development of speech as a field of study, and its contemporary emphases.

SPCH 421 Advanced Speech Composition (5) Preparation and delivery of public speeches, with emphasis on style, thought organization, and proof. Analysis of model speeches. Recommended: 220 or 320.

SPCH 424 Rhetorical Perspective in Revolutionary Documents (5) *Campbell* Rhetorical investigation of selected major writings. Examines the rhetorical dimension in the progress of ideas through analysis of revolutionary documents as persuasive works. Relates principal revolutions in Western thought to contemporary controversy. Examines *Rights of Man, Communist Manifesto, The Origin of Species*, etc.

SPCH 425 American Public Address (5) Historical and critical study of principal speakers and speeches and of their relationship to American political, social, and intellectual life. Oratory of the American Revolution; the "Golden Age" of American oratory; debates on ratification of the federal Constitution, the slavery question, Reconstruction, woman suffrage, populism, imperialism.

SPCH 426 American Public Address (5) Historical and critical study of principal speakers and speeches and of their relationship to American political, social, and intellectual life. The public lecture—Lyceum to Chautauqua; academic addresses; the progressive era; League of Nations debate; polemics of the New Deal era; isolationism vs. one world; the Cold War era; controversy over civil rights. Recommended: 425.

SPCH 428 British Public Address (5) *Campbell* Historical and critical analysis of significant speeches and speakers and of their relationship to British social, political, and religious life. Historical overview of the major periods of British oratory and of the unique role of the oration in each as a means of exhortation and advocacy.

SPCH 440 Oral Interpretation of Poetry (3) W *Post* Study of forms of verse through analysis and oral presentation. Recommended: 140.

SPCH 442 Oral Interpretation of Fiction (3) A *Post* Analysis and oral interpretation of narrative perspectives in the novel and the short story. Recommended: 140.

SPCH 444 Oral Interpretation of Modern Dramatic Literature (3) Sp *Post* Study of dramatic literature from Ibsen to the present for purposes of developing understanding, appreciation, and ability to communicate its meaning. Recommended: 140.

SPCH 455 Communication in Children's Environments (4) *Nyquist, Staton-Spicer* Study of the communication capacity of children with emphasis on the analysis of the communication process in formal and informal learning environments. Includes examination of communication-based educational approaches and instructional strategies.

SPCH 456 Communication in Youth Environments (4) *Nyquist, Staton-Spicer* Study of the communication process in youth environments with a primary focus on formal and informal learning. Includes critical analysis of communication in contemporary instructional settings, and the development of communication strategies for teaching and learning.

SPCH 471 Persuasion (3) Analysis of the ways in which beliefs, values, attitudes, and behavior are deliberately influenced through communication. Recommended: junior standing.

SPCH 472 Empirical Approaches to Interpersonal Communication (5) Examination of major theoretic positions and empirical research findings in current speech communication literature on interpersonal influence. Emphasis on the insights that such theory and research provides on human speech-communication behavior in common interpersonal situations. Recommended: junior standing.

SPCH 473 Problems of Discussion Leadership (3) Critical analysis of leadership in committee and conference, with emphasis on the development of speech effectiveness in the cooperative achievement of goals. Recommended: 373.

SPCH 475 Organization Communication (5) *Albrecht* Role of communication in organizations, the types of problems arising, and approaches to their resolution. Communication in the human relations and productivity of organizations. Applying communication skills in various organization roles. Recommended: junior standing.

SPCH 476 Models and Theories in Speech Communication (4) Examination of selected theories and models of speech communication from the behavioral sciences, as well as of criteria applicable to them. Emphasis on the nature and function of theories and models, especially as these relate to basic principles underlying the scientific study of speech communication phenomena. Recommended: junior standing.

SPCH 484 Cultural Codes in Communication (5) *Phillipsen* Social and cultural codes in interpersonal communication, with special reference to contemporary American subcultural groups and their communication patterns.

SPCH 498 Special Topics in Speech Communication (2-5, max. 15) AWSp Lecture, seminar, and/or team study. Topics vary.

SPCH 499 Undergraduate Research (1-5, max. 10) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

SPCH 501 Introduction to Graduate Research in Speech Communication (3) A *Scheidel*

SPCH 521 Studies in Greek and Roman Rhetoric (5) A *Gaines* Development of the Greek tradition in rhetorical theory, criticism, and pedagogy from Homer to Augustine; analysis of the contributions of major figures and works to that tradition.

SPCH 522 Studies in Medieval Rhetoric (5) W *Gaines* Critical analysis of selected persons, works, and topics related to the development of rhetorical theory during the Middle Ages.

SPCH 523 Studies in Renaissance and Modern Rhetoric (5) W *Campbell* Critical analysis of writings on rhetoric by Cox, Wilson, Bacon, Campbell, Blair, Whately, and others.

SPCH 524 Studies in Contemporary Rhetoric (5) Sp *Warnick* Critical analysis of theories of rhetoric from early twentieth century.

SPCH 525 Rhetorical Criticism (5) History and method of rhetorical criticism. Application of critical standards to notable British and American speeches.

SPCH 540 History of Oral Interpretation (3) *Post* Critical analysis of writings by Sheridan, Walker, Rush, Delsarte, Bell, Curry, Emerson, and others.

SPCH 550 Studies in Speech Communication Education (3) A *Staton-Spicer* Philosophical, curricular, and methodological problems of speech instruction.

SPCH 560 Social Scientific Perspectives on Interpersonal Communication (5) W *Parks* Social scientific research and theory on the role of communication in developing and maintaining interpersonal relationships. Nature of interpersonal communication, relationship change processes, interpersonal control through communication, and personal communication networks.

SPCH 570 Organizational Communication (5) *Albrecht* Examination of social scientific theory and research on communication in organizations. Topics include quantitative and qualitative approaches to process of organizational communication, function and structure of macro networks, superior-subordinate relationships, and the role of communication in organizational change, development, and effectiveness. Prerequisite: graduate standing in the social sciences.

SPCH 575 Phenomenological Methods and Philosophical Criticism in Speech Communication (5) *Phillipsen, Stewart* Application of philosophical criticism, participant observation, and ethnomethodology primarily in interpersonal and small-group communication.

SPCH 576 Research Methods in Speech Communication (5) A *Parks* Application of behavioral research principles to problems in quantification, design, and analysis of data in speech communication research.

SPCH 577-578 Research Problems in Speech Communication (3, max. 6)-(3, max. 6) W,Sp Application of methodology and design principles to research problems in speech communication. Prerequisite: 577- for -578.

SPCH 588 Small-Group Communication (5) *Scheidel* Major small-group theories relevant to communicative behavior. Descriptive and experimental research findings in current speech communication literature. Prerequisite: 473.

SPCH 590 Seminar in Theory of Speech Communication (3-4, max. 12)

SPCH 592 Seminar in Public Address (3-4, max. 12)

SPCH 593 Seminar in Rhetorical Theory (3-4, max. 12)

SPCH 595 Seminar in Speech Communication Education (3-4, max. 12) Sp

SPCH 597 Seminar in Interpersonal Communications (3-4, max. 12) WSp Examination of experimental literature on selected topics. Subject changes from year to year; topics include conflict resolution, information processing, communication networks, feedback systems, audience composition research, communication effects.

SPCH 598 Small-Group Discussion and Communication (3-4, max. 12) Introduction to study of communication within small problem-solving groups. Theoretical as well as methodological dimensions of selected studies. Emphasis on role communication in decision-making process. From a communication viewpoint, examines topics such as conformity, consensus, interpersonal attraction, and emergent phases of discussion.

SPCH 600 Independent Study or Research (*) AWSpS

SPCH 700 Master's Thesis (*) AWSpS

SPCH 800 Doctoral Dissertation (*)

Statistics

B313 Padelford

The Department of Statistics was established in 1979 to provide a focus for the diverse interests in statistical theory and application that exist on campus.

Undergraduate Program

Bachelor of Science Degree

Major Requirements: MATH 124, 125, 126; 302, 303 or 205, 238 (recommended: 238, 302, 303); 327, 328, 329; ENGR 141 (or C SCI 210); STAT 311, 341, 342, 421 and four other upper-division statistics courses (often include 394, 395) with prior approval of the statistics adviser. At least 9 additional credits in upper-division electives chosen with prior approval of the statistics adviser. Electives may be upper-division credits from another field; thus, the statistics degree could have secondary emphasis in computer science, economics, psychology, sociology, quantitative methods, quantitative science, etc. At least 9 credits (typically lower division) in substantive courses from a single natural science discipline outside the mathematical sciences. Grades of 2.0 or better in all courses used to satisfy major requirements. Cumulative grade-point average of 2.50 in required statistics courses.

Graduate Program

Master of Science Degree

Graduation Requirements: At least twelve approved courses numbered 400 or above with a value of 36 credits or more; of these, at least six courses must be numbered in the 500 series (exclusive of 511, 512, 513) with a value of 18 credits or more, and with a coherent theme. Approved proficiency in statistical computing. Satisfactory participation in statistical consulting and the departmental seminar. Passage of an appropriate final master's examination. Successful completion of a master's thesis can count as up to three courses worth 9 credits (may not replace any of the six courses in the 500 series mentioned above). All programs must be approved in advance by the departmental graduate program coordinator.

Doctor of Philosophy Degree

Admission Requirements: Background in mathematics, statistics, or a quantitative field.

Graduation Requirements: Appropriate training in statistics and related sciences. Appropriate General Examination of basic graduate-level knowledge in statistics and probability (including three preliminaries). Satisfactory performance in MATH 424, 425, 426. Satisfactory performance in STAT 521, 522, 523 (in some circumstances, other graduate-level mathematical science courses may be used as a substitute). Approved performance in statistical consulting (typically continuing participation in STAT 599). Demonstration of proficiency in computing. 1 credit of STAT 590 per quarter. Demonstration of ability to read technical literature in French, German, or Russian. Dissertation. Final Examination.

In general, the Ph.D. program includes a minimum of course work equivalent to STAT 570, 571, 573; 581, 582, 583; 521, 522, 523; six other 500-level courses in a coherent program; 599; and demonstrated computing ability.

Special Research Facilities

Instructional computing facilities: (1) A CDC Cyber 750 computer and several VMS-based VAX 11/780's at the University computer center. (2) An expected addition during 1984 to the mathematical science departments of a large UNIX-based system comprising personal computers and one or two main frames on a network.

Research computing facilities: The department has powerful state-of-the-art facilities for support of research activities: (1) A UNIX-based VAX 11/750 (shared with Mathematics and Biostatistics) with state-of-the-art interactive statistical languages and systems, such as ISP and S. (2) A super micro-computer-based graphics work station (also UNIX-based) for research on advanced statistical graphics methodologies. (3) An expected addition during 1984 of several color graphics work stations and a LISP-processor for expert systems development (shared with the Applied Physics Laboratory).

The department has an ongoing statistical consulting program for all graduate students to provide practical experience in using statistics and in communicating with users of statistics. With faculty supervision, participants in the program assist members of the University community in applying statistical methodology.

The graduate program emphasizes both the theory and application of statistics, including probability theory, mathematical statistics, data analysis, statistical computing, and scientific applications. The department is located administratively in the College of Arts and Sciences, and by means of joint faculty appointments it maintains active academic contact with the College of Engineering, the School of Business Administration, the departments of Computer Science, Economics, Geological Sciences, Mathematics, Psychology, Genetics, and Zoology, the Applied Physics Laboratory, and the Applied Statistics Division of The Boeing Company. This department has an especially close relationship with the Department of Biostatistics, one of the largest in the world, with about twenty faculty members and seventy graduate students, which emphasizes the application of statistical methods in the health sciences. Graduate students in the departments of Statistics and Biostatistics take many of their courses and examinations together during the first two years, and may move freely between the two programs.

The department has had a continuous flow of distinguished visitors who contribute greatly to the academic environment. In addition, biostatistics usually has several long-term visitors. Summers bring an additional influx of visitors.

Faculty

Chairperson

Michael D. Perlman

Professors

Bimbaum, Z. W. (Emeritus), Ph.D., 1929, John Casimin (Poland); nonparametric statistics, probability, theory competing risks.

Felsenstein, Joseph,*‡ (Genetics), Ph.D., 1968, Chicago; theoretical population genetics, models of long-term evolutionary processes and estimation of evolutionary trees.

King Benjamin F.,* (Business Administration),† Ph.D., 1964, Chicago; methods of sampling, market and survey research, Bayesian statistics.

Martin, R. Douglas,* Ph.D., 1969, Princeton; robust methods, time series, data analysis.

Nelson, Charles R.,*‡ (Economics), Ph.D., 1969, Wisconsin; econometrics, time-series analysis, monetary economics.

Perlman, Michael D.,* Ph.D., 1967, Stanford; multivariate analysis, decision theory.

Shorack, Galen R.,* (Mathematics), Ph.D., 1965, Stanford; empirical processes, tolerance bounds, nonparametric statistics.

Wellner, Jon A.,* Ph.D., 1975, Washington; large-sample theory, asymptotic efficiency, empirical processes, survival analysis.

Associate Professors

Lunneborg, Clifford E.,* (Psychology), Ph.D., 1959, Washington; applied multivariate analysis, linear models, educational and psychological measurement.

Siegel, Andrew F.,* (Business Administration),† Ph.D., 1977, Stanford; exploratory data analysis, statistical computing and graphics, image analysis, robust methods, geometric probability, applications in business, economics, zoology and the biological sciences.

Assistant Professors

Buja, Andreas,* Ph.D., 1980, Switzerland; statistical computing, data analysis, robust statistics.

Guttorp, Peter,* Ph.D., 1980, California (Berkeley); time series, point processes, statistical computing, stochastic models.

Possolo, Antonio,* (Geological Sciences), Ph.D., 1983, Yale; spatial statistics, point processes.

Sampson, Paul D.,* Ph.D., 1979, Michigan; applied multivariate analysis, statistical modeling of shape, statistical consulting.

Course Descriptions

Courses for Undergraduates

STAT 220 Basic Statistics (5) AWSpS Objectives and pitfalls of statistical studies. Structure of data sets, histograms, means, and standard deviations. Correlation and regression. Probability, binomial and normal. Interpretation of estimates, confidence intervals, and significance tests. (Students may receive credit for only one of 220, 301, and 311.) Prerequisite: 1½ years of high school algebra.

STAT 301 Basic Statistics With Applications (5) AWSpS Objectives and pitfalls of statistical studies. Structure of data sets, histograms, means, and standard deviations. Correlation and regression. Probability, binomial and normal. Interpretation of estimates, confidence intervals, and significance tests. Application to problems in the student's major field. (Students may receive credit for only one of 220, 301, and 311.) Prerequisites: 1½ years of high school algebra.

STAT 311 Elements of Statistical Methods (5) AWSpS Elementary concepts of probability and sampling; binomial and normal distributions. Basic concepts of hypotheses testing, estimation, and confidence intervals; t-tests and chi-square tests. Linear regression theory and the analysis of variance. (Students may receive credit for only one of 220, 301, 311, and ECON 281.) Prerequisite: MATH 105 or 156.

STAT 341, 342 Introduction to Probability and Statistical Inference I, II (4,4) W,Sp Sample spaces, random variables, probability. Distributions: binomial, normal, Poisson, geometric. Expectation, variance, moment generating functions. Central limit theorem. Basic concepts of estimation, testing, and confidence intervals. Maximum likelihood estimators and likelihood ratio tests; efficiency. Introduction to regression and analysis of variance. (Students may not receive credit for both 341 and 481.) Prerequisite: 311, MATH 126.

STAT 390 Probability and Statistics in Engineering and Science (4) AWSpS Concepts of probability and statistics. Conditional probability, independence, random variables, distribution functions. Descriptive statistics, transformations, sampling errors, confidence intervals, least squares and maximum likelihood. Exploratory data analysis and interactive computing. Offered jointly with MATH 390. (Students may not receive credit for both 390 and 481.) Prerequisites: MATH 238 or 327, and MATH 205 or 302.

STAT 394 Probability I (3) AWS Sample spaces; basic axioms of probability; combinatorial probability; conditional probability and independence; binomial, Poisson and normal distributions. Offered jointly with MATH 394. Prerequisite: MATH 327.

STAT 395 Probability II (3) WSpS Random variables; expectation and variance; laws of large numbers; normal approximation and other limit theorems; multidimensional distributions and transformations. Offered jointly with MATH 395. Prerequisite: 394.

STAT 396 Probability III (3) Sp Characteristic functions and generating functions; recurrent events and renewal theory; random walk. Offered jointly with MATH 396. Prerequisite: 395 or 511.

STAT 403 Introduction to Data Analysis (4) W Philosophy, methods of exploratory data analysis, robustness, statistical graphis. Structure in data sets: group of numbers, several groups, bivariate, time series, two-way tables. Includes plotting, transformation, outlier identification, regression, smoothing, median polish. Offered jointly with QMETH 403. May not be taken for credit if credit received for 503. Prerequisite: 220 or 311 or QMETH 201 or ECON 281.

STAT 404 Multivariate Analyses for the Social Sciences (5) Survey of multivariate techniques commonly used in social and behavioral sciences. Development of linear models for interdependence (factor and canonical analyses) and dependence (MANOVA, discriminant function, and classification) studies. Illustrations of the techniques utilizing social science data and computer statistical packages. Prerequisite: 311 or PSYCH 218 or equivalent.

STAT 421 Introduction to Applied Statistics and Experimental Design (4) A Comparing two treatments: t-tests, paired t-tests, randomization t-tests, contingency tables, and binomial and Poisson models. Introduction to experimental design. Analysis of variance: additivity and interactions, two-cubed designs. ANOVA, regression, response surface methods, nonlinear models, components of variance, and time series. Prerequisites: 342, 390, 481, or grade of 3.0 in 311 plus MATH 126, or permission of instructor.

STAT 425 Introduction to Nonparametric Statistics (3) Overview of nonparametric methods, such as rank tests, goodness of fit tests, 2x2 tables, nonparametric estimation. Useful for students with only a statistical methods course background. Offered jointly with BIOST 425. Prerequisites: 311, BIOST 473, 511, or permission of instructor.

STAT 427 Introduction to Analysis of Categorical Data (4) Indices of association, loglinear models, ordered response categories, discrete discriminant analysis, and factor analysis of polychotomous observations. Emphasizes computational techniques; illustrated by social, behavioral, and biological science examples. Prerequisites: MATH 124 plus either 311, PSYCH 218, SOC 423, or equivalent; or permission of instructor.

STAT 480 Sampling Theory for Biologists (3) Sp Simple random sampling, stratified random sampling, ratio estimates, regression estimates, systematic sampling, cluster sampling, sample size determinations, applications in fisheries and forestry. Sampling plant and animal populations, sampling distributions, estimation and statistical treatment of data. Offered jointly with Q SCI 480. Prerequisites: Q SCI 482, 483, or permission of instructor.

STAT 481 Introduction to Mathematical Statistics (5) Probability, generating functions; the δ-method, Jacobians, Bayes theorem; maximum likelihoods, Neyman-Pearson, efficiency, decision theory, regression, correlation, bivariate normal. Offered jointly with ECON 481. (Students receiving credit for either 341 or 390 may not receive credit for 481.) Prerequisites: 311, ECON 281 or equivalent; MATH 124, 125, 126; and a course in linear algebra, which may be taken concurrently.

STAT 486 Experimental Design (3) Sp Topics in analysis of variance and experimental designs; choice of design, comparison of efficiency, power, sample size, use of computer for standard analyses. Offered jointly with Q SCI 486. Prerequisite: Q SCI 483.

STAT 491, 492 Introduction to Stochastic Processes (3,3) Random walks, Markov chains, branching processes, Poisson process, point processes, birth and death processes, queuing theory, stationary processes. Offered jointly with MATH 491, 492. Prerequisites: 396 for 491; 491 for 492.

STAT 498 Special Topics (1-5, max. 15) Reading and lecture course intended for special needs of students. Prerequisite: permission of instructor. (Offered when demand is sufficient.)

STAT 499 Undergraduate Research (1-5, max. 15) Prerequisite: permission of instructor.

Courses for Graduates Only

STAT 503 Practical Methods for Data Analysis (3) Sp Basic exploratory data analysis with business examples. Groups of numbers, multivariate data, time series, multiway tables. Techniques, include plotting, transformation, outlier identification, cluster analysis, smoothing regression, median polish, and robustness. Offered jointly with QMETH 503. May not be taken for credit if credit received for 403. Prerequisite: 342 or QMETH 500 or equivalent, or permission of instructor.

STAT 511 Probability (5) A Fundamental concepts; discrete and continuous random variables; expectation, law of large numbers; important distributions; characteristic functions; central limit theorem. No more than 6 credits from among 394, 395, and 511 can be counted toward any degree. Prerequisites: MATH 327 and senior or graduate standing, or permission of instructor.

STAT 512, 513 Statistical Inference (4,4) W,Sp General theory of statistical inference; estimation and hypothesis testing; multivariate theory; regression, correlation, and analysis of variance. Prerequisites: for 512: 395 (concurrent registration permitted) or 511, and 421, or BIOST 512 (concurrent registration permitted for these three).

STAT 520 Spectral Analysis of Time Series (4) Estimation of spectral densities for single and multiple time series. Nonparametric estimation of spectral density, cross-spectral density, and coherency for stationary time series, real and complex spectrum techniques. Bispectrum. Digital filtering techniques. Aliasing, prewhitening. Choice of lag windows and data windows. Use of the fast Fourier transform. The parametric autogressive spectral density

estimate for single and multiple stationary time series. Spectral analysis of nonstationary random processes and for randomly sampled processes. Techniques of robust spectral analysis. Offered jointly with E E 520. Prerequisite: 390, 342, 481, or permission of instructor.

STAT 521, 522, 523 Advanced Probability (3,3,3) A,W,Sp Measure theory and integration, independence, laws of large numbers. Fourier analysis of distributions, central limit problem and infinitely divisible laws, conditional expectations, martingales. Offered jointly with MATH 521, 522, 523. Prerequisite: MATH 426.

STAT 524 Design of Medical Studies (3) Emphasis on randomized controlled clinical trials. Bias elimination, controls, treatment assignment and randomization, precision, replication, power and sample size calculations, stratification, and ethics. Suitable for students in biostatistics and other scientific fields. Offered jointly with BIOST 524. Prerequisites: BIOST 511 or equivalent, and one of 421, BIOST 513 or EPI 512; or permission of instructor. (Offered even-numbered years.)

STAT 529 Sample Survey Techniques (3) Design and implementation of selection and estimation procedures. Emphasis on human populations. Simple, stratified, and cluster sampling; multistage and two-phase procedures; optimal allocation of resources; estimation theory; replicated designs; variance estimation; national samples and census materials. Offered jointly with BIOST 529 and QMETH 529. Prerequisites: 421, QMETH 500 or BIOST 511 or equivalent; or permission of instructor.

STAT 542 Multivariate Analysis (3) Multivariate normal distribution; partial and multiple correlation; Hotelling's T^2; Bartlett's decomposition; various likelihood ratio tests; discriminate analysis; principal components. Prerequisite: 513 or permission of instructor.

STAT 543 Nonparametric Statistics (3) Linear rank statistics, asymptotics, ties; tests of fit; the Hodges-Lehmann estimator. Nonparametric analysis of variance; Kruskal-Wallis, Friedman, and aligned-rank tests. Prerequisite: 512 or permission of instructor.

STAT 544 Bayesian Statistical Methods (3) Statistical methods based on the idea of a probability distribution over the parameter space. Coherence and utility. Subjective probability. Likelihood principle. Conjugate families. Structure of Bayesian inference. Limit theory for posterior distributions. Sequential experiments. Exchangeability. Bayesian nonparametrics. Empirical Bayes methods. Prerequisite: 513 or permission of instructor.

STAT 545 Statistical Decision Theory (3) Formulation of the statistical decision problem; decision rules and their risk functions; Bayes rules. Game theory and the minimax theorem; admissibility and Wald's complete class theorem. Sufficiency, invariance, and the Hunt-Stein theorem. Applications in estimation, testing, and multiple decision problems. Sequential decision theory. Prerequisite: 513 or permission of instructor.

STAT 546 Sequential Statistical Methods (3) Advantages of sequential sampling schemes. Stein's two-stage procedure for fixed-width confidence intervals. Optimality of Wald's sequential probability ratio test. Sequential decision theory; Bayes rules; the method of backward induction. Sequential t, chi-square, and F-tests. Sequential estimation of regression functions, the Robbins-Munro procedure. Martingales; theory of optimal stopping and its applications. Prerequisite: 513 or permission of instructor.

STAT 548 Robust Statistical Methods (3) Robust statistical methods: algorithms, data analysis, and theory. Basic robustness concepts. Robust estimation techniques for the following estimation problems: location, scale, correlation, covariance matrices, regression. Use of robust methods for exploratory data analysis and outlier detection diagnostics. Nonlinear optimization and root-finding algorithms for computing robust estimates. Prerequisite: 513 or permission of instructor.

STAT 561, 562, 563 Special Topics in Applied Statistics (1-5, max. 15; 1-5, max. 15; 1-5, max. 15) AWSp Data analysis, spectral analysis or robust estimation, etc. Prerequisite: permission of instructor.

STAT 565 Inference in Stochastic Processes (3) Methods for statistical inference from dependent observations. Emphasis on one or more of the following: Markov chains in discrete or continuous time; diffusion processes; point processes; asymptotic theory; filtering and smoothing of linear models. Prerequisite: 581 or permission of instructor.

STAT 570 Linear Models (3) A Review of linear algebra and matrix manipulations. Statistical distribution theory for quadratic forms of normal variables. Fitting of the general linear model by least squares. Computer data analysis for classical experimental designs. Offered jointly with BIOST 570. Prerequisites: 421 or BIOST 513; and 513; and a course in matrix algebra.

STAT 571 Applied Regression Analysis (3) W Advanced statistical methods course for biostatistics, statistics, and other graduate students already familiar with the general linear hypothesis. Develops extensions of the usual linear least squares theory and discusses the effects of departures from this theory. Examples of analyses for nonstandard problems are presented; computers are used for homework assignments. Analysis of residuals, use of transformations, polynomial models, methods of model selection and robust methods. Offered jointly with BIOST 571. Prerequisite: 570.

STAT 572 Multivariate Statistical Methods (3) Use of multivariate normal sampling theory, linear transformations of random variables, one- and two-sample tests, profile analysis, partial and multiple correlation, multivariate ANOVA and least squares, discriminant analysis, principal components, factor analysis, robustness, and some special topics. Some computer use included. Offered jointly with BIOST 572. Prerequisite: 570 or permission of instructor.

STAT 573 Statistical Methods for Categorical Data (3) Sp Exact and asymptotic methods for 2x2 contingency tables. Maximum likelihood estimation of logistic regression models for binary response. Examples in epidemiologic and clinical research. Theory and applications of log-linear models for discrete data. Selected special topics. Offered jointly with BIOST 573. Prerequisites: 571 and 581; or permission of instructor.

STAT 574 Statistical Computing (3) Introduction to topics in statistical computing: application of numerical methods to statistical problems; generation of pseudorandom numbers, design and execution of Monte Carlo studies, comparative evaluation of statistical algorithms, matrix methods and least squares, computation of probabilities, data structures, and data base management. Offered jointly with BIOST 574. Prerequisites: 511 and programming; or permission of instructor.

STAT 575 Population Models (3) Models in demography, using real and simulated data. Estimation of demographic rates, the life table; stationary, stable, and quasi-stable populations; determinants of the age-structure of a population; age-specific models of mortality, fertility, and nuptiality. Offered jointly with BIOST 575. Prerequisite: permission of instructor.

STAT 576 Statistical Methods of Survival Data (3) Statistical methods for censored survival data arising from follow-up studies on human or animal populations. Covers parametric and nonparametric methods, Kaplan-Meier survival curve estimator, comparison of survival curves, log-rank test, regression models including the Cox proportional hazards model, competing risks. Offered jointly with BIOST 576. Prerequisites: 581 and either BIOST 513 or Q SCI 483, or equivalent. (Offered alternate years.)

STAT 577 Advanced Design and Analysis of Experiments (3) Concepts important in experimental design: randomization, blocking, confounding. Application and analysis of data from randomized blocks designs, Latin and Graeco-Latin squares, incomplete blocks designs, split-plot and repeated measures, factorial and fractional replicates, response surface experiments. Offered jointly with BIOST 577. Prerequisite: 570 or 421 (minimum grade 3.0), or permission of instructor.

STAT 578 Special Topics in Advanced Biostatistics (*, max. 3) Advanced-level topics in biostatistics offered by regular and visiting faculty. Offered jointly with BIOST 578. Prerequisite: permission of instructor.

STAT 579 Advanced Data Analysis (4) Resampling methods; jackknife, bootstrap, cross-validation. Smoothing techniques; local averages; projection-pursuit regression; recursive partitioning regression. Selected aspects of linear regression. Robust-resistant methods. Density estimation. Clustering techniques. The EM-algorithm. Graphical exploratory methods. Prim-81. Offered jointly with BIOST 579. Prerequisites: 513 and 571 or 421 or permission of instructor.

STAT 581, 582, 583 Advanced Theory of Statistical Inference (3,3,3) A,W,Sp Limit theorems, asymptotic efficiency, maximum likelihood statistics; sufficient and ancillary statistics; elements of decision theory; Neyman-Pearson theory, uniformly most powerful unbiased and invariant tests; sequential analysis; distribution-free statistics; linear hypotheses. Prerequisites: 513 and MATH 424, 425, 426 for 581 (concurrent enrollment in MATH 424, 425, 426 permissible); 570 and 581 for 582; 582 for 583.

STAT 590 Statistics Seminar (*, max. 15) AWSp Prerequisite: permission of graduate program adviser.

STAT 591, 592, 593 Special Topics in Statistics (1-5, max. 15; 1-5, max. 15; 1-5, max. 15) A,W,Sp Distribution-free inference, game and decision theory, advanced theory of estimation (including sequential estimation), robustness, advanced probability theory, stochastic processes or empirical processes, etc. Prerequisite: permission of instructor.

STAT 599 Statistical Consulting (*, max. 12) AWSpS Consulting experience in data analysis, applied statistics, etc. Student required to provide consulting services to students and faculty three hours per week. Prerequisite: permission of graduate program coordinator.

STAT 600 Independent Study or Research (*) AWSpS Prerequisite: permission of graduate program coordinator.

STAT 700 Master's Thesis (*) AWSpS Prerequisite: permission of graduate program coordinator.

STAT 800 Doctoral Dissertation (*) Prerequisite: permission of graduate program coordinator.

Women Studies

C254 Padelford

Women Studies is an interdisciplinary program that offers students the opportunity to select courses from a variety of academic disciplines while pursuing concentrated study in a particular department or track within the program. Women Studies courses are planned to foster open, vigorous inquiry about women, to challenge curricula in which women are absent or peripheral, to question cultural assumptions in light of new information, and to create a supportive environment for those interested in studying women.

Undergraduate Program

Major Requirements: Although an undergraduate degree in Women Studies is not offered, students may work toward a Bachelor of Arts degree in General Studies with a concentration in Women Studies. Course requirements are as follows: WOMEN 200 or equivalent; 5 additional lower-division credits in Women Studies; 15 credits selected from WOMEN 310, 353, 357, 364, 383, ENGL 375 or 376; one course of 3-5 credits in an ethnic area; either a course on quantitative methods or ENGL 271, depending on the focus within Women Studies; senior seminar (WOMEN 400) and senior thesis (G ST 493). 30 additional credits may be satisfied under one of three options: (1) 30 credits in a single department relevant to Women Studies curriculum; (2) 30 credits in a Women Studies track (an interdisciplinary series of courses); or (3) 30 credits in an individual course of study arranged between the student and a Women Studies adviser, with approval by the Director.

Faculty

Director

Sydney J. Kaplan

Professors

Blake, Kathleen A.,*‡ (English), Ph.D., 1971, California (San Diego); English.

Bynum, Caroline W.,*‡ (History), Ph.D., 1969, Harvard; history.

Deyrup-Olsen, Ingrith J.,*‡ (Zoology), Ph.D., 1944, Columbia; zoology.

Eastman, Carol M.,*‡ (Anthropology), Ph.D., 1967, Wisconsin; anthropology.

Gerstenberger, Donna,*‡ (English), Ph.D., 1958, Oklahoma; English.

Gottlieb, Naomi,*‡ (Social Work), D.S.W., 1970, California (Berkeley); social work.

Lunneborg, Patricia W.,*‡ (Psychology), Ph.D., 1962, Texas; psychology.

McElroy, Colleen W.,*‡ (English), Ph.D., 1973, Washington; English.

Russ, Joanna,*‡ (English), M.F.A., 1960, Yale; English.

Teller, Davida Y.,*‡ (Psychology), Ph.D., 1965, California (Berkeley); psychology.

Associate Professors

Allen, Carolyn R. J.,*‡ (English), Ph.D., 1972, Minnesota; English.

Bereano, Philip L.,*‡ (Engineering Interdepartmental Curricula), M.R.P., 1971, Cornell; social management of technology.

Blumstein, Philip W.,*‡ (Sociology), Ph.D., 1970, Vanderbilt; sociology.

Clatterbaugh, Kenneth C.,*‡ (Philosophy), Ph.D., 1967, Indiana; philosophy.

Hartsock, Nancy,* (Political Science),† Ph.D., 1972, Chicago; philosophy of feminism, feminist theory, political theory.

Jacobs, Sue Ellen, Ph.D.,* 1970, Colorado; women studies,

Kaplan, Sydney J.,* (English),† Ph.D., 1971, California (Los Angeles); women studies.

Kenney, Nancy J.,* Ph.D., (Psychology),† 1974, Virginia; women studies, psychology.

Kotcheck, Lydia D.,*‡ (Parent and Child Nursing), Ph.D., 1975, Washington; maternal and child nursing.

Levi, Margaret A.,*‡ (Political Science), Ph.D., 1974, Harvard; American government and politics, political economy.

Palomo, Dolores J.,‡ (English), Ph.D., 1972, New York State (Buffalo); English.

Richey, Cheryl A.,*‡ (Social Work), D.S.W., 1974, California (Berkeley); social work.

Schwartz, Pepper J.,*‡ (Sociology), Ph.D., 1974, Yale; sociology.

Assistant Professors

Blair, Karen J., Ph.D., 1976, State University of New York (Buffalo); women studies.

Case, Sue Ellen,*‡ (Drama), Ph.D., 1981, California (Berkeley); dramatic criticism.

Estler, Sue E.,‡ (Higher Education), Ph.D., 1978, Stanford; education.

Howard, Judith A.,*‡ (Sociology), Ph.D., 1982, Wisconsin; social psychology, gender roles.

Silbertstein, Sandra V.,*‡ (English), Ph.D., 1982, Michigan; English, sociolinguistics.

Course Descriptions

Courses for Undergraduates

WOMEN 200 Introduction to Women Studies (5) AWSpS Interdisciplinary course drawing selectively from the following fields: anthropology, art history, economics, history, law, literature, psychology, and sociology. Not open for credit to students who have taken GIS 255 or 256.

WOMEN 206 Philosophy of Feminism (3) Philosophical analysis of the concepts and assumptions central to feminism. Theoretical positions within the feminist movement; views of the ideal society, goals and strategies of the movement, its relation to racial liberation, and ethical issues. Offered jointly with PHIL 206. Not open to students who have taken GIS 106.

WOMEN 257 Psychology of Sex Differences (5) A *Kenney* Major psychological theories of sex-role development; biological and environmental influences that determine and maintain sex differences in behavior; sex roles in children, sex differences in aggression, cognitive abilities, achievement motivation, affiliation, sexuality. Offered jointly with PSYCH 257. PSYCH 101 or 102 recommended. Not open for credit to students who have taken GIS 244.

WOMEN 283 Introduction to Women's History (5) *Blair* Includes units on American, European, and Third World women that examine centers of women's activities (convents, women's clubs), women's place in male-dominated spheres (politics), women's impact on culture (health, arts), and the effect of larger changes on women's lives (technology, colonization).

WOMEN 290 Special Topics in Women Studies (2-5, max. 15) Offered occasionally by visitors or resident faculty.

WOMEN 310 Women and the Law (5) ASpS Focus on the status of women and the law; the legal status of single and married women, the rationale of protective legislation, and the effect of the legal changes such as the Civil Rights Act of 1964 and Equal Rights Amendment. Current cases on abortion, child care, tax laws, Social Security benefits, lesbianism, prostitution, etc. Not open for credit to students who have taken GIS 355.

WOMEN 313 Women in Politics (5) Political theory, historical and contemporary, including writings of the women's liberation movement on the political role of women in society. Empirical studies of the "apolitical" woman; process of political socialization in various cultural contexts; women's participation in political decision making. Offered jointly with POL S 313. Prerequisite: 200 or a political science course.

WOMEN 353 Anthropological Studies of Women (5) A *Jacobs* Cross-cultural and comparative survey of the varieties of women's cultural experiences, statuses, and roles in cultural context and the anthropological theories used to account for them. Topics include: biological factors, studies of primates, woman the gatherer, work in preindustrial and industrial societies, matriarchy and matrilineal kinship, childbirth, and women's roles in economic development. Offered jointly with ANTH 353. Prerequisites: 200 and ANTH 202, or permission of instructor.

WOMEN 354 Lesbianism (3) Position and concerns of lesbians in our society; the biological, cross-cultural, and psychosocial evidence. Historical and current information and discussion on the nature of lesbianism. Prerequisite: 200 or 257; or ANTH 100 or 353; or PSYCH 101 or 210 or 257 or 305; or SOC 110 or 271 or 347; or permission of instructor.

WOMEN 357 Psychobiology of Women (5) A *Kenney* Physiological and psychological aspects of women's lives: determinants of biological sex; physiological and psychological events of puberty, menstruation, and menopause; sexuality; pregnancy, childbirth; the role of culture in determining the psychological response to the physiological events. Offered jointly with PSYCH 357. Not open for credit to students who have taken GIS 357. Prerequisite: 257 or PSYCH 257 or permission of instructor.

WOMEN 364 Women in the Social Structure (5) Women's current roles within social institutions, focusing on women's work roles, both in the labor force and in the home. Women in political organizations, religion, education, and law. Includes selected groups of women with compounded problems: Black women, lesbians, older women, women on welfare. Examines the structural, ideological, and historical determinants of women's position. Offered jointly with SOC 364. Prerequisites: SOC 110 and junior or senior standing.

WOMEN 374 Methods in Life History Research (5) *Jacobs* Techniques and procedures for constructing life histories: use of diaries, letters, photography, and personal interviews. Technical instruction in use of tape recorder; indexing, cataloging, and writing summaries of tapes; use of cameras for copying documents and photography. Each student completes one life history per quarter. Prerequisite: 200.

WOMEN 383 Social History of American Women (5) *Blair* From colonial times to the present. Emphasizes the experience of the "ordinary" woman: her work at home, charitable activities, and entrance into the labor force. Also examines the ideology of "the lady" and the feminist movements of the nineteenth century and the post-World War II era. Uses primary materials: diaries, letters, and speeches. Not open to students who have taken GIS 210 or 483. Prerequisite: 200, 283, or HSTAA 201.

WOMEN 400 Senior Seminar in Women Studies (3) Sp Part of the senior thesis requirement in Women Studies. Must be taken concurrently with G ST 493. Prerequisites: senior standing, General Studies major concentrating on Women Studies, and permission of adviser.

WOMEN 415 Sexism in American Schools (3) Implications of sex-role stereotyping in American education, kindergarten through grade twelve, and development of insights into experiences as students, educators, and parents. Includes image of women and girls in curriculum materials; socialization and career counseling, teacher behavior, effects of Title IX and affirmative action on present school policy, and practical alternatives and skills useful for changing attitudes about sex roles. Prerequisite: 200; or 15 credits in education or Women Studies.

WOMEN 416 Sexist Language and Education (3) How language reflects or determines sexist attitudes, particularly in current educational institutions: includes male and female language use, systematic lexical syntactic distinctions based on sex, derogatory references to women, influences of classroom language on sex roles, and effects of language of sex differences on learning. Prerequisite: 200; or 15 credits in education or Women Studies.

WOMEN 446 Theories and Tactics of the Women's Movement (3) History of the women's movement and its current philosophies and tactics used to achieve change in women's status. Recommended: background in status of women and philosophies of women movements. Offered jointly with SOC 446. Prerequisites: 200 or SOC 110, and junior or senior standing.

WOMEN 453 Women in Evolutionary Perspective (5) Critical appraisal of major theories accounting for evolution of sex and gender roles and status differences; cross-cultural testing of sociobiological, biocultural, cultural materialist, structural, and symbolic explanations for "female power and male dominance." Offered jointly with ANTH 483. Prerequisite: 353 or permission of instructor.

WOMEN 454 Women, Words, Music, and Change (5) Sp *Jacobs* Comparative analysis of use of myths, tales, music, and other forms of expressive culture to account for, reinforce, and change women's status and roles; cross-cultural analysis of planned change and development. Offered jointly with ANTH 454. Prerequisite: 353 or permission of instructor.

WOMEN 490 Special Topics in Women Studies (2-5, max. 15) Exploration of specific problems and issues relevant to the study of women. Offered by visiting or resident faculty. Primarily for upper-division and graduate students.

WOMEN 497 Fieldwork in Women Studies (3-5, max. 15) AWSpS Internships in local agencies. Allows development of specific skills in area of specialization. Prerequisites: 200, junior standing, or permission of instructor.

WOMEN 499 Undergraduate Research (1-5, max. 10) AWSpS Independent study and research supervised by a faculty member with appropriate academic interest. Prerequisite: permission of instructor and adviser.

Zoology

106 Kincaid

Undergraduate Program

Zoology is a natural science concerned primarily with animals: their development, structure, and function, and their relationship with their environments.

The department offers two degree programs: Bachelor of Science, designed for students planning graduate work, and Bachelor of Arts, a program with minimal stated requirements.

Bachelor of Science Degree

Major Requirements: A total of 90 credits distributed as follows: (1) BIOL 210, 211, 212. (2) A minimum of 25 credits from the following, with at least two courses from each of the three groups (two courses must be laboratory courses from two different groups): Group I. *Cell Biology, Development, Gene Action:* ZOOL 403, 455-456, 457, BIOL 401, 402, GENET 451; Group II. *Morphology, Physiology:* ZOOL 301, 432, 433, 434, 438, 439, 448, 449, 453-454, 469, 478, 488, 489; Group III. *Ecology, Natural History, Evolution, Organisms:* ZOOL 220, 330, 362, 409, 410, 423, 430, 434, 444, 445, 464, 465, BIOL 454, 472, 473, 474, 475, BOT 445. (3) 16 credits in electives from the above or from other biological departments, selected in consultation with the zoology adviser. (4) Additional requirements: CHEM 140, 150, 151, 231, 232; two courses from PHYS 114, 115, 116; two courses from MATH 124, 125, Q SCI 291, 292, 381, 482, 483, STAT 311. Students are encouraged to exceed the college language requirement. A 2.00 grade-point average is required in all courses taken at this university in zoology, the related biological disciplines, and all supporting courses.

Bachelor of Arts Degree

Major Requirements: A minimum of 50 credits, no more than 20 in lower-division courses, to include BIOL 210, 211, 212, plus a program of upper-division courses in the major areas of biology to be selected in consultation with the zoology adviser. A 2.00 grade-point average in all courses taken at the University in zoology and in the related biological disciplines, and in all supporting courses is required. Additional requirements: CHEM 140, 150, 231, 232 (or 231, 235, 236); GENET 451, if the student has not taken BIOL 210, 211, 212; MATH 157, or Q SCI 381, or MATH 124 and 125, or Q SCI 291 and 292. PHYS 114, 115, 116 recommended.

Graduate Program

Programs of study leading to the degrees of Master of Science (both thesis and nonthesis) and Doctor of Philosophy are available in the areas of comparative physiology, cell biology, developmental biology, ecology, endocrinology, invertebrate and vertebrate morphology, and neurobiology. An interdisciplinary program is offered in developmental biology and other areas as well.

Research Facilities

The laboratories of the department in Kincaid Hall are equipped with modern instruments and special facilities needed for advanced instructional and research purposes. The extensive facilities of the Friday Harbor Laboratories on San Juan Island are available for research throughout the year. Departmental graduate students often carry on an extensive part of their research there or at other field stations.

Special Requirements

Entering students should have preparation in several of the areas listed above, organic chemistry, physical chemistry in some cases, two quarters of college physics, and mathematics through calculus. All students are required to gain some teaching experience regardless of the source of support.

Financial Aid

Normally all prospective candidates for M.S. and Ph.D. degrees are supported by teaching or research assistantships or by fellowships or traineeships from national or private agencies. Some summer appointments are available both on the Seattle campus and at the Friday Harbor Laboratories on San Juan Island.

Application Date

Completed applications for entry in the Autumn Quarter must be received by January 1.

Correspondence and Information

Graduate Program Coordinator
106 Kincaid, NJ-15

Faculty

Chairperson

A. O. Dennis Willows

Professors

Barash, David P.,*‡ (Psychology), Ph.D., 1970, Wisconsin; sociobiology, behavioral ethology, animal behavior and evolution.

Cloney, Richard A.,* Ph.D., 1959, Washington; invertebrate embryology, histology, morphogenetic movements, metamorphosis, biology of ascidians.

Deyrup-Olsen, Ingrith J.,* Ph.D., 1944, Columbia; general physiology, cell-membrane phenomena.

Edmondson, W. Thomas,* Ph.D., 1942, Yale; ecology, rotifers, limnology with emphasis on productivity of lakes.

Edwards, John S.,* Ph.D., 1960, Cambridge; arthropod neurobiology, insect physiology and development, tundra and alphine biology.

Farner, Donald S.,* Ph.D., 1941, Wisconsin; avian and comparative physiology, biochronometry, reproductive physiology, photoperiodic systems, neuroendocrinology.

Gorbman, Aubrey,* Ph.D., 1940, California (Berkeley); endocrinology and neuroendocrinology, mechanisms of actions of hormones; evolutionary, adaptive, and behavioral aspects of endocrine systems.

Hatch, Melville H. (Emeritus), Ph.D., 1925, Michigan; zoology.

Hauschka, Stephen D.,*‡ (Biochemistry), Ph.D., 1966, Johns Hopkins; developmental biology, mechanism of embryonic cellular interactions.

Huey, Raymond B.,* Ph.D., 1975, Harvard; evolutionary and physiological ecology, herpetology, behavior.

Illg, Paul L. (Emeritus), Ph.D., 1952, George Washington; invertebrate zoology and systematics, copepods, symbiosis of crustaceans.

Kohn, Alan J.,* Ph.D., 1957, Yale; invertebrate zoology, ecology and functional morphology of marine invertebrates, biology of molluscs,

Kozloff, Eugene N.,* Ph.D., 1950, California (Berkeley); biology of lower invertebrates, ciliates, orthonectids, turbellarians and kinorhynches.

Laird, Charles D.,* (Genetics), Ph.D., 1966, Stanford; cell and developmental biology.

Martin, Arthur W.* (Emeritus), Ph.D., 1936, Stanford; comparative invertebrate physiology, emphasis on excretory and cephalopod physiology.

Orians, Gordon H.,* Ph.D., 1960, California (Berkeley); ecology and ethology, vertebrate social systems, community structure, plant-herbivore interactions.

Paine, Robert T.,* Ph.D., 1961, Michigan; experimental ecology, organization and structure of marine communities.

Palka, John M.,* Ph.D., 1965, California (Los Angeles); neurophysiology, sensory physiology, developmental neurobiology.

Rausch, Robert L.,*‡ (Pathobiology, Animal Medicine), D.V.M., 1945, Ohio State; Ph.D., 1949, Wisconsin; biology and taxonomy of helminths in their mammalian hosts with emphasis on the arctic.

Riddiford, Lynn M.,* Ph.D., 1961, Cornell; insect development and physiology, invertebrate endocrinology.

Schroeder, Thomas E.* (Research), Ph.D., 1968, Washington; fine structure and biochemistry of cellular contractile systems.

Schubiger, Gerold A.,* (Genetics), Ph.D., 1967, Zurich; developmental biology of insects, embryonic determination in *Drosophila*, pattern formation in imaginal discs.

Slatkin, Montgomery W.,* Ph.D., 1970, Harvard; theoretical population biology, population genetics, evolutionary biology, mathematical-theoretical ecology, animal social behavior.

Snyder, Richard C.,* Ph.D., 1948, Cornell; comparative and functional vertebrate anatomy, vertebrate biology.

Strathmann, Richard R.,* Ph.D., 1970, Washington; invertebrate development and ecology, larval ecology and developmental strategies of marine invertebrates.

Svihla, Arthur (Emeritus), Ph.D., 1931, Michigan; zoology.

Truman, James W.,* Ph.D., 1970, Harvard; hormones and invertebrate behavior, insect physiology, circadian rhythms.

Whiteley, Arthur H.,* Ph.D., 1945, Princeton; comparative developmental physiology of invertebrates, gene action in normal and hybrid sea urchin development, fertilization.

Willows, A. O. Dennis,* Ph.D., 1967, Oregon; invertebrate neurophysiology, neural mechanisms underlying behavior.

Associate Professors

Bakken, Aimee H.,* Ph.D., 1970, Iowa; developmental and cell biology, chromosome structure and function in oogenesis and embryogenesis, developmental genetics.

Boersma, P. Dee,*‡ Ph.D., 1974, Ohio State; ecology and ethology, reproductive strategies, evolution of sexual dimorphism, seabird biology.

Griffiths, Mary (Emeritus), Ph.D., 1953, California (Berkeley); zoology.

Hille, Merrill B.,* Ph.D., 1965, Rockefeller; cell and developmental biology, RNA and protein synthesis, fertilization and embryogenesis of echinoderms.

Kenagy, George J.,* Ph.D., 1972, California (Los Angeles); ecology, behavior and physiology, daily and seasonal rhythms, reproductive cycles, physiological ecology, biology of mammals.

Osterud, Kenneth L. (Emeritus), Ph.D., 1941, New York; zoology.

Pinter, Robert B.,*‡ (Electrical Engineering), Ph.D., 1964, Northwestern; neurophysiology, physiology of the retina and visual system.

Richardson, Frank (Emeritus), Ph.D., 1939, California (Berkeley); zoology

Rohwer, Sievert A.,* Ph.D., 1971, Kansas; ecology and evolution of social behavior, deception and evolution of status-signaling systems, avian biology.

Steiner, Robert A.,*‡ (Physiology and Biophysics), Ph.D., 1975, Oregon; neuroendocrine control of the onset of puberty in the monkey, ultradian and circadian reproductive hormone rhythms.

Zaret, Thomas M.* (Research), Ph.D., 1971, Yale; ecology and evolutionary biology, fresh-water community structure, ecology of fishes, tropical ecology.

Assistant Professors

Daniel, Thomas L., Ph.D., 1982, Duke; invertebrate zoology, biomechanics, physiology, biophysical ecology.

Kareiva, Peter M., Ph., 1981, Cornell; ecology of plant and animal interactions, underlying spatial and temporal factors in insect populations.

Moody, William J.,* Ph.D., 1977, Stanford; single-cell electrophysiology.

Wakimoto, Barbara T., Ph.D., 1981, Indiana; developmental genetics, eukaryotic gene organization and regulation.

Course Descriptions

Courses for Undergraduates

ZOOL 114 Evolution (2) Sp *Slatkin* Evolutionary biology for nonmajors. Evolutionary history of the earth and various theories of evolution.

ZOOL 118 Survey of Physiology (5) AWSpS Elementary human physiology. For nonmajors. Credit is not given for 118 if credit has previously been given for 208.

ZOOL 119 Elementary Physiology Laboratory (1) ASpS Prerequisite: 118 taken concurrently.

ZOOL 220 Diversity in Animals (5) WS Morphological, functional, and ecological diversity within the major phyla of animals. Prerequisite: high school biology or permission of instructor.

ZOOL 301 Introductory Physiology (4) *Deyrup-Olsen, Riddiford, Truman* Fundamentals of physiology: biochemistry of cell constituents, environment of the cell, bioenergetics, intermediary metabolism, membranes, control mechanisms. Laboratory project required. Prerequisites: chemistry through organic, one year of college physics, 10 credits in biological sciences.

ZOOL 330 Natural History of Marine Invertebrates (5) SpS *Kohn, Paine* Field and laboratory course emphasizing the habits, habitats, adaptations, and interrelationships of marine animals. Students may be required to share a portion of the transportation costs of field trips.

ZOOL 382 Natural History of Vertebrates (5) SpS *Huey, Snyder* Field and laboratory course on the classification, ecology, adaptations, and natural history of fishes, amphibians, reptiles, birds, and mammals. Students may be required to share a portion of the transportation costs of field trips. Prerequisite: permission of instructor.

ZOOL 403 Comparative Vertebrate Histology (5) A *Cloney* Microscopic and submicroscopic anatomy of vertebrates. Emphasis on mammals. Light microscopy and interpretation of ultrastructure. Functions of basic tissue types and organs as related to structure. Prerequisite: BIOL 212.

ZOOL 409 Sociobiology (4) W *Rohwer* Biological bases of social behavior, emphasizing evolution as a paradigm. Topics are: individual *vs.* group selection, kin selection, altruism, group *vs.* individual living, mating systems, parental care of offspring, and competitive strategies. Offered jointly with PSYCH 409. Prerequisites: BIOL 211 and 212 or PSYCH 200, or equivalent.

ZOOL 410 Ethology and Ecology Laboratory (4) Sp *Boersma, Paine* Field projects on foraging and social behavior, species interactions and structure of terrestrial and marine communities, including special student research problems. Students may be required to share a portion of the costs of transportation. Prerequisite: permission of instructor.

ZOOL 423 Protozoology (5) Introduction to protozoa exclusive of parasites, with emphasis on morphology (including fine structure and function), ecology, taxonomy, and life histories. Prerequisite: 20 credits in biological sciences or permission of instructor; recommended: BIOL 401.

ZOOL 430 Marine Zoology (8) ASp *Kozloff, Strathmann* Survey of groups of invertebrate animals represented in marine environments; natural history, ecology, distribution, habitat, adaptation, and trophic interrelationships. Offered at Friday Harbor Laboratories. Concurrent registration in BOT 445 required at Friday Harbor. Prerequisites: 20 credits in biological sciences and permission of Director of Friday Harbor Laboratories.

ZOOL 432 Marine Invertebrate Zoology (9) S Comparative morphology and biology of marine invertebrates. Laboratory study covers the structure and interrelationships among marine invertebrate animals. Representatives of all major and most minor phyla are collected, observed alive, and studied in some detail. Offered at Friday Harbor Laboratories. Not open for credit to students who have taken 433 or 434. Prerequisites: BIOL 212 or equivalent and permission of Director of Friday Harbor Laboratories.

ZOOL 433, 434 Invertebrate Zoology (5,5) A,W *Illg, Kohn, Kozloff* Comparative morphology and biology of invertebrates. Laboratories emphasize structures and functions. Not open to students who have had 432. Prerequisites: BIOL 212; 433 for 434.

ZOOL 435 Parasitology (5) General course covering the principles of parasitism and the major groups of animal parasites. Prerequisite: 20 credits in biological sciences or permission of instructor.

ZOOL 438 Comparative Endocrinology (3) W *Gorbman* Hormonal integration of living processes at all levels in animals: cells, organs, organisms, populations. Prerequisite: one year of biology; recommended: histology and organic chemistry.

ZOOL 439 Comparative Endocrinology Laboratory (2) Sp *Gorbman* Appropriate experiments to accompany and enlarge on material presented in 438. Prerequisites: 438 and permission of instructor.

ZOOL 444 Entomology (3) Sp *Edwards* Biology of terrestrial arthropods, with emphasis on insects. Structure, classification, physiology, and ecology of insects. Interrelationships of insects and man. Prerequisite: 15 credits in biological sciences or permission of instructor.

ZOOL 445 Entomology Laboratory (2) Sp *Edwards* Structure and function of arthropods, with emphasis on insects. Field studies and taxonomy of important insect groups. Students may be required to share a portion of the transportation costs of field trips. Prerequisites: concurrent registration in 444 and permission of instructor.

ZOOL 448 Concepts of Nervous System Function (3) *Palka* Broad examination of integrative mechanisms in central nervous system function, with emphasis on sensory processing, plasticity, and control of behavior. Examples are taken from a variety of animal groups.

ZOOL 449 Concepts of Nervous System Function Laboratory (2) *Palka* Experiments to accompany material presented in 448. Prerequisites: 448 and permission of instructor.

ZOOL 453-454 Comparative Anatomy of Chordates (5-5) A,W *Snyder* Morphology and phylogeny of the chordates; structure, function, and evolution of vertebrate organ systems. Prerequisite: BIOL 212.

ZOOL 455-456 Developmental Biology of Animals and Developmental Biology of Animals Laboratory (3-3) Comparative study of development; properties and experimental analysis of developing systems. Examples from both vertebrate and invertebrate animals. Both 455- and -456 must be completed within one year. Prerequisites: BIOL 210, 211, and 212 or permission of instructor. Recommended: 301, GENET 451, and BIOC 405, 406.

ZOOL 457 Methods and Problems in Development (3) Experimental embryology, focusing on modern approaches to developmental problems. Selected topics. Prerequisites: 456 or equivalent and permission of instructor.

ZOOL 464 Natural History of Birds (5) Sp *Rohwer* Field, lecture, and laboratory study of birds framed in biological theory rather than taxonomy. Breeding systems, brood parasitism, appearance, molt, migration, orientation, social behavior, song, and flight are emphasized. Includes Saturday and weekend field trips for which students are required to share a portion of transportation costs. Prerequisites: BIOL 210, 211, 212 or equivalent, and permission of instructor.

ZOOL 485 Natural History of Mammals (5) A *Kenagy* Field, lecture, and laboratory course introducing mammals in a general biological context, emphasizing ecology, evolution, behavior, morphology, and adaptation to the environment. Fieldwork focuses on rodent populations and their habitats in Washington State. Includes weekend field trips, for which students may be required to share a portion of transportation costs. Prerequisites: BIOL 210, 211, 212 and permission of instructor; recommended: 453-454 and BIOL 472.

ZOOL 469 Reproductive Endocrinology (3) Sp *Gorbman* Endocrine regulation of the processes of mammalian reproduction. Integration of reproduction with environmental features through behavioral and metabolic adjustments. Planned endocrine manipulation of reproduction and its demographic implications. Prerequisite: one year of college-level biology.

ZOOL 478 Environmental Physiology (5) A *Kenagy* Physiological adaptation in an ecological and evolutionary context. Adaptation to physical aspects of the environment and to daily and seasonal environmental cycles; whole-animal energetics, including thermal relations; water and solute regulation; respiration. Laboratory emphasizes the combination of field and laboratory work. Students may be required to share a portion of the transportation costs of field trips. Prerequisite: 301; recommended: course in vertebrate or invertebrate zoology.

ZOOL 488, 489 Animal Physiology (5,5) W,S *Deyrup-Olsen, Huey, Kenagy, Riddiford* Physiology at levels of organisms and behavior, organ systems, and cells—an ecological and evolutionary perspective. Energy relations, temperature effects, movement, circulation, respiration, water and solute regulation, membranes, neural and hormonal function, biological rhythms, reproduction. Experimental design and techniques; data analysis; written reports. Prerequisites: introductory biology, chemistry, and physics.

ZOOL 490 Undergraduate Seminar (3, max. 6) Supervised reading and group discussion on selected concepts of zoology. Prerequisites: 20 credits in zoology and permission of instructor.

ZOOL 491 Topics in Zoological Research (1, max. 3) Undergraduate seminar on research problems currently under investigation by department faculty members. Includes discussions and laboratory demonstrations of aims, techniques, and results of zoological research. Prerequisites: upper-division standing and permission of instructor.

ZOOL 498 Special Problems in Zoology (1-5, max. 15) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

ZOOL 508 Topics in Developmental Biology (1-2, max. 15) Seminars and discussions of aspects of growth of special current interest. Prerequisite: permission of instructor.

ZOOL 509 Topics in Animal Behavior (1-3, max. 9) AWSp *Orians, Rohwer* Detailed consideration of topics in behavioral integration, communication, and social organization. Prerequisite: 409 or PSYCH 409 or equivalent.

ZOOL 517 Comparative Developmental Physiology (6 or 9) *Whiteley* Oogenesis, fertilization, and differentiation of invertebrates from the point of view of biosyntheses, permeability, metabolic changes, acquisition of specific biochemical properties and physical mechanisms of developmental processes. Laboratory deals comparatively with a variety of marine invertebrates. 9 credits available at Friday Harbor Laboratories only. Prerequisite: permission of instructor.

ZOOL 520, 521, 522 Seminar (1,1,1) A,W,Sp

ZOOL 528 Advanced Topics in Physiology (1-3, max. 15) Recent developments. Prerequisite: at least one 400-level course in physiology.

ZOOL 529 Advanced Topics in Physiology (1-3, max.15) *Edwards, Farner, Huey, Kenagy, Palka, Riddiford, Schubiger, Truman* Recent developments. Prerequisite: one 400-level course in physiology.

ZOOL 533 Advanced Invertebrate Zoology (9) SpS Invertebrate fauna of the San Juan Archipelago. Topic changes from year to year. Individual research projects are emphasized. Offered at Friday Harbor Laboratories. Prerequisites: 10 credits in invertebrate zoology or equivalent and permission of Director of Friday Harbor Laboratories.

ZOOL 536 Comparative Invertebrate Embryology (9) SpS Morphological and experimental studies of development of selected types of marine invertebrates. Offered at Friday Harbor Laboratories. Prerequisites: 433, 434, and 456 and permission of Director of Friday Harbor Laboratories.

ZOOL 538 Advanced Invertebrate Physiology (9) Sp General and comparative aspects of nerve and muscle physiology with particular emphasis upon neuronal control of behavior, neuronal interactions, and other advanced topics determined by visiting faculty. Extensive laboratory experience, including intracellular and extracellular stimulating and recording techniques. Offered at Friday Harbor Laboratories. Recommended: background in cellular physiology and invertebrate morphology.

ZOOL 556 Insect Development (3) *Edwards, Riddiford, Schubiger* Characterizes developmental processes and their adaptations in diverse insect groups. Emphasizes hormonal control mechanisms in metamorphosis, polymorphism and diapause, regeneration and genetic analysis of development. Prerequisites: 456 or equivalent, BIOL 212 or equivalent, or permission of instructor.

ZOOL 568 Chemical Integration (2, max. 6) AW *Gorbman* Graduate seminar dealing with current problems in endocrinology and neuroendocrinology. Prerequisite: permission of instructor.

ZOOL 572 Topics in Ecology (2 or 3) W *Edmondson, Kohn, Orians, Paine* Graduate seminar on modern problems in ecology. Prerequisites: BIOL 472 or equivalent, and permission of instructor.

ZOOL 574 Ecology of Marine Communities (3) *Paine* Lecture course emphasizing the ecological structure and functioning of marine communities. Topics include population interactions and dynamics, distributional patterns, bioenergetics, stability, and species diversity. Prerequisites: BIOL 472 or equivalent, and permission of instructor.

ZOOL 575 Principles of Ecology as Applied to Fishes (3) A *Zaret* Theoretical ecology as applied to fishes. Includes fish vision, color pattern determinants, adaptive radiation, competition and predation, fish behavior, reproductive patterns, community organization, and species diversity. Offered jointly with FISH 575. Prerequisite: graduate standing or permission of instructor.

ZOOL 578 Advanced Ecology (5) *Orians* Strategies of reproduction, habitat selection, foraging and spacing; theory of competition and predator-prey interactions; niche theory and community structure. Prerequisites: BIOL 472 or equivalent, and permission of instructor.

ZOOL 583 Advanced Techniques in Microscopy (5) W *Cloney* Theory and use of light and electron microscopes; modern techniques of specimen preparation for morphological studies, photomicrography. Methodologies are applied to analyses of special problems selected by students. Prerequisite: permission of instructor.

ZOOL 600 Independent Study or Research (*) AWSpS

ZOOL 700 Master's Thesis (*) AWSpS

ZOOL 800 Doctoral Dissertation (*) AWSpS

School and Graduate School of Business Administration

Dean

Nancy L. Jacob

Associate Deans

Warren W. Etcheson
Robert C. Higgins

126 Mackenzie

Men and women embarking on business careers will have the opportunity to influence many of the social, political, and economic forces in today's world. The School of Business Administration seeks to provide a foundation upon which students can continue to build their professional careers.

The School of Business Administration offers an undergraduate program leading to the degree of Bachelor of Arts in Business Administration. The Graduate School of Business Administration offers programs leading to the degrees of Master of Business Administration, Master of Professional Accounting, and Doctor of Philosophy.

Business Administration became an independent unit within the University system in 1917. Since 1921, it has been a member of the American Assembly of Collegiate Schools of Business, with both undergraduate and graduate programs accredited.

Facilities and Services

Most business adminjstration classes and activities are in two buildings. Balmer Hall, named for Thomas Balmer, former president of the University Board of Regents, contains classrooms, the business administration library, and the business administration computer users center. Mackenzie Hall, named in memory of Prof. Donald Mackenzie, Chairperson of the Department of Accounting from 1949 to 1955, contains the Dean's office, the Office of Graduate Programs, the Office of Undergraduate Programs, faculty offices, and other business administration program offices.

The Graduate School of Business Administration, in association with the Western Finance Association, publishes the monthly journal, *Journal of Financial and Quantitative Analysis*.

To serve the continuing education needs of business persons, the School and Graduate School of Business Administration offer a number of short programs, either University initiated or cosponsored with various community and industry organizations. The management program, designed for middle to upper management, focuses on self-renewal in a society that is experiencing an accelerating pace of change. Offerings in the various small business series courses assist owners and managers in planning, organizing, and operating their small businesses. Other continuing education activities include the Tax Clinic for Small Business, the Entrepreneurship Symposium, Pacific Rim Bankers Program, Pacific Coast Banking School, and the Savings and Loan School for Executive Development. Also offered are a number of special interest programs (e.g., Women in Management, Impasse Procedures and Collective Bargaining). Information on the continuing education program may be obtained from the conference coordinator, 543-8560.

Student Organizations

Chapters of Alpha Kappa Psi, Beta Alpha Psi, Beta Gamma Sigma, as well as the Association of University Women in Business, Finance Club, Association of Black Business Students, International Association of Students in Economics and Commerce, Marketing Club, and Student Advisory Council provide opportunities for undergraduate students to meet informally and to participate in a variety of projects and events.

The goals and interests of graduate students are served by the M.B.A. Association, Graduate Women in Management, and the Doctoral Association.

Undergraduate Program

Undergraduate Office

137 Mackenzie

Virginia S. Morrison, Undergraduate Program Director

The School of Business Administration, with admission at the junior level, offers a two-year program leading to the degree of Bachelor of Arts in Business Administration. The curriculum, building upon a basic foundation in the arts and sciences, provides an exposure to a wide range of functional business areas and the opportunity for study in selected areas in some depth.

Bachelor of Arts in Business Administration Degree

Specific School Admission Requirements: A minimum of 90 credits with at least a 2.50 cumulative grade-point average and a 2.50 cumulative grade-point average in required lower-division business courses. The 90 credits must include the following (or equivalents): 20 credits in natural sciences, including 5 credits in college-level mathematics (MATH 156 or 105) and 5 credits in calculus (MATH 157 or 124); 30 credits in social sciences, including 10 credits in microeconomics and macroeconomics (ECON 200 and 201) and 10 credits in anthropology, psychology, and/or sociology; 10 credits in humanities; 5 credits in English composition; ACCTG 210, 220, 230; Q METH 200, 201; BG&S 200; 5 elective credits. (Students may not count credit for more than one introductory statistics course.) Applicants who meet the University and School of Business Administration requirements at the time they transfer are eligible to be placed directly in the school; those who meet the University entrance requirements, but not the business administration requirements, are eligible to be placed in the College of Arts and Sciences as prebusiness majors. For admission to the School of Business Administration, a supplemental application, together with all supporting materials, must be on file by the following quarterly deadlines: for Summer or Autumn quarters, April 1-21; Winter Quarter, October 1-21; Spring Quarter, January 1-21. If the number of eligible applicants exceeds that for which space is available, acceptance will be competitive, based on a selection index.

Specific Upper-Division School Requirements: B ECN 300, 301; MKTG 301; I BUS 300; OPMGT 301; BG&S 333; FIN 350; A ORG 420, 440; B POL 470 or 471 or 480; and a minimum of 16 credits of 300- or 400-level business administration electives (or area of concentration); minimum of 4 credits in an approved writing course.

Specific School Graduation Requirements: No more than 9 lower-division business elective credits; a minimum of 72 non-business administration credits, including those listed under Specific School Admission Requirements, and 72 business administration credits, including those listed under the preceding two requirements sections; and a cumulative average of at least 2.50 in all business administration credits earned at the University; and a cumulative grade-point average of 2.50 for all University credits.

Double Baccalaureate Degrees and Second Baccalaureate Degree

Students who wish to earn more than one baccalaureate degree should consult an adviser in the business administration advisory office, either during or before the junior year. Persons seeking a second baccalaureate degree should apply at the University's Office of Undergraduate Admissions. To be considered, applicants must complete by quarter of entry the same prerequisites for admission as applicants for the first baccalaureate degree. If the number of eligible applicants exceeds that for which space is available, acceptance will be competitive, based on a selection index. The grade-point average for the last 90 credits earned will be used to determine the selection index number.

Graduate Program

Graduate Office

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Richard F. Yalch, Graduate Program Coordinator
Donald R. Bell, Alternate Graduate Program Coordinator

Admission

Qualified students who are graduates of the University of Washington or of other accredited colleges or universities may be admitted Autumn Quarter to graduate degree programs. Grade-point average, Graduate Management Admission Test score, work experience, educational and professional objectives, and other factors are considered in the admission process. Inquiries concerning the details of admission should be made to University of Washington, Graduate School of Business Administration, Mackenzie Hall, DJ-10, Seattle, Washington 98195.

Application Procedure

In February, the admissions committee begins review of applications for Autumn Quarter. A high percentage of admission decisions are made at that time, and these applicants receive notice of the decision soon thereafter. The formal deadlines for applications are February 15 for the Ph.D. program, March 15 for the Master of Business Administration and Master of Professional Accounting degree programs, and May 1 for the Executive M.B.A. Program.

The Graduate School of Business Administration offers programs of study leading to the advanced degrees of Master of Business Administration, Master of Professional Accounting, and Doctor of Philosophy.

The Master of Business Administration degree program has been designed for students with varied academic backgrounds (e.g., arts and sciences, engineering, business administration) who are preparing for a professional career in management. A period of two academic years, or 72 academic credits, is required for most students to complete the M.B.A. program. The program consists of 36 credits of required first-year courses, 6 credits of required second-year courses, and 30 elective credits split between an area of concentration and other areas of interest. The student must take 12-18 elective credits in an area of concentration and work in at least two other areas. In addition, within the 30 elective credits the student must satisfy the research requirement by either writing an M.B.A. research report in the area of concentration or taking two electives designated by the faculty as satisfying the research requirements. In order for a given course or seminar to be so designated, forty percent or more of its graded requirements must consist of rigorous independent problem investigation and reporting.

In the autumn of 1983, an additional pathway to the Master of Business Administration degree, called the Executive M.B.A. Program, was initiated. Its primary objective is to provide a special executive development experience to a select group of midcareer managers. Candidates for this two-year program should have seven or more years of increasingly successful work experience and currently hold a management-level position. They also should be identified by their sponsoring organization as having potential for continued advancement toward general management. Participants are selected to ensure diversity of industry, experience, function, and organizational size. Following an initial September session of one week in residence, classes meet for a full day on alternating Fridays and Saturdays. Course work is comparable to that of the regular M.B.A. program, with adjustments made to provide a distinctly managerial focus. Students move through the program together as a group. There are no electives. Applications are accepted throughout the year for the class beginning each autumn.

The Master of Professional Accounting degree program is aimed at preparing high-level professional accounting specialists. The M.P.Acc. degree (1) provides an opportunity for graduate study in accounting beyond the typical undergraduate accounting major and in greater depth than that offered by an accounting concentration in an M.B.A. program, and (2) fosters a professionally oriented academic environment within which professional attitudes, ethics, and a sense of personal, public, and social responsibility develop and grow.

The Doctor of Philosophy degree program has been designed for persons who wish to prepare for careers in research and teaching, business, or government. Students enrolled in this program are expected to possess the broad professional administrative competency that is the objective of the M.B.A. program, and, in addition, are expected to pursue doctoral-level competency in an area of concentration and several supporting areas. Moreover, all students must show evidence of competency in the methods and tools of research appropriate to their areas of interest. Opportunities for gaining teaching experience under supervision are available, and each student is required to obtain at least a minimum of such experience.

Special Requirements

Applicants to graduate business programs are required to submit scores on the Graduate Management Admission Test. Those admitted to the M.B.A. program must demonstrate understanding of the fundamental concepts of calculus and proficiency in the use of computers.

Financial Aid

The Graduate School of Business Administration offers a number of teaching assistantships and predoctoral teaching associate appointments each year. A limited number of scholarships and fellowships also are available.

Accounting

Accounting involves development and communication of financial and operational information for business and nonprofit economic entities. Courses provide a foundation for careers in accounting (public, industrial, private, governmental, or institutional) for a general business career, or for such professions as law. The notation "Accounting" will be included on the permanent record, or transcript, of a student who graduates with a degree of Bachelor of Arts in Business Administration and who completes with a grade-point average of at least 2.00 the following courses: ACCTG 301, 302, 303, 311, 411, 421, and 9 elective credits in 400-level accounting courses, except 401, 490, and 499.

Faculty

Chairperson

Roland E. Dukes
231 Mackenzie

Professors

Alkire, Durwood L., B.A., 1935, Washington; tax accounting.

Berg, Kenneth B. (Emeritus), Ph.D., 1952, Illinois; financial and managerial accounting.

DeCoster, Don T.,* Ph.D., 1961, Texas; cost and managerial accounting.

Dukes, Roland E.,* Ph.D., 1974, Stanford; financial accounting.

Heath, Loyd C.,* Ph.D., 1965, California (Berkeley); financial accounting.

Mueller, Fred J.,* Ph.D., 1956, Ohio State; auditing, not-for-profit, tax accounting.

Mueller, Gerhard G.,* Ph.D., 1961, California (Berkeley); Director, Master of Professional Accounting Program; financial accounting and reporting, international accounting.

Ramanathan, Kavasseri V.,* Ph.D., 1969, Northwestern; managerial accounting.

Roller, Julius A. (Emeritus), M.A., 1960, Michigan; tax accounting.

Sundem, Gary L.,* Ph.D., 1971, Stanford; information systems, managerial accounting.

Walker, Lauren M. (Emeritus), M.B.A., 1943, Washington; financial and international accounting.

Associate Professors

Jiambalvo, James,* Ph.D., 1977, Ohio; managerial accounting.

Kelly, Lauren, Ph.D., 1975, Alabama; financial accounting.

Noreen, Eric W.,* Ph.D., 1976, Stanford; managerial accounting.

Pratt, James H., D.B.A., 1977, Indiana; financial accounting.

Assistant Professors

Bowen, Robert M., Ph.D., 1978, Stanford; financial and managerial accounting.

Burgstahler, David C., Ph.D., 1981, Iowa; financial and managerial accounting.

Klemme, Dana, Ph.D., 1983, Michigan; managerial accounting and auditing.

Pfeiffer, Glenn M., Ph.D., 1980, Cornell; financial accounting.

Business, Government, and Society

The field of business, government, and society examines the general perspective and analytical tools necessary to understand the relationships between business institutions and the rest of society. The political, social, and legal framework within which business institutions operate constitutes the central focus. The department is interdisciplinary, encompassing law, economics, and the other social sciences. Among the major issues studied are: business and politics, ideologies and business, corporate responsibility and business ethics, corporate governance, social and political forecasting, comparative enterprise systems, geopolitics, and the evolution and future of modern capitalism.

Faculty

Chairperson

Thomas M. Jones
370 Mackenzie

Professors

Brown, S. Darden (Emeritus), LL.M., 1938, Stanford; business law.

Goldberg, Leonard D.,* J.D., 1945, Chicago; business responsibilities and comparative business.

Jamieson, Ronald B. (Emeritus), LL.B., 1939, Harvard; business, government, and society.

Lessinger, Jack,* Ph.D., 1956, California (Berkeley); urban development and real estate.

Monsen, R. Joseph,* Ph.D., 1960, California (Berkeley); business environment, theory of the firm, capitalist systems.

Robinson, Dwight E. (Emeritus), Ph.D., 1948, Columbia; business, government, and society.

Wheeler, Bayard O. (Emeritus), Ph.D., 1942, California (Berkeley); urban economics.

Associate Professors

Barsh, Russel L.,* J.D., 1974, Harvard; law and its environment.

Jones, Thomas M.,* Ph.D., 1977, California (Berkeley); business, government, and society.

Strong, Dennis F.,* Ph.D., 1959, Washington; business history.

Wickman, James A. (Emeritus), Ph.D., 1961, Washington; risk control and insurance.

Lecturer

Erxleben, William C., J.D., 1966, Stanford; business and public policy.

Finance, Business Economics, and Quantitative Methods

Finance, business economics, and quantitative methods facilitate understanding the financial, economic, and quantitative aspects of decision making. The finance curriculum focuses on teaching sound principles of financial management and on understanding the behavior of the financial markets within which firms and individual investors operate. Business economics courses study the economic behavior of firms, examining factors that determine costs and prices. They also analyze how real and monetary factors (such as government policies) affect the national and international economic environment. Courses in quantitative methods cover statistics, operations research, mathematics, and computer information systems.

Faculty

Chairperson

Peter A. Frost
269 Mackenzie

Professors

Alberts, William W.,* Ph.D., 1961, Chicago; finance and business economics.

Bourque, Philip J.,* Ph.D., 1956, Pennsylvania; business economics.

Chiu, John S. Y.,* Ph.D., 1954, Illinois; quantitative methods.

D'Ambrosio, Charles A.,* Ph.D., 1962, Illinois; finance.

Faaland, Bruce H.,* (Applied Mathematics), Ph.D., 1971, Stanford; quantitative methods.

Frost, Peter A.,* Ph.D., 1966, California (Los Angeles); finance and business economics.

Haley, Charles W.,* Ph.D., 1968, Stanford; finance.

Hanson, Kermit O. (Emeritus), Ph.D., 1950, Iowa State; accounting and statistics.

Henning, Charles N.,* Ph.D., 1952, California (Los Angeles); finance and business economics.

Hess, Alan C.,* Ph.D., 1968, Carnegie Institute of Technology; business economics.

Higgins, Robert C.,* Ph.D., 1968, Stanford; finance.

Jacob, Nancy L.,* Ph.D., 1970, California (Irvine); finance.

Johnson, Dudley W.,* Ph.D., 1957, Northwestern; business economics.

King, Benjamin F.,* (Biomathematics), Ph.D., 1964, Chicago; quantitative methods, statistics.

Page, Alfred N.,* (Health Services), Ph.D., 1964, Chicago; business economics.

Schall, Lawrence D.,* Ph.D., 1969, Chicago; finance and business economics.

Scott, Robert H.,* Ph.D., 1961, Harvard; business economics.

Associate Professors

Diehr, George E.,* Ph.D., 1969, California (Los Angeles); quantitative methods.

Pigott, William III (Emeritus), Ph.D., 1957, Washington; finance and business economics.

Prater, George I.,* Ph.D., 1963, Stanford; quantitative methods.

Rice, Edward M.,* Ph.D., 1978, California (Los Angeles); finance and business economics.

Roley, V. Vance,* Ph.D., 1977, Harvard; economics.

Siegel, Andrew F.,* (Statistics),† Ph.D., 1977, Stanford; statistics.

Tamura, Hirokuni,* Ph.D., 1967, Michigan; quantitative methods.

Assistant Professors

Hart, J. Pirie, Jr. (Acting), M.B.A., 1977, California (Berkeley); operations management.

Karpoff, Jonathan M., Ph.D., 1982, California (Los Angeles); economics.

Malatesta, Paul H., Ph.D., 1981, Rochester; finance.

Management and Organization

Management and organization provides an understanding of the processes and structures of organizations through courses in four main areas of management. Administrative theory and organizational behavior is concerned with an interdisciplinary development of concepts, skills, and attitudes, in both theory and application, to enable students to be more effective managers. Business policy supplements and integrates all work undertaken in other areas of the school, adding to the understanding of the executive viewpoint in strategic management decisions by emphasizing problem analysis, decision making, strategic planning and control, and entrepreneurship. Human resource systems, formerly personnel and industrial relations, deals with: employee selection, motivation, appraisal, compensation, and development; union-management relations; and evaluation of human resource systems. Operations management focuses on the operations function in organizations, including the production of goods and services, design of productive systems, materials management, production scheduling, quality assurance, facilities location, systems analysis, and dynamics of system behavior.

Faculty

Chairperson

Karl H. Vesper
155 Mackenzie

Professors

Brown, Edward G. (Emeritus), M.B.A., 1921, Harvard; business policy.

Fenn, Margaret P. (Emeritus), D.B.A., 1963, Washington; organizational behavior and administrative theory.

French, Wendell L. (Emeritus), D.Ed., 1956, Harvard; organizational behavior, human resources management, organization development.

Henning, Dale A.,* Ph.D., 1954, Illinois; administrative theory and organizational behavior.

Johnson, Richard A. (Emeritus), Ph.D., 1958, Washington; business policy.

Kast, Fremont E. (Emeritus), Ph.D., 1956, Washington; administrative theory and organizational behavior.

Knowles, Henry P. (Emeritus), Ph.D., 1961, Stanford; administrative theory and organizational behavior.

Knudson, Harry R., Jr.,* D.B.A., 1958, Harvard; business policy.

LeBreton, Preston P. (Emeritus), Ph.D., 1953, Illinois; business policy and administrative theory.

Mitchell, Terence R.,* (Psychology),† Ph.D., 1969, Illinois; organizational behavior.

Newell, William T.,* Ph.D., 1962, Texas; operations management and business policy.

Peterson, Richard B.,* Ph.D., 1966, Wisconsin; human resources management.

Rosenzweig, James E. (Emeritus), Ph.D., 1966, Illinois; administrative theory and organizational behavior.

Saxberg, Borje O.,* Ph.D., 1958, Illinois; administrative theory and organizational behavior.

Schrieber, Albert N. (Emeritus), M.B.A., 1947, Harvard; business policy.

Scott, William G.,* D.B.A., 1957, Indiana; administrative theory and organizational behavior.

Summer, Charles E.,* Ph.D., 1957, Columbia; business policy and administrative theory.

Sutermeister, Robert A. (Emeritus), M.A., 1942, Washington; personnel and organizational behavior.

Vesper, Karl H.,* (Mechanical Engineering; Institute for Marine Studies),† Ph.D., 1969, Stanford; business policy, mechanical engineering, marine studies.

Associate Professors

Beard, Donald W.,* Ph.D., 1975, Nebraska; business policy.

Bell, Cecil H.,* Ph.D., 1968, Boston; organizational behavior and administrative theory.

Buck, Vernon E.,* Ph.D., 1963, Cornell; organizational behavior and administrative theory.

Kienast, Philip K.,* Ph.D., 1972, Michigan State; human resources management.

Klastorin, Theodore D.,* Ph.D., 1973, Texas (Austin); operations management.

Lopez, David A.,* D.B.A., 1977, Southern California; operations management.

Woodworth, Robert T.,* Ph.D., 1963, Northwestern; administrative theory and organizational behavior, human resources management.

Assistant Professors

Fry, Louis W., Ph.D., 1978, Ohio State; administrative theory and organizational behavior.

Latham, Gary P., Ph.D., 1974, Akron; administrative theory and organizational behavior, human resources management.

Lee, Thomas, Ph.D., 1984, Oregon; administrative theory and organizational behavior, human resources management.

Napier, Nancy K., Ph.D., 1981, Ohio State; human resources management.

Schmitt, Thomas G., D.B.A., 1979, Indiana; operations management.

Watts, Charles, Ph.D., 1984, Indiana; operations management.

Marketing and International Business

Marketing provides knowledge of concepts and relationships in the areas of consumer behavior, channels of distribution, measurement and analysis of markets, pricing, physical movement of goods, product development and mix, promotion, and sales administration. Marketing careers may involve specialization in product or brand management, advertising, sales management, marketing research, retailing, wholesaling, and international marketing for a wide spectrum of firms and industries. International business includes trade, payments, and multinational corporate systems and activities. The area prepares students for international responsibilities in domestic business firms, governmental agencies, and overseas business. Courses in business communications stress the writing dimension as it relates to business; also included are theory and techniques of effective communication in interpersonal relationships.

Faculty

Chairperson

Douglas L. MacLachlan
156 Mackenzie

Professors

Etcheson, Warren W.,* Ph.D., 1956, Iowa; marketing.

Gordon, Guy G. (Emeritus), Ph.D., 1957, California (Berkeley); marketing.

Harder, Virgil E.,* Ph.D., 1958, Illinois; business communications.

Johansson, Johny,* Ph.D., 1972, California (Berkeley); quantitative models of marketing.

Kolde, Endel J. (Emeritus), Ph.D., 1954, Washington; international business and marketing.

MacLachlan, Douglas L.,* Ph.D., 1971, California (Berkeley); quantitative methods and marketing research.

Miller, Charles J. (Emeritus), M.B.A., 1927, Washington; marketing.

Moinpour, Reza,* Ph.D., 1970, Ohio State; consumer behavior and marketing research.

Murphy, Herta A. (Emeritus), M.A., 1942, Washington; international business.

Narver, John C.,* Ph.D., 1965, Ohio State; marketing.

Spratlen, Thaddeus,* Ph.D., 1962, Ohio State; marketing.

Wheatley, John J.,* Ph.D., 1959, State University of New York (Buffalo); marketing.

Associate Professors

Grathwohl, Harrison L. (Emeritus), D.B.A., 1957, Indiana; marketing.

Moxon, Richard W.,* D.B.A., 1973, Harvard; international business.

Sullivan, Jeremiah J.,* Ph.D., 1970, New York; business communications.

Truitt, J. Frederick,* D.B.A., 1969, Indiana; international business.

Yalch, Richard F.,* Ph.D., 1974, Northwestern; advertising and consumer behavior.

Assistant Professors

Erickson, Gary,* Ph.D., 1978, Stanford; quantitative models of marketing.

Obermiller, Carl, Ph.D., 1981, Ohio State; consumer behavior and marketing.

Roehl, Thomas W., Ph.D., 1983, Washington; international business.

Lecturer

Rustia, Manuel S. (Emeritus), M.B.A., 1925, Washington; international business.

Course Descriptions

Accounting

Courses for Undergraduates

ACCTG 210 Introduction to Accounting (3) Nature and social setting of accounting; uses of accounting information; introduction to basic accounting concepts, and some accounting techniques. Prerequisite: sophomore standing or above.

ACCTG 220 Fundamentals of Financial Accounting (3) Principal procedures and concepts utilized in contemporary financial accounting and reporting. Preparation and interpretation of financial statements. Prerequisite: 210.

ACCTG 230 Fundamentals of Managerial Accounting (3) Analysis and evaluation of accounting information as part of the managerial processes of planning, decision making, and control. Concentrates on types of economic decision making in enterprises and on accounting information useful to enterprise managers. Prerequisite: 220.

ACCTG 301, 302, 303 Intermediate Accounting I, II, III, (3,3,3) Concepts and principles of financial accounting. Analysis of controversies and problems related to the measurement of enterprise income. Prerequisites: 230 and admission to accounting major for 301; 301 for 302; 302 for 303.

ACCTG 311 Cost Accounting (3) Introduction to the theory of cost accounting; job order, process, and standard cost systems; overhead accounting; problems in accumulation and allocation of costs; decision making with cost data. Prerequisite: 301.

ACCTG 371 Auditing or Industrial Internship (2) One quarter's internship with a certified public accounting firm, industrial organization, or government agency. Prerequisite: prior departmental approval.

ACCTG 375 Topics in Financial Reporting (4) Critical examination of the uses and limitations of general purpose financial statements that have been prepared in accordance with generally accepted accounting principles. Prerequisite: 230; not open to accounting majors.

ACCTG 401 Federal Income Tax Factors in Business Decisions (3) Service course recommended for the junior year for the School of Business Administration. May also be taken by M.B.A. students for graduate credit. Prerequisite: 230.

ACCTG 411 Auditing Standards and Principles (3) Intensive introduction to the attest function in society today. The environment, the process, and the report of the public auditor are analyzed. Potential extensions of the attest function are examined. Prerequisites: 303, 311.

ACCTG 421 Tax Effects of Business Decisions (3) Issues in taxation, including tax considerations in business decision making, tax effects of business transactions, taxation of compensation, fringe benefits, capital gains, fixed asset transactions, disposition of business distribution from corporations. Prerequisite: 303 or permission of undergraduate office.

ACCTG 430 Introduction to Information Systems (3) Study of the concepts of information systems in administrative organizations and the processes of analyzing and designing systems, with an emphasis on those using computer facilities. Includes sufficient study of computer systems to understand their present and future impact on information systems and to evaluate proposals for computerization of existing systems. Prerequisites: 302 and QMETH 200.

ACCTG 450 Business Taxation (3) Issues of taxation for entities other than individuals, including corporations, subchapter S corporations, partnerships, estates and trusts, corporate distributions, liquidations, and reorganizations. Prerequisite: 421.

ACCTG 451 Individual Income Taxation (3) Political, economic, and social forces influencing federal income taxation, role of taxation in personal decisions. Coverage of individual income tax matters, including business and investment income, business and personal deductions, property transactions, and tax issues of employees. Prerequisite: 421.

ACCTG 460 Advanced Cost Accounting (3) Advance analysis of cost and management accounting problems; special applications of cost accounting techniques for management planning and control; current developments in cost accounting. Prerequisite: 311.

ACCTG 470 Case Studies in Auditing (3) Application of the theory, standards, and principles to a simulated audit engagement. Guest lecturers discuss the broad-ranging audit involvement. Prerequisite: 411.

ACCTG 471 Internal Auditing (3) Independent appraisal function established within an organization. Role and nature of internal auditing; intensive review of internal control; management effectiveness audits; and financial audits from the point of view of the internal auditor. Prerequisite: 411.

ACCTG 480 Accounting for Not-for-Profit Organizations (3) Fund and budgetary accounting as applied to public sector organizations, such as governments, foundations, hospitals, and colleges. Prerequisite: 303.

ACCTG 485 Advanced Financial Accounting (3) Accounting for partnerships, accounting for business combinations, parent-subsidiary and branch relationships, foreign exchange. Prerequisite: 303.

ACCTG 490 Advanced Problems (3) Intensive study of accounting principles, procedures, and financial reporting, principally through consideration of C.P.A. examination problems. Prerequisites: 311, 411, 421, 480.

ACCTG 495 Advanced Accounting Theory (3) Theory of accounting related to income measurement, assets, and equities. Prerequisites: 303 and senior standing.

ACCTG 499 Undergraduate Research (3, max. 9) Arranged and supervised by individual members of the faculty. Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of graduate business program office required. Entry card required.

ACCTG 500 Financial Accounting (3) Introduction to concepts and procedures underlying determination and presentation of information for financial decisions by investors and other decision makers outside the business enterprise. Study of problems of valuation, income determination, and financial reporting.

ACCTG 501 Managerial Accounting (3) Study of the generation and the use of accounting information within the firm for purposes of planning and controlling operations. Topics covered include cost concepts, responsibility accounting systems, cost control, and the use of accounting information in short- and long-term management decision problems. Prerequisite: 500.

ACCTG 505 Intensive Analysis of Accounting Principles and Practices (15) S Intensive covering of subjects in required core for undergraduate accounting majors: intermediate accounting, advanced accounting, cost accounting, auditing, and tax accounting. Available to M.B.A. students, but credits will not count toward M.B.A. degree. Prerequisites: 210, 220, 230 or equivalent, or permission of instructor.

ACCTG 510 Problems in Financial Reporting (3) Extension of 500 emphasizing financial reporting from user's perspective. Alternative approaches to recognition, valuation, and measurement of assets, equities, and income. Choice of accounting methods and effects on the firm of accounting policy regulation. Prerequisites: 500, 501 or permission of instructor.

ACCTG 511 Problems in Managerial and Cost Accounting (3) Discussion and analysis of costing techniques, use of accounting data in planning and evaluating managerial performance, and use of accounting data in short- and long-run decisions. Issues in human behavior involved in cost allocation, budgeting, and performance evaluation. Prerequisites: 500, 501, or permission of instructor.

ACCTG 512 Auditing (3) Introduction to auditing from the perspective of the professional manager. The environment, opinion formulation process, and reporting activities of the public auditor. Acquisition and management of auditing services as an aspect of managerial control. Prerequisite: 511 or permission of instructor.

ACCTG 513 Tax Effects of Business Decisions (3) Importance of tax considerations in making business decisions. Relationship of taxable income to accounting and economic concepts of income, and the economic, political, and social background of important tax provisions. Prerequisite: 500 or 501 or permission of instructor.

ACCTG 520 Seminar in Financial Statement Analysis (3) Emphasizes use of published financial reports by decision makers external to the firm (e.g., investors, creditors). Within each decision context, traditional models and recent empirical research in accounting and finance are discussed. Project required as an application of course subject matter. Prerequisite: 521 or permission of instructor.

ACCTG 521 Seminar in Financial Control Systems (3) Design and administration of formal information systems to aid the planning and control process in large organizations; formulation of divisional financial goals and control criteria; measurement of divisional performance and problems of goal congruence; administration of new investment programs. Prerequisites: 501 and A ORG 550 or permission of graduate office.

ACCTG 524 Seminar in International Accounting (3) Introduction to the conceptual, managerial, professional, and institutional issues of international accounting. Comparative and empirical studies. Current interest topics (e.g., standard setting and transnational financial reporting). Research paper required. Prerequisites: 500, 501 or permission of instructor.

ACCTG 550 Communications in Professional Accounting (4) Introduction to communications forms and to practices of professional accountants and accounting managers. Development of effective written and oral skills employed in accounting presentations, such as audit reports and consultants' reports. Study of results of organizational communications research applicable to accounting firms and/or units within firms. Prerequisite: undergraduate accounting concentration or permission of instructor.

ACCTG 551 Management Information Systems (4) Develops the professional accountant's responsibilities in designing and operating management information systems with an emphasis on accounting systems. Data organization and management, effects on accounting functions, responsibilities for controls and security, and planning and acquisition of system resources. Prerequisites: 430, QMETH 404, 504, or equivalent.

ACCTG 552 Conceptual Framework for Financial Accounting (4) Basic premises relative to a conceptual framework for financial accounting. Historical and current research efforts. Roles of economics, government, society, and politics in setting of concepts and standards. Recent FASB, SEC, and AICPA efforts. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 555 Statistical Methods in Professional Auditing (4) Comparative analysis of the methods of statistical inference used in auditing and incorporation of these methods in the auditor's decision processes. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 556 Management Accounting Standards and Practices (4) Systematic coverage of advanced management accounting issues and practices. Major emphasis on analyzing complex management accounting cases and discussing research articles related to management accounting issues. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 557 Tax Consulting, Planning, and Research (4) Decision-making processes in relation to problems of taxation are examined. Tools of tax analysis and research and the communication of conclusions flowing from professional tax work. Role of the professional accountant in client business transactions and in negotiations with taxing authorities is highlighted and simulated on the basis of actual case histories. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 558 Current Financial Accounting and Reporting Issues (4) Develops professional-level ability to understand, analyze, and report upon selected political, economic, social, and legal dimensions of current financial accounting and reporting issues. Issues vary each year. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 559 Advanced Auditing Problems and Cases (4) Analysis of current developments in auditing and comprehensive case studies. Designed to extend knowledge of audit decision making and advanced techniques. Topics covered vary depending upon current issues facing professional auditors. Prerequisite: undergraduate accounting concentration or equivalent.

ACCTG 571-572 Research Reports (3-3) Independent study in business administration; critical evaluation of business analysis and research methods. Effective communication of ideas is emphasized. Methods and content of independent research studies subjected to critical evaluation. Open only to M.B.A. nonthesis students. Prerequisites: instructor's approval of preliminary research topic outline for 571-; 571 for -572.

ACCTG 580 Seminar in Financial Accounting (3) Critical examination of conceptual and practical issues in financial accounting. Specific topics may change from quarter to quarter to include applications of behavioral and economic models to financial accounting issues. Prerequisite: 510 or permission of instructor.

ACCTG 581 Seminar in Managerial Accounting (3) Critical examination of conceptual and practical issues of cost and managerial accounting. Specific topics may change from quarter to quarter, and they include application of behavioral, quantitative, and economic models to managerial accounting problems. Prerequisite: 511 or permission of instructor.

ACCTG 595 Introduction to Accounting Research (3) A Examination of research problems and techniques in accounting. Interdisciplinary nature of accounting research emphasized. Work in finance, economics, and psychology may be used to develop current trends in accounting research. Prerequisite: admission to doctoral program.

ACCTG 598 Seminar in Financial Accounting Research (3, max. 6) Sp Review and critical analysis of research strategies and methods applied to problems in financial reporting practice and financial accounting standard setting. May be repeated for credit with permission. Prerequisite: doctoral standing and 580 or equivalent or permission of graduate office.

ACCTG 597 Seminar in Managerial Accounting Research (3, max. 6) A Critical analysis of current managerial accounting research, both published and unpublished. May be repeated for credit with permission. Prerequisite: doctoral standing and 581 or equivalent or permission of graduate office.

ACCTG 599 Doctoral Seminar in Accounting (3) Study and research in advanced topics of accounting. The seminar is generally concerned with unpublished areas of research as well as research methodology and philosophy. It is conducted by departmental faculty and occasional distinguished visiting faculty. For doctoral students only.

ACCTG 600 Independent Study or Research (*)

Administration

Approval of graduate business program office required. Entry card required.

Course for Graduates Only

ADMIN 510 Integrative Administration (5, max. 15) AWSpS *Johnson* Includes materials basic to the study and analysis of administration in organizations: organization theory and

administrative behavior; resource allocation, accounting, and financial control; systems operation and analysis; marketing; and governmental-societal framework. Faculty team-teaching approach. Not open to business administration majors. Offered on credit/no credit basis only. Prerequisite: permission of Graduate School of Business Administration.

Administrative Theory and Organizational Behavior

Courses for Undergraduates

A ORG 301 Behavioral Science and Administration (4) Introduction to some of the fundamental research and theories of behavioral science that are particularly relevant to the study of management. Materials are presented to aid the student of management and administration in understanding the behavior of individuals and work groups. Prerequisite: junior standing or above.

A ORG 420 Human Relations in Organizations (4) Develops understanding of organizational behavior, with a clinical focus on basic processes and methods involved in diagnosing human situations and in taking action; includes specific personal, social, and organizational aspects; case discussion, instrumental exercises, and analysis of concepts and conceptual schemes. Prerequisite: admission to business administration or permission of undergraduate office.

A ORG 440 Organization Theory (3) Studies of concepts of formal organization structures, power, authority, and influence; communications, delegation and decentralization, decision and planning theory; philosophy and values in business organizations, and considerations of organization as a social issue. Prerequisite: 420 and admission to business administration or permission of undergraduate office.

A ORG 441 Advanced Organization Theory (3) Deals with current research, measuring organizational effectiveness, planning, leadership patterns, current problems, developments in related disciplines. Prerequisite: 440.

A ORG 461 Two-Person Behavior in Organizational Contexts (4) Clinically examines those behavioral skills and processes that are most basic in the development of effective individual behavior in business and other organizational contexts. Emphasis on practice in developing: (1) self-awareness; (2) skills and processes in face-to-face communication and interaction; and (3) structuring of effective interpersonal relationships in organizational contexts. Offered on credit/no credit basis only. Prerequisite: junior standing or above.

A ORG 463 Administrative Behavior (4) Practice and theory in formal organizations; selected readings and actual cases. Emphasizes the superior-subordinate relationship at all levels. Administrator's frame of reference, communication in organizations, motivation, informal organization, situational and environmental aspects, and administrative controls. Offered on credit/no credit basis only. Prerequisite: 420 or HRMGT 301.

A ORG 464 Racial, Ethnic, and Cultural Factors in Administration (4) Understanding difference based upon racial, ethnic, and cultural factors and the impact of difference on the administration of organizations. Emphasis on the comprehension of behavioral dynamics of discrimination through case analysis, role playing, and other exercises. Offered on credit/no credit basis only. Prerequisite: permission of undergraduate office.

A ORG 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required.

A ORG 500 Human Relations in Organizations (3) Analytically examines basic processes related to diagnosing organizational behavior and taking action. Aspects of individual and group behavior, basic human relations skills, behavioral processes, and the effects of organizational systems and processes on human behavior. Prerequisite: permission of graduate office.

A ORG 550 Organization and Management (3) Studies concepts of objectives and goals, decision making and planning, communication, delegation and decentralization, power, authority and influence, leadership and motivation, and considerations of values, social issues, and future trends in organization. Research and theories in other fields, such as behavioral science and economics, are related to business organization and management theory. Prerequisite: permission of graduate office.

A ORG 560 Seminar in Organization Design (3) Those who design organizations in business firms, or other organizations, have available to them certain alternative patterns from which they may choose. Each is thought to be contingent upon (1) current conditions outside the organization, or (2) current conditions inside the organization, or (3) the stage of evolution or growth in which the organization exists. The seminar examines these alternative patterns, asking which structure is likely to be most productive. Prerequisite: permission of graduate office.

A ORG 565 Seminar in Comparative Administrative Theory (3) Identifies and evaluates the variations that occur among significant factors within organizations, across organizations, institutional groups (business, education, health services, government), national cultures (U.S., Russia, France, Brazil) and supranational cultures (SEATO, EEC), and their effect upon unit effectiveness. Prerequisite: permission of graduate office.

A ORG 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

A ORG 575 Human Aspects of Administration (3) Examines administration process with a primary focus on organizational behavior. Develops the basic contributions of social science and other sources in the formulation of administrative-organizational conceptual schemes. Critically evaluates administrative theory in relation to administrative practice. Prerequisite: permission of graduate office.

A ORG 576 Human Aspects of Administration (3) Develops in depth some of the basic contributions to administrative theory and practice made by past and current research, thought, and experience. Examines several major research studies, drawing on findings from psychology, sociology, social and cultural anthropology, business administration, government, and other sources. Prerequisite: permission of graduate office.

A ORG 577 Practicum in Human Relations (3) Utilizes the concepts, structures, methods, and techniques, commonly called the laboratory training method, for learning about personal and interpersonal phenomena. The seminar presents the opportunity for an in-depth examination of one's own and others' behavior and of the consequences of that behavior, using the vehicle of the T- (for training) group—an unstructured, agendaless small group that focuses on the "here and now" actions, reactions, and interactions of the group members. The T-group provides the environment for inquiry, examination, and experimentation; the data are created and analyzed by the group members working together. Offered on credit/no credit basis only. Prerequisite: permission of graduate office.

A ORG 580 Planning and Decision Theory (3) Usually focuses on the development of a theory of decision making, with emphasis on behavioral aspects. Consideration of information-decision systems and the role of model building. Occasionally emphasizes the development of a theory of planning, including foundation for theory, process of planning, role of participants in planning, the auxiliary functions, and integration into general theory. Prerequisite: permission of graduate office.

A ORG 581 Seminar in Advanced Organizational Behavior (3) Analysis and examination in depth of human behavior in the organizational setting. Emphasis on research, theory, and practice and their impact on individual or group behavior. In different quarters one topic such as leadership, motivation, interpersonal communication, small-group dynamics, etc., is covered. Prerequisite: permission of graduate office.

A ORG 584 Theory and Practice in Organization Development (3) Provides a conceptual understanding of organization development and some practice in developing applicable skills. Inquires into such matters as the history of organization development, conditions for successful application, organization diagnosis, client-consultant relationships, the action research model, team building, intergroup-conflict resolution, and implications for the total organization. Prerequisite: permission of graduate office.

A ORG 587 Seminar in Advanced Organization Theory (3) Investigates the development of a theory of organization with subtheories on structures, processes, goal determination, problem solving, innovation, and change. Appraises various approaches to the study of organizations such as the sociological, normative, descriptive, analytical, and systems approaches. Studies in detail the most important conceptual and analytical models of organization such as bureaucratic, information-communication, coalition, economic, and behavioral. Appraises the research methodologies in field studies, laboratory investigations, model building, and simulation. Discusses the future trends in organization theory. Prerequisite: permission of graduate office.

A ORG 590 Special Topics in Administrative Theory and Organizational Behavior (1-3, max. 9) Topics of current concern to faculty and students. Offered only when faculty is available and sufficient student interest exists. Seminar content announced in advance of scheduled offerings.

A ORG 599 Doctoral Seminar in Administrative Theory and Organizational Behavior (3) Study and research in advanced topics of administrative theory and organizational behavior. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. For doctoral students only. Prerequisite: permission of graduate office.

A ORG 600 Independent Study or Research (*) Prerequisite: permission of graduate office.

Business Administration

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

B A 700 Master's Thesis (*) AWSp

B A 800 Doctoral Dissertation (*)

Business Administration Research Methods

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

BA RM 500 Statistical Methods I (4) Statistical methods useful for research in various areas of business administration. Topics include estimation and hypothesis testing, enumerative techniques, and simple linear models. Prerequisite: QMETH 500 or equivalent.

BA RM 501 Statistical Methods II (4) Continuation of 500. Further coverage of statistical research methods. Topics include introduction to multiple regression, analysis of variance, analysis of covariance, design of experiments, nonparametric techniques. Prerequisites: 500 and permission of graduate office.

BA RM 510 Applied Econometrics I (3) Emphasizes the application of econometric methods rather than the mathematical proofs of statistical procedures. Introduction to the linear regression model, interpretation of summary statistics, bias and precision of regression estimates, analysis of the residuals. Prerequisites: 500 and 501, or permission of graduate office.

BA RM 511 Applied Econometrics II (3) Continuation of 510. Hypothesis testing, distributed lags, serial correlation models, simultaneous equation models. Prerequisite: 510.

BA RM 520 Behavioral Research Methods—Theory and Design (3) Philosophy of science, development of scientific method, and meaning of behavioral research. Historical perspective of scientific investigation and the evaluation of research. The development of theory and its relationship to research. Various strategies and designs in behavioral research. Prerequisites: 500 and 501, or permission of graduate office.

BA RM 521 Behavioral Research Methods—Approaches and Applications (3) Considers alternative research approaches, such as laboratory and field experimentation, simulation, and surveys, with data-gathering techniques appropriate for each approach. It is primarily concerned with developing alternative approaches to research problems and with discussing specific applications. It builds upon a background of specific statistical tools and techniques and an understanding of theory development and research design. Prerequisites: 500 and 501, and permission of graduate office.

Business Communications

Courses for Undergraduates

B CMU 301 Basic Written Business Communications (4) Broad analytical approach to written communications as a management tool. Analysis of the psychology, semantics, planning, and principles of effective business writing. Practical application through messages that inform and persuade, grant and refuse; plus short business reports and applications for positions. Prerequisite: junior standing or above.

B CMU 410 Business Reports and Other Specialized Communications (5) Covers both internal and external communications that businessmen and businesswomen write on the job. Emphasis is on various types of internal reports, ranging from short informal memos to the more complex formal reports. Also covered are specialized external types of communications directed to customers. Prerequisite: junior standing or above.

B CMU 510 Business Communications for Managers (3) Sp Seeks to develop understanding of communications and related theories, to describe strategies for planning managerial communications, and to build skills in oral and written reporting and persuading.

Business Economics

Courses for Undergraduates

B ECN 300 Managerial Economics (3) Analysis of economic factors affecting decisions made by business firms. Demand and cost analysis, and alternative policies from the firm's point of view. Prerequisites: ECON 200 and admission to business administration or permission of undergraduate office.

B ECN 301 Money, National Income, and Prices (4) Measurement and analysis of business activity in the commodity and money markets; static and dynamic models of income and interest rate determination; problems and policies in the stabilization of business conditions. Prerequisites: ECON 200 and 201 and admission to business administration or permission of undergraduate office.

B ECN 420 Financial Markets (4) Analysis of the structure and functions of the money and capital markets; the saving-investment process and financial intermediaries; supply and demand for lendable funds and the level and structure of interest rates, role of Federal Reserve and Treasury in money market developments. Prerequisites: 301 and senior standing.

B ECN 427 International Finance (4) Asset choice and institutional operations in international finance; foreign-exchange problems; the impact of international financial problems and operations on business; short- and long-term international financing. Prerequisite: 301.

B ECN 439 Business Forecasting (4) Analysis of basic variations affecting general business conditions as a background for business and investment decisions; appraisal of proposals for controlling cycles and of forecasting techniques. Prerequisites: 301 and QMETH 201.

B ECN 499 Undergraduate Research (3, max. 6) Research in selected areas of business economics. Prerequisites: 300 and 301, and permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

B ECN 500 Business Economics I (3) Factors underlying the determination of cost and prices for the industry and the firm, demand analysis and firm behavior. Relation of economic environment to microeconomic decisions of the firm.

B ECN 501 Business Economics II (3) Analysis of real and monetary factors affecting the national and international economic environment, supply and demand for money, interest rates, stabilization problems and policies, in relation to government and policy effects on business and individual affairs. Prerequisite: 500.

B ECN 512 Advanced Managerial Economics (3) Focus is on application of basic firm theory as developed in 500. Principles of optimum resource allocation, empirical estimation of cost and demand schedules. Prerequisites: 500 and QMETH 500, and permission of graduate office.

B ECN 513 Forecasting the Economic Environment of the Firm (3) Survey, evaluation, and synthesis of techniques available to forecast supply and demand conditions at the macro and industry levels. Emphasis on understanding macro forecasts and converting them to industry forecasts. Prerequisite: 501.

B ECN 520 Financial Markets (3) Analysis of the functions and the structure of money markets; the saving-investment process and financial intermediaries; supply and demand for lendable funds and the level and structure of interest rates, role of the Federal Reserve and Treasury in the money markets. Prerequisites: 501 and permission of graduate office.

B ECN 521 Seminar in Financial Markets (3) Analysis of managerial and environmental financial problems of banks and nonbank financial institutions; theory of flow of funds and financial intermediation. Prerequisites: 500, 501, 520.

B ECN 527 International Finance and Investments (3) Study of selected problems in financing, international trade, investment, and foreign business operations; international aspects of money markets; problems of evaluation of foreign investments. Prerequisites: 501, FIN 502.

B ECN 528 International Financial Management (3) Analysis of financial problems facing United States businesses engaged in international activities: financing foreign investment, financial control of foreign operations and working capital management, including foreign-exchange positions, using cases and readings.

B ECN 529 Competition Policies in the Context of International Business (3) Legal and economic analysis of the competition policies of selected developed countries, including the Common Market, the Federal Republic of Germany, the United Kingdom, Japan, Canada, and the United States, with particular reference to the impact of the policies upon the multinational corporation enterprise and international business transactions. Offered jointly with BG&S 555. Entry card required.

B ECN 530 Industry Structure and Performance (3) Market structure, conduct, and performance; mergers and diversification; price and nonprice patterns of firm behavior. Prerequisite: 500.

B ECN 532 Seminar on Applied Economic Analysis (3) Analysis of contemporary economic issues. Emphasis on current problems and policies. Prerequisites: 500, 501.

B ECN 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

B ECN 599 Doctoral Seminar in Business Economics (3) Study and research in advanced topics of business economics. The seminar is generally concerned with unpublished areas of research, and is conducted by visiting professors and departmental faculty. May be repeated for credit. For doctoral students only. Prerequisite: permission of graduate office.

B ECN 600 Independent Study or Research (*)

Business, Government, and Society

Courses for Undergraduates

BG&S 200 Introduction to Law (5) Legal institutions and processes; law as a system of social thought and behavior and a frame of order within which rival claims are resolved and compromised; legal reasoning; law as a process of protecting and facilitating voluntary arrangements in a business society. Prerequisite: sophomore standing or above.

BG&S 310 Legal Aspects of Business and Public Policy (5) Legal questions involved in government and economic institutions including government regulation of competition, business-labor relations, government ownership, government assistance to business as well as business influences on government, regulation and the alternative of public control in selected case studies in such areas as pollution control and public utilities. Prerequisites: 200 and junior standing or above.

BG&S 333 Business and Society (4) Major concepts in the behavioral sciences with respect to the influence of cultural norms and goals upon business activity, and the interdependence of business and other elements of the social order. Lectures and discussion. Prerequisite: admission to business administration or permission of undergraduate office.

BG&S 345 Comparative Enterprise Systems (5) Investigation of functions, modes of operation, and methods of coordinating business enterprises in various economic systems, ranging from the competitive to the highly centralized. Prerequisite: junior standing or above.

BG&S 361 Business History (3) Exploration and analysis of the development of the American business system within the context of environmental forces shaping the growth of the nation. Prerequisite: junior standing or above.

BG&S 362 The Social Responsibilities of Business (3) Focus on the more conventional issues of social responsibility; economic, social, and political trends and their implications for business managers and the business system; role of business ethics and corporate morality in capitalist ideology; managerial responses to the changing social and political environment; corporate social audits. Prerequisite: junior standing or above.

BG&S 397 Behavioral Science and the Study of Business (3) Basic developments in behavioral studies that bear upon the American business system and its relation to American society. Development and applicability of behavioral concepts to the role of business. Major developments in behavioral science.

BG&S 403 Commercial Law (5) Principles of the law of property, sales, negotiable instruments, and security transactions. Prerequisites: 200 and junior standing or above.

BG&S 440 Pre-Modern Social and Economic Systems (3) Examination of the social and economic institutions of representative premodern societies around the world. Prerequisite: junior standing or above.

BG&S 490 Special Topics and Issues in Business, Government, and Society (3, max. 9) Emphasis is on contemporary topics and issues of business in their governmental and societal contexts. The content of the course reflects contemporary developments and the current interests of the instructors and students. Prerequisite: junior standing or above.

BG&S 499 Undergraduate Research (3, max. 9) Selected problems in social, legal, and economic institutions. Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

BG&S 510 Business and Public Policy (3) Legal institutions and processes in the development of public policies affecting business with special emphasis on the newly emerging issues of business and public policy. Emphasis on the analysis of selected public policy developments relating to competition, corporate power, the governance of the corporation, and consumer and environmental protection. Analysis of the relation of these developments to corporate social responsibility. Prerequisite: permission of graduate office.

BG&S 511 The Context of the Business System (3) Specific problems that arise between the business system and the environmental context within which it operates. The role and contribution of the business system to American society and the symbiotic relationship that exists between the two. Prerequisite: permission of graduate office.

BG&S 523 Commercial Law (3) Sp Graduate business law, including selected topics in the law of contracts, agency, partnership, corporations, commercial paper, sales, securities regulation. Opportunities for guided, independent study of recent legal developments of special interest to individual students.

BG&S 540 Cultural Change and Modernization (3) Intensive analyses of specific cases of culture change around the world. The emphasis is on economic development and modernization with special attention to problems of introducing change and the practical consequences of change.

BG&S 552 Legal Aspects of Business Regulation (3) Examination, from the point of view of the business manager and the society, of advanced problems bearing upon top management's operating policy, with particular reference to selected legal and economic issues in public policies relating to competition. Prerequisite: permission of graduate office.

BG&S 553 Advanced Problems in Business and Public Policy (3) Advanced contemporary problems in business and public policy; wage and price controls; collective bargaining and strikes in essential industries; racial integration; "undesirable" and "excessive" advertising; industrial impact on the physical environment. Prerequisite: permission of graduate office.

BG&S 555 Competition Policies in the Context of International Business (3) Sp Legal and economic analysis of the competition policies of selected developed countries, including the Common Market, the Federal Republic of Germany, the United Kingdom, Japan, Canada, and the United States, with particular reference to the impact of the policies upon the multinational corporation enterprise and international business transactions. Offered jointly with B ECN 529.

BG&S 562 Responsibilities of Business Leadership (3) Relationships among business and consumers, government, labor, and agriculture as affected by changing social forces. Problems of business ethics. Prerequisite: permission of graduate office.

BG&S 565 Industrialization and Social Structure (3) Continuity and change in the structure of societies undergoing industrialization, with special attention to theories of the American experience and to the status and power of business. Prerequisite: permission of graduate office.

BG&S 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

BG&S 575 Theories of Capitalism (3) Focuses upon the various theories of capitalism developed over the past several centuries and their relevance for our contemporary society. Prerequisite: permission of graduate office.

BG&S 590 Business History (3) Development of the American business system, with special emphasis on dynamic forces, both internal and external, that shape the form and character of business. Prerequisite: permission of graduate office.

BG&S 591 Special Topics in Business, Government, and Society (3, max. 9) Contemporary topics and issues of business in their governmental and societal context. Contemporary developments and the current interests of instructors and students. Prerequisites: 510, 511, and permission of instructor.

BG&S 597 Behavioral Science of the Business System (3) Examination of basic developments in behavioral science relevant to the American business system. Attention centers on the business scholar's need for an integrative approach to the social environment of business. Prerequisite: permission of graduate office.

BG&S 598 Analysis of Business Behavior (3) Analysis of the behavior of the modern firm and its environment in the light of traditional and contemporary theory. Emphasis is placed upon empirical investigation of firm behavior. Prerequisite: permission of graduate office.

BG&S 599 Doctoral Seminar in Business, Government, and Society (3) Study and research in advanced topics of business, government, and society. Generally concerned with unpublished areas of research and conducted by visiting professors and departmental faculty. May be repeated for credit. Prerequisite: permission of graduate office.

BG&S 600 Independent Study or Research (*) Prerequisite: permission of graduate office.

Business Policy

Courses for Undergraduates

B POL 470 Business Policy (4) Policy making and administration from a general management point of view. Emphasis is on problem analysis, the decision-making process, administration and control, and continuous reappraisal of policies and objectives. This course integrates and builds upon the work of the core curriculum. Prerequisites: admission to business administration, senior standing or above, and FIN 350, MKTG 301, OPMGT 301, and HRMGT 301 or A ORG 420, or permission of undergraduate office.

B POL 471 Small Business Management (4) Policy formulation and implementation in smaller firms from the top manager's point of view. Integrates and builds upon work of the core curriculum. Includes analysis of cases and field projects related to small firms. Prerequisites: admission to business administration, senior standing or above, and FIN 350, MKTG 301, OPMGT 301, and HRMGT 301 or A ORG 420, or permission of undergraduate office.

B POL 480 Business Simulation (5) Critical analysis of integrated business policy formulation in a complex and dynamic industrial environment by means of simulation (business gaming). Prerequisites: admission to business administration, senior standing or above, and FIN 350, MKTG 301, OPMGT 301, and HRMGT 301, or A ORG 420, or permission of undergraduate office. Entry card required.

B POL 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

B POL 509 Policy Decisions in Business and Nonbusiness Institutions (3) Analysis of policy problems faced by managers in business, government, and nonprofit institutions. Determination of organizational product/service objectives, development of operating policies and methods to achieve objectives at a satisfactory cost to the consumer and to society. Designing organizational structures, provision of executive personnel to fit the organization's goals and operating methods. Prerequisites: ACCTG 500 and 501, A ORG 500 and 550, FIN 502, MKTG 500, OPMGT 500, or equivalents.

B POL 510 Strategic Planning in Larger Corporations (3) Similar to 509 and can be taken instead of 509. Brings together in one course students who plan careers in larger regional, national, and international business corporations; or in firms that serve such corporations (accounting, law, engineering, and consulting firms).

B POL 530 Entrepreneurship (3) Entrepreneurship, both in the form of (1) establishment of new independent businesses owned largely by those who manage them and (2) initiation of new enterprises having exceptional autonomy within larger organizations that finance and own them. Basic knowledge in accounting, marketing, and finance is assumed. Prerequisite: permission of graduate office.

B POL 545 Management Strategy Simulation (3) Simulation practice to make decisions at general management level. Integrates concepts of marketing, finance, operations, administration, and control in company decisions. Uses computer simulation or other approaches. Students should check with advising office before enrolling. Prerequisites: ACCTG 500 and 501, A ORG 550, FIN 502, MKTG 500, OPMGT 500, or permission of instructor.

B POL 570 Strategic Planning Systems (3) Formal institutional procedures for involving the entire organization in strategic planning and quantitative methods for doing such planning. These are applied to analyzing strategy and firm performance, predicting long-range industry and national environments, formulating corporate-level and business-level strategies, and integrating planning models into the planning process. Prerequisites: ACCTG 500 and 501, A ORG 550, FIN 502, MKTG 500, OPMGT 500, or permission of graduate office.

B POL 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

B POL 575 Strategic Decision Making (3) Focuses on (1) role of strategic leadership in success of organizations, (2) conceptual-logical methods for doing strategic planning, (3) organization-wide experience methods for formulating policies, and (4) decision methods for use within the strategic coalition. Prerequisites: ACCTG 500 and 501, FIN 502, MKTG 500, or permission of graduate office.

B POL 590 Special Topics in Business Policy (3) Topics of current concern to faculty and students. Offered only when allowed by faculty availability and sufficient student interest. Content announced in advance of scheduled offerings.

B POL 599 Doctoral Seminar in Business Policy (3) AWSpS Study and research in advanced topics of business policy. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. Prerequisite: permission of graduate office.

B POL 600 Independent Study or Research (*) Prerequisite: permission of graduate office.

Finance

Courses for Undergraduates

FIN 350 Business Finance (4) Sources, uses, cost, and control of funds in business enterprises. Internal management of working capital and income sources and cost of long-term funds; capital budgeting; financing of the growth and expansion of business enterprises; government regulation of the financial process. Prerequisites: B ECN 300 and admission to business administration or permission of undergraduate office.

FIN 423 Banking and the Financial System (4) Role of banks and nonbank financial institutions in the financial system; asset choices of banks and nonbank financial institutions; problems in the management of financial institutions with emphasis on commercial banks. Prerequisites: 350 and B ECN 420.

FIN 450 Problems in Corporation Finance (4) Case problems in corporate financial management. Includes cases on management of current assets, obtaining short-term loans, raising long-term capital, capital budgeting, and dividend policy. The management point of view is stressed. Prerequisites: 350 and ACCTG 375.

FIN 453 Financial Theory and Analysis (4) Determination of liquidity needs subject to firm constraints and longer-term capital budgeting problems involving cost of capital and capital rationing considerations; analytical approach. Prerequisites: 350 and QMETH 201.

FIN 460 Investments (4) Introduction to the nature, problems, and process of evaluating particular securities and portfolio construction and administration. Special attention is directed to the risk and rate-of-return aspects of particular securities portfolios, and total wealth. Prerequisites: 350 and senior standing.

FIN 461 Investment Analysis (4) A sequence course to 460 in which traditional investment analysis of securities is explored in more detail, and special emphasis is directed to more recent developments, especially portfolio analysis. Prerequisite: 460.

FIN 499 Undergraduate Research (3, max. 6) Research in selected areas of business finance, money and banking, or investments. Prerequisites: 350 and permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

FIN 502 Business Finance (3) Financial management of the firm, including capital budgets, working capital analysis, and financing policy. Prerequisites: ACCTG 500, B ECN 500, QMETH 500.

FIN 515 Urban Real Estate and Finance Investment (3) Develops principles for evaluating opportunities to invest in urban real estate, discusses the question of determining the cost of capital for such investments, investigates some problems in the application of an appropriate investment criterion to specific types of opportunities, and explores some aspects of the urban renewal problem. Offered jointly with URB P 553. Prerequisite: 502, URB P 552, or permission of graduate office.

FIN 530 Financial Management of Banks (3) Analysis of problems in the financial management of commercial banks and other financial institutions. Loan and investment policies, liability management, capital policies, and other selected issues are discussed. Prerequisite: B ECN 520 or permission of graduate office.

FIN 550 Advanced Business Finance (3) Systematic coverage of the theory of financial management. Application of quantitative analysis to financial problems of the firm, including the investment and financial decisions, lease analysis. Prerequisite: 502.

FIN 551 Problems in Business Finance (3) The application of financial principles and techniques to problems in financial management. Topics include cash management, credit management, problems in short- and long-term financing, and capital budgeting. Prerequisite: 502.

FIN 552 Seminar in Business Finance (3) Study of the financing of the corporation, including recent theoretical and institutional developments. Extensive reading and discussion in designated areas covering problems relating to financial management and to the social and economic implications of the financial process. Prerequisite: 550.

FIN 553 Capital Investment Planning (3) Capital investment planning by a multiproduct company organized into strategic business units. Determinants of the company's value, diversification by acquisition, diversification by start-up, divestiture analysis, tests for choosing the best market share-growth policy in each strategic business unit, problems in applying these tests. Prerequisite: 502.

FIN 560 Investments (3) Introduction to the nature, problems, and process of evaluating particular securities and portfolio construction and administration. Special attention is directed to the risk and rate-of-return aspects of particular securities, securities portfolios, and total wealth. Prerequisite: 502 or permission of graduate office.

FIN 561 Seminar in Investments (3) Discussion and analysis of concepts, processes, and problems of investment media valuation, portfolio valuation, and portfolio construction, and administration for individuals and institutions. Prerequisite: 560.

FIN 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

FIN 580 Doctoral Seminar in Capital Market Theory (3) Decision making under uncertainty, information and capital market efficiency, portfolio theory, capital asset pricing model, arbitrage pricing model, and options pricing model. For doctoral students or by permission. Prerequisites: ECON 500 and 517.

FIN 581 Doctoral Seminar in Corporate Finance (3) Principles of intertemporal choice, alternative valuation models, theory of investment under uncertainty, impact of dividend and financing decisions on firm valuation in perfect and imperfect markets, and theory of firm organization and agency costs. For doctoral students or by permission. Prerequisite: 580.

FIN 582 Doctoral Seminar in Financial Research (3) Empirical research in finance with emphasis on methodology and scientific method. Empirical research in market efficiency, capital asset pricing model, options pricing model, and impact of firm's dividend and financing decisions on firm value. For doctoral students or by permission. Prerequisites: 580, 581, BA RM 510.

FIN 600 Independent Study or Research (*)

Human Resources Management

Courses for Undergraduates

HRMGT 301 Personnel Systems and Industrial Relations (3) The recruitment, selection, utilization, and development of human resources, with special emphasis on union-management relations and relevant behavioral science research. Prerequisite: junior standing or above.

HRMGT 443 Staffing (4) Includes manpower planning, recruitment, testing, selection, placement orientation, training, promotion. Prerequisite: junior standing or above.

HRMGT 445 Compensation and Performance Evaluation (4) Includes job evaluation, wage and salary administration, performance standards and appraisal, employee benefits. Prerequisite: junior standing or above.

HRMGT 450 Collective Bargaining and Arbitration (5) Focus on helping the student acquire knowledge and skills that will enable him to be effective in resolving intergroup conflict. This is accomplished almost exclusively through the active participation of each student in arbitration and collective bargaining simulations. These experiences are analyzed at the end of the course from a behavioral science perspective. In addition, attention is given ways in which the knowledge and skills acquired can be utilized in other conflict situations. Prerequisite: junior standing or above.

HRMGT 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

HRMGT 510 Human Resources Management (3) Focuses on critical policy and practice questions in the human resource area, such as fair employment practices, and policies toward labor organizations. Examines the personnel/industrial relations function from a general management perspective. Topics include selection and appraisal interviewing, discipline, and compensation. A case/experiential method is used to foster the development of skills in managing employee relations effectively. Recommended for students without previous courses in personnel and human resources management. Prerequisite: permission of graduate office.

HRMGT 520 Job Design and Staffing (3) A Job design considerations as they affect employee performance, such as job enrichment and work simplification schemes. Examines systems related to manpower planning, recruitment, selection, placement, training, and development. Focus on advanced techniques with emphasis on validating predictive measures of performance. Topics include criterion development, psychological testing, validation procedures, and cost effectiveness of personnel research.

HRMGT 530 Compensation and Performance Appraisal (3) Analyzes the strategies, problems, and procedures of assessing and rewarding human potential, abilities, and performance. Topics include: measurement methods, performance appraisal systems, feedback, and the design of operational assessment systems and the integration of performance appraisal and job evaluation dimensions within an overall compensation program.

HRMGT 540 Collective Bargaining (3) Focuses on current and emerging forms of management and employee relations systems. Primary emphasis is given to new forms of white-collar unionization, public sector labor relations, bargaining and quasibargaining situations between professionals and management, and emerging forms of third-party participation in these relationships. Prerequisite: permission of graduate office.

HRMGT 560 Dispute Settlement in Labor Relations (3) Examines, from an interdisciplinary perspective, techniques such as fact-finding mediation and arbitration that are used to resolve disputes between labor and management: recent innovations such as last-offer arbitration and mediation-arbitration formats; understanding and skills necessary to function as a neutral third party in labor relations disputes.

HRMGT 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

HRMGT 590 Special Topics in Human Resources Management (3) Topics of current concern to faculty and students. Offered only when allowed by faculty availability and sufficient student interest. Content announced in advance of scheduled offerings.

HRMGT 599 Doctoral Seminar in Personnel and Industrial Relations (3) Study and research in advanced topics of personnel and industrial relations. Generally concerned with unpublished areas of research and is conducted by visiting professors from other universities, professors from other departments in the University, and departmental faculty. For doctoral students only. May be repeated for credit. Prerequisite: permission of graduate office.

HRMGT 600 Independent Study or Research (*) Prerequisite: permission of graduate office.

International Business

Courses for Undergraduates

I BUS 300 The International Environment of Business (3) Prepares students to understand the most important aspects of the international political economy. Emphasis on the important relationships among nations and business and economic institutions that influence students' performances as managers, consumers, and citizens. Prerequisites: ECON 200, 201, admission to business administration or permission of undergraduate office.

I BUS 330 Business Environment in Developing Nations (4) The international environment for transnational trade, investment, and operations in the less developed countries; survey of the economics of underdevelopment; analysis of foreign economic, cultural, and political environments and their impact on international business; foreign investment in the development process; case studies. Prerequisites: 300 or equivalent and junior standing or above.

I BUS 340 Business Environment in Industrial Countries (4) Study of factors and conditions affecting business operations and behavior in developed countries; international integration; business relations among nation states and integrated supranational systems; direct investment and multinational industrial activities; analysis of sources and causes of international change. Prerequisites: 300 or equivalent and junior standing or above.

I BUS 440 Business in Japan (4) Problems of doing business in the Japanese market. Causes of economic growth in the postwar period; Japanese business practices and institutions. Japanese and U.S. marketing and investment strategies. Available for graduates as a part of an international business concentration. Prerequisite: 300 or 550 or permission of instructor.

I BUS 470 Management of International Trade Operations (4) Applicable for students interested in exporting and importing activities, but especially relevant to small companies. Emphasis on the management of import-export operations and the application of relevant functional tools. Cases and class projects are drawn from service companies as well as from manufacturers. Prerequisites: 300 and junior standing or above.

I BUS 480 Multinational Operations Management (4) Case studies in foreign operations management: planning international objectives and strategies; developing multinational company structures and executives; adapting administrative practices and operating policies to international diversities. Prerequisites: 300, 470, and junior standing or above.

I BUS 490 Special Topics in International Business (4, max. 12) Students and faculty focus on current topics of concern. Prerequisites: 300 or permission of instructor and junior standing or above. (Offered when faculty, student interest, and availability allow.)

I BUS 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

I BUS 550 International Business Environment (3) Understanding the underlying economic, political, and social forces in the international business environment and assessing impact of these forces on international trade and investment. Theories of international trade, foreign investment, international monetary relations and economic integration, and national policy response to international market forces. May be taken first year of M.B.A. program, preferably after student has had B ECN 500 and 501, or equivalent.

I BUS 560 Multinational Business Management (3) Managerial responses to problems of international business organizations and operations. Emphasis on: (1) strategy formulation in an international context; (2) design and control of multinational organization; and (3) adaptation of management systems and policies to different economic, sociocultural, and political environments. Prerequisite: 550 or equivalent, or course in international economics or trade or international finance, or permission of graduate office.

I BUS 570 International Business in Less-Developed Countries (3) Emphasis on understanding the economic, sociocultural, and political environment in less-developed countries. Problems of international trade and investment, north-south relations, commodities, technology transfer, foreign aid, and capital flows. Prerequisites: 550 or equivalent, a course in international economics or trade or international finance, or permission of graduate office. Entry card required.

I BUS 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

I BUS 580 International Business in Industrialized Countries (3) Emphasis on understanding the economic, sociocultural, and political environment in developed, industrialized countries. Problems of international trade and payments relations, economic integration, national policies, and supranational organizations' impact on managerial environments. Prerequisite: 550 or equivalent, or course in international economics or trade or international finance, or permission of graduate office.

I BUS 590 Seminar: Special Topics in International Business (3) Application of international business principles to the analysis of a specific issue in trade or resource transfer, or to the business conditions in a particular country. Japan and other Pacific Rim countries are frequent topics. Prerequisite: 550 or permission of instructor.

I BUS 595 Business Studies Abroad (*, max. 9) Research and study of foreign business problems in the country or countries where the firms are located. Limited to students who have the approval of their major adviser and a faculty member who has agreed to direct their work in accordance with a definite program of studies. Prerequisite: permission of graduate office.

I BUS 599 Doctoral Seminar in International Business (3) Study and research in advanced topics of international business. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. For doctoral students only. Prerequisite: permission of graduate office.

I BUS 600 Independent Study or Research (*)

Marketing

Courses for Undergraduates

MKTG 300 Marketing Concepts for Nonbusiness Majors (4) Analysis of tools, factors, and concepts used by management in planning, establishing policies, and solving marketing problems. Topics cover marketing concepts, consumer demand and behavior, location analysis, marketing functions, institutions, channels, prices, and public policy. Not open to business administration students for credit, nor to those who have taken 301.

MKTG 301 Marketing Concepts (4) Analysis of tools, factors, and concepts used by management in planning, establishing policies, and solving marketing problems. Topics cover marketing concepts, consumer demand and behavior, location analysis, marketing, functions, institutions, channels, prices, and public policy. Prerequisites: ECON 200 and admission to business administration or permission of undergraduate office.

MKTG 310 Product and Price Policies (4) Examines important aspects of product planning and development, product line decisions, packaging, brand policies, guarantees, and services. Price theory is considered but emphasis is placed on special pricing policies and problems and legal constraints on pricing activity. Prerequisites: 301, B ECN 300, and junior standing or above.

MKTG 320 Marketing Channels and Institutions (4) Analysis of marketing institutions and their functions, marketing channel structure, and channel alternatives available to management. Special attention is given to the role and perspective of the channel manager in directing marketing channel systems. Prerequisites: 301 and junior standing or above.

MKTG 330 Sales Force Management (4) Sales and distribution planning; sales organization and training; management of the sales force; methods of sales, cost, and performance analysis. Prerequisites: 301 and junior standing or above.

MKTG 340 Advertising (4) The management of the advertising function and its integration with other forms of promotion. Topics covered are planning the program; determining the most effective approach; evaluation of media and budget; advertising research; advertising institutions; economic and social aspects. Prerequisites: 301 and junior standing or above.

MKTG 450 Consumer Behavior (4) Theory and practice pertinent to marketing decisions of individuals and business firms; utilization of theories from behavioral sciences in marketing research; theories of fashion, characteristics of goods, shopping behavior, product differentiation, market segmentation, and opinion leadership; application of concepts to management of advertising, personal selling, pricing, and channels of distribution. Prerequisites: 301 and junior standing or above; recommended: QMETH 201.

MKTG 460 Marketing Research (4) The marketing research process; preliminary steps and research design, questionnaires, secondary and primary data, sampling, processing and interpreting data, evaluation and effective presentation of findings. A class research project provides practical application of methods studied. Prerequisites: 301, QMETH 201, or equivalent, and junior standing or above.

MKTG 465 Advanced Marketing Research (4) Application of various analytical methods in marketing research. Examines the applied aspects of multivariate techniques (multiple regression, factor analysis, and multidimensional scaling) and their usefulness in such marketing problems as communication strategy, market segmentation, and product positioning. Prerequisites: 301, QMETH 201 or equivalent, and junior standing or above.

MKTG 470 Retailing (4) Profit planning and business control; buying, stock control, pricing, promotion; store location, layout, organization, policies, systems; coordination of store activities. Prerequisites: 301 and junior standing or above.

MKTG 480 Advanced Marketing Management (4) Introduction to advanced marketing management through the application of various decision-making models and selected computer routines to such marketing problems as advertising budgeting, media planning, sales forecasting, sales-force allocation, and pricing. Applications include market simulation, Bayesian approaches, and linear programming. Prerequisites: 301, MATH 157, or equivalent, and junior standing or above.

MKTG 485 Cases in Marketing Management (4) Analysis of managerial marketing cases involving market trends, marketing research, product planning, distribution channels, pricing, promotion, and social trends. Prerequisites: 301 and senior standing.

MKTG 490 Special Topics and Issues in Marketing (4, max. 8) Emphasis on contemporary topics and issues in marketing: marketing in nonprofit organizations, marketing of services, marketing in the public sector, and marketing in an economy of scarcity. Ordinarily only one topic area is addressed in any one quarter. Course content reflects contemporary developments and the current interests of instructors and students. Prerequisites: 301 and junior standing or above.

MKTG 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

MKTG 500 Marketing Management (3) Analysis of markets and institutions and the role of marketing in the economy. Considerations necessary for sound marketing management decisions in pricing, demand creation, physical distribution, channel selection, and product development; marketing structures and policies under various competitive relationships; public policy and legislative constraints. Prerequisite: permission of graduate office.

MKTG 510 Product and Price Management (3) Identification of market opportunities, choice of which goods and services in what combinations to market, and prices at which to offer them. Considers product and price interrelationships in product-line management; product differentiation; the marketing mix; and multiple-market, oligopoly, and monopoly contexts. Includes policy considerations. Prerequisite: 500.

MKTG 520 Distribution Management (3) Location and distribution decisions for goods and services in profit and nonprofit organizations. Considers methods of optimizing the number and quality of institutions and activities employed in dealing with exchange, and space and time aspects of distribution. Relates distribution questions to the marketing mix and organizational objectives. Prerequisite: 500.

MKTG 540 Promotion Management (3) Management of advertising and personal selling and their integration with other elements of the marketing mix. The communication process, situation analysis, determining promotional mix and the budget, media selection, management of personal selling resources, stimulating reseller promotional support, measurement and evaluation of promotional effectiveness, and social and economic considerations. Prerequisite: 500.

MKTG 550 Seminar in Consumer Behavior (3) Analysis of current research in consumer behavior. Topics include consumer decision-making processes, models of buyer behavior, and contributions from the behavioral sciences. Prerequisites: 500 and permission of graduate office.

MKTG 560 Research for Marketing Decisions (3) Methods and applications of marketing research incorporating analytical procedures and relevant concepts from behavioral and quantitative sciences. Deals with various aspects of research: problem definition, research design, questionnaire construction, sampling, and data analysis. Introduces promising new developments: multivariate techniques of data analysis, laboratory and field experimentation, and demand analysis in both business and public environments. Prerequisites: 500, QMETH 500.

MKTG 565 Analysis of Multivariate Marketing Data (3) Methods of analyzing multivariate data in such marketing research problems as market segmentation and product positioning. The analytical procedures include factor, cluster, and discriminant analysis, multidimensional scaling, and conjoint measurement. Prerequisites: 500 and QMETH 500.

MKTG 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

MKTG 580 Marketing Management Models (3) Introduction to advanced marketing management through the application of various decision-making models to such marketing problems as advertising budgeting, media planning, brand switching, sales forecasting, sales-force allocation, and pricing. The applications include computer simulation, stochastic models, Bayesian approaches, and optimization techniques. Prerequisites: 500, QMETH 510 and OPMGT 500.

MKTG 590 Special Topics in Marketing (3, max. 9) Marketing topics of current concern to faculty and students. Offered only when allowed by faculty availability and sufficient student interest. Seminar content to be announced in advance of scheduled offerings. Prerequisites: 500 and permission of graduate office.

MKTG 599 Doctoral Seminar in Marketing (3) Study and research in advanced topics of marketing. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. For doctoral students only. Prerequisite: permission of graduate office.

MKTG 600 Independent Study or Research (*)

Operations Management

Courses for Undergraduates

OPMGT 301 Principles of Operations Management (3) Introduces application of quantitative analysis to problems in planning, operating, and controlling production function. Topics include: problems of distribution and allocation, management of inventory systems, production scheduling, improvement curves, and service systems. Uses computer and quantitative models in formulating managerial problems. Prerequisites: QMETH 200, 201, and admission to business administration, or permission of undergraduate office.

OPMGT 401 Administration of Operations (4) Analysis of case studies in the management of operations. Uses analytical techniques to derive solutions for actual situations. Strategic resource allocation, project planning, scheduling, and the coordination of domestic and international operations with other parts of the organization. Prerequisites: 301 and junior standing or above.

OPMGT 443 Inventory and Materials Management (4) Production and inventory management decisions for manufacturing and distribution firms. Techniques for forecasting demand for finished product items; role of inventories in production process. Integrated materials requirements planning systems and capacity planning. Prerequisites: 301 and junior standing or above.

OPMGT 450 Operations Scheduling and Quality Control (4) Continuous flow, intermittent, and project production processes and tools for managing them. Assembly-line balancing, job shop scheduling, project planning and control, quality assurance, improvement curves, work-force scheduling, and vehicle scheduling. Offered jointly with MEIE 450 and O ENG 451. Prerequisites: 301 and junior standing or above.

OPMGT 485 Introduction to System Dynamics (4) Focuses on theory and concepts of system dynamics, a continuous flow simulation method of modelling. Goal is to analyze organizations as complex systems, emphasizing interactions between management decisions and information feedback theory. A general purpose simulation language, such as DYNAMO, is used. Prerequisite: 301, or permission of instructor.

OPMGT 499 Undergraduate Research (3, max. 9) Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required.

OPMGT 500 Introduction to Operations Management (3) Production of goods or services in any type of organization or institution. Managerial decision making in operations problems, including application of quantitative analysis and use of computers. Inventory management, scheduling, facility location, management of service systems, and quality assurance. Prerequisites: QMETH 500 and 510 and permission of graduate office.

OPMGT 517 Materials Management and Production Scheduling (3) Managing materials and information flows in manufacturing and distribution firms. Cost analysis, quantity, quality, timing, control, and vendor selection. Demand forecasting, production scheduling, inventory management (including materials requirements planning), capacity planning, and procurement. Prerequisites: 500 and permission of graduate office.

OPMGT 522 Service System Design and Control (3) Design and management of service operations in nonmanufacturing organizations. Strategic planning of service-delivery systems, establishment of desired service level and quality, measurement and assessment of service criteria, capacity planning, work-force planning, scheduling, and life cycle of service enterprises. Prerequisites: 500 and permission of graduate office.

OPMGT 530 Facility Layout and Location (3) Quantitative models used to analyze problems in the layout and location of economic facilities. Location problems in both the public and private sectors, including specific applications. Current research. Prerequisite: 500.

OPMGT 540 Manufacturing Strategy (3) Develops a general framework for creating and analyzing a strategy for domestic and international manufacturing-based companies and industries. Identifying and integrating those categories of manufacturing decisions that have a strategic impact. Work-force management, capacity planning, and organization of the manufacturing function. Course based substantially on case studies. Prerequisite: 500.

OPMGT 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

OPMGT 577 System Dynamics (3) Analysis of feedback structure and dynamic behavior of management decision and information systems. Dynamics of management decision making from an overall systems point of view. Interaction of separate components of an enterprise. Organizational control and growth of firms and other social, economic, and environmental systems viewed as feedback systems. Construction of continuous-flow computer simulation models using a specialized language such as DYNAMO. Prerequisite: 500 or permission of graduate office.

OPMGT 582 Special Topics in Operations Management and Systems Analysis (3, max. 6) Major topics in operations management and systems analysis. Emphasis on research and, where appropriate, application of quantitative analysis and computer. Topics vary, including work-force planning, project management, research and development management, quality assurance, technology planning and forecasting, systems analysis of complex organizations, and urban systems analysis. May be repeated for credit. Prerequisites: 500 and permission of graduate office.

OPMGT 599 Doctoral Seminar in Operations Management (3) Study and research in advanced topics of operations management. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. Prerequisite: permission of graduate office.

OPMGT 600 Independent Study or Research (*) AWSpS Prerequisite: permission of graduate office.

Quantitative Methods

Courses for Undergraduates

Statistics

QMETH 201 Introduction to Statistical Methods (4) Survey of principles of data analysis and their applications for management problems. Elementary techniques of classification, summarization, and visual display of data are discussed. Applications of probability models for inference and decision making are illustrated through examples. Prerequisites: MATH 157 or equivalent, and sophomore standing or above.

QMETH 401 Statistical Methods for Business Research (4) Applied statistical linear models: simple and multiple regression, analysis of variance. Prerequisite: 201.

QMETH 403 Introduction to Data Analysis (4) Philosophy, methods of exploratory data analysis, robustness, statistical graphics. Structure in data sets: groups of numbers, several groups, bivariate, time series, two-way tables. Includes plotting, transformation, outlier identification, regressions, smoothing, median polish. Offered jointly with STAT 403. May not be taken for credit if credit received for 503. Prerequisite: 201 or STAT 220 or STAT 311 or ECON 281.

Business Mathematics and Operations Research

QMETH 350 Quantitative Analysis for Business (4) Introduction to mathematical tools utilized for analysis of business problems; appreciation of the use of these tools in business situations; calculus; linear algebra. Prerequisites: MATH 157 and junior standing or above.

QMETH 424 Simulation Techniques (4) Construction and operation of simulation models, including study and use of specialized simulation languages on digital computers. Prerequisites: 200, 201, and junior standing or above; recommended: 350.

QMETH 450 Operations Research—Deterministic Models (4) Formulation and solution of business problems of primarily deterministic nature through use of operations research tools. Emphasis on techniques of mathematical programming, dynamic programming, network algorithms. Prerequisites: 350 or equivalent and junior standing or above.

Information Systems

QMETH 200 Computer Programming (2) Application of computing to business problems. Introduction to computer programming using the BASIC language, use of business problem-solving software, use of editors, operating system language. Introduction to computer hardware and business data processing concepts. (Not recommended for students with credit for ENGR 141.) Prerequisite: sophomore standing or above.

QMETH 304 Business Information Systems (4) Computer processing systems, data organization, and design and development activities required to develop business information systems. Continued study of structured design and BASIC programming, using interactive computing facilities. Prerequisite: 200.

QMETH 470 System Design and Development I (4) Design, development, and management processes used in business information systems projects. Continuing study of data structures and file-processing methodologies. Use of BASIC on the VAX 11/780 in transaction and on-line processing activities, with emphasis on structured programming. Prerequisite: 304.

QMETH 472 System Design and Development II (4) Advanced system design, development, and programming topics. Integrated on-line file processing and data-base systems: Comprehensive study and use of COBOL on interactive computing systems. System and data security. Management of the information systems process. Prerequisites: 304, 470.

QMETH 490 Special Problems in Quantitative Analysis (4) Specialized quantitative techniques useful for solving business problems. Topics from operations research, statistics, computer methods. Emphasis on application. Prerequisites: 304, 401, 450, depending on topic, and junior standing or above.

QMETH 499 Undergraduate Research (3, max. 9) Research in selected problems in business statistics, operations research, decision theory, and computer applications. Prerequisite: permission of undergraduate office.

Courses for Graduates Only

Approval of the graduate business program office required. Entry card required. Students interested in probability and statistics are also urged to consider BA RM 500 and 501.

QMETH 500 Probability and Statistics (3) Introduction to statistical techniques useful for aiding management decisions. Emphasis on use of interactive computer methods in basic business problems. Topics include random sequences, probability distributions, linear regression, and elementary time series analysis. Prerequisites: 350 or equivalent preparation in elementary calculus and 200 or equivalent preparation in computer programming.

QMETH 503 Practical Methods for Data Analysis (3) Basic exploratory data analysis with business examples. Groups of numbers, multivariate data, time series, multiway tables. Techniques include plotting, transformation, outlier identification, cluster analysis, smoothing, regression, median polish, and robustness. Offered jointly with STAT 503. May not be taken for credit if credit received for 403. Prerequisite: 500 or STAT 342 or equivalent or permission of instructor.

QMETH 504 Computer-Based Information Systems for Management (3) Introduction for graduate students with little or no prior course work or experience in information systems and computing technology. Covers concepts of information use in decision processes and an introduction to computing technology. Management's responsibilities in determining and developing information systems is the focal point.

QMETH 508 Introduction to Probability Theory (4) Introduction to fundamental concepts of probability. Topics include combinatorial techniques, point probability and density functions, transformations of random variables, expectation, and families of distributions. Prerequisite: 350 or equivalent preparation in elementary calculus.

QMETH 510 Quantitative Methods (3) Survey of operations research techniques for business problem solving. Emphasis on linear programming and general mathematical programming techniques. Prerequisite: 350 or equivalent preparation in elementary calculus.

QMETH 520 Statistical Applications of Linear Models (4) Exploration and inference using linear models. Advanced treatment of simple and multiple regression, use of dummy variables, analysis of covariance, and selection of variables to be included in the equation. Prerequisite: 500.

QMETH 529 Sample Survey Techniques (3) Design and implementation of selection and estimation procedures in sample surveys. Emphasis on sampling of human populations, although principles apply to other sampling problems. Simple, stratified, and cluster sampling, multistage and two-phase procedures, optimal allocation of resources; estimation theory, replicated designs, variance estimation, national samples, and census materials. Offered jointly with STAT 529 and BIOST 529. Prerequisites: 500, BIOST 511, STAT 421 or 423, or equivalent, or permission of instructor.

QMETH 530 Stochastic Series Analysis and Forecasting (4) Introduction to modern time series analysis and forecasting. Autoregressive, moving average, and mixed models. Practical methods for model identification, estimation, diagnostic checking, and adaptive forecasting. Oriented toward real data and application. Prerequisite: 500; strongly recommended: 520 or equivalent.

QMETH 540 Statistical Decision Theory (4) Application of utility theory and probability theory to decision making under conditions of uncertainty. Emphasis on Bayesian methods—prior-to-posterior, preposterior analysis, design of optimal experiments. Prerequisite: 500 or equivalent.

QMETH 549 Topics in Applied Business Statistics (4, max. 8) Application of statistical techniques. Topics vary. Prerequisite: 500 or equivalent.

QMETH 551 Mathematical Programming (4) Advanced topics in linear programming and an introduction to nonlinear programming; the managerial significance of nonlinear models. Topics include the revised and dual simplex algorithms, decomposition of large linear programs, shortest-route problems, unconstrained optimization of nonlinear functions, steepest descent and feasible direction methods, quadratic and separable programming; Kuhn-Tucker conditions for nonlinear programming; penalty functions. Prerequisite: 510 or 450 or MATH 407.

QMETH 552 Stochastic Models in Operations Research (4) Optimal decision making in an uncertain environment; probabilistic dynamic programming, including finite horizon and unbounded horizon models, Markov chain models, inventory models, and waiting-line models. Prerequisite: 510 or 450 or MATH 407.

QMETH 560 Research Seminar in Operations Research (4, max. 8) Intensive study into operations research techniques relevant to business analysis. Selected topics include: extensions of linear programming, solution of large systems, stochastic processes, dynamic programming, discrete programming, and network models. Prerequisite: 551 or 552.

QMETH 570 Computer Information Structures (4) Concepts of data structure and file organization typical to administrative data processing and management information systems. List structures, list-processing algorithms. Sorting and searching algorithms for internal and external storage. Sequential, indexed, direct, and hash-coded file organizations and processing. Introduction to data-base concepts and data-base management systems. Programming exercises utilizing the University's central computing facility. Prerequisites: 504 or equivalent, and knowledge of a computer programming language.

QMETH 571-572 Research Reports (3-3) See ACCTG 571-572 for description.

QMETH 574 System Analysis, Design, and Programming (4) Introduction to system analysis, design, and programming. Emphasis on structured and modular design, integrating design processes and utilizing COBOL to implement typical data-processing applications. Planning and management of design and programming functions. Prerequisite: 504 or equivalent.

QMETH 580 Data-Base Management System (4) Intensive investigation of data-base concepts and data-base management system software (DBMS). Hierarchic, network, and relational based DBMS. DBMS languages. Data dictionary/directory concepts. Role of the data-base administrator. Use of the University's DBMS. Prerequisite: 504; recommended: 570.

QMETH 599 Doctoral Seminar in Quantitative Methods (3) Study and research in advanced topics of quantitative methods. The seminar is generally concerned with unpublished areas of research and is conducted by visiting professors and departmental faculty. May be repeated for credit. For doctoral students only. Prerequisite: permission of graduate office.

QMETH 600 Independent Study or Research (*) Prerequisite: permission of graduate office.

School of Dentistry

Dean

Karl-Åke Omnell
D322 Health Sciences

In the School of Dentistry, the student learns fundamental principles significant to the entire body of dental knowledge and is expected to acquire habits of reasoning and critical judgment that will enable implementation of that knowledge. Students are expected to learn fundamentals of basic health sciences, to master certain clinical skills, and to acquire a thorough understanding of professional and ethical principles. The school is accredited by the Council on Dental Education and is a member of the American Association of Dental Schools.

The following departments participate in the curriculum for the school's programs: *Community Dentistry* is concerned with the social, legal, political, economic, and psychological aspects of dental health-care delivery. *Endodontics* offers training in the diagnosis and treatment of disease of the tooth pulp. *Oral and Maxillofacial Surgery* trains in the procedures used for all types of operations in the oral cavity and all phases of dental pain control. *Oral Biology* concerns the study of basic biological mechanisms in normal and diseased oral tissues and structures. *Oral Medicine* provides training in diagnostic techniques, so students learn to correlate information gained in various departments and to plan treatment for the patient. *Orthodontics* provides training in the prevention and correction of malocclusion of the teeth. *Pedodontics* provides students with a broad understanding of the growth and development of the child and teaches students the principles of preventive dentistry, allowing them to develop the skills necessary for maintenance of optimal oral health in children. *Periodontics* offers training relative to the periodontium in health and disease, diagnosis of periodontal disease, and treatment of diseases that affect the periodontal tissues. *Prosthodontics* provides instruction in the fabrication and maintenance or removable complete and partial dentures. *Restorative Dentistry* offers training in the restoration or replacement of tooth structure and study of the form and function of the masticatory structures.

The school offers courses leading to the degrees of Bachelor of Science with a major in dental hygiene, Doctor of Dental Surgery, Master of Science in Dentistry, Master of Science, and Doctor of Philosophy, as well as postgraduate certificate programs and residency training in specified areas.

Undergraduate Program

Bachelor of Science Degree

The Department of Dental Hygiene offers a Degree Completion Program for graduates of two-year associate degree or certificate programs in dental hygiene. A Bachelor of Science degree in Dental Hygiene is granted. This advanced dental hygiene program is designed to enhance the present level of clinical skills of practicing dental hygienists and to expand their career opportunities.

Students meet with an adviser to plan a program to fit their individual needs and goals. Some of the following opportunities are available as part of a B.S. degree completion program in dental hygiene: pursuit of qualifications to teach dental auxiliary students in two-year programs, including teaching internships; advanced qualifications for public health positions; theoretical and clinical development as dental hygiene prevention specialists; expanded dental hygiene function skills legal in the state of Washington (e.g., administration of local anesthetics and placing of amalgams and tooth-colored restorations after a dentist has cut the preparation); management skills for dental clinics or group practices; basic or behavioral sciences for admission to professional degree programs (e.g., dentistry, medicine, pharmacy, graduate studies in basic or behavioral sciences and the Master of Science degree in oral biology); or study in a field related to dental specialties.

Admission to the program is open each quarter. The student must meet the admission requirements of the University as well as the University admission deadlines for each quarter. All students awarded the B.S. degree in dental hygiene meet both the basic proficiency and distribution requirements of the College of Arts and Sciences. On admission, students must possess a certificate or an associate degree in dental hygiene from a program accredited by the Commission on Dental Accreditation of the American Dental Association and a license to practice dental hygiene in at least one state or province. Students in the dental hygiene program pay the undergraduate tuition of the College of Arts and Sciences.

Inquiries may be addressed to the University of Washington, Department of Dental Hygiene, SB-28, Seattle, Washington 98195.

Professional Programs

Doctor of Dental Surgery

The curriculum of the D.D.S. degree includes study in two main areas: basic sciences and clinical dental sciences. The program of instruction is designed to equip the student, as a practicing dentist, with the knowledge and qualities necessary for solving problems of oral health and disease. Emphasis is placed on the role of the dentist in the community and the professional obligation necessary to respond to the oral needs of the total population. The school is committed to improving and increasing care within dentally underserved communities. The four-year program includes a required summer quarter following the second year and an optional summer quarter following the third year. The curriculum may be modified in response to the availability of current information.

A student seeking admission to the D.D.S. degree program must make application through the American Association of Dental Schools Application Service (AADSAS), 1625 Massachusetts Avenue

Northwest, Washington, D.C. 20036, before November 1 of the year prior to that for which the applicant seeks entrance. Application materials and instructions should be requested from AADSAS or the School of Dentistry, Office of Academic Affairs. The school will request the following supplementary materials: (1) a nonrefundable application fee of $35, (2) four letters of recommendation, (3) Dental Admission Test scores, (4) an autobiographical résumé, and (5) a list of current and future courses. Firm predental requirements are: preparatory courses in general chemistry, organic chemistry, physics, and introductory biology or zoology. Highly recommended are courses in vertebrate zoology and embryology. Equally important is a background in the social sciences and the humanities. A minimum of 135 predental quarter credits is required for admission. Although a prior degree is not required, it is preferred. Exceptionally qualified students may be accepted, after three years of undergraduate education, to an Early Scholarship Program. This refers to either the traditional college junior or the mature student seeking a second career goal.

Undergraduate grade-point averages and performance on the Dental Admissions Test are given strong consideration in the selection process. The applicant's knowledge of dentistry, interest in health care, and ability to communicate orally and in writing, as well as evaluations by the recommenders, are given serious consideration. Historically, approximately eighty percent of the freshman class members are from Washington, while the balance are from elsewhere in the United States. Special consideration is given those students whose states belong to the Western Interstate Commission for Higher Education (WICHE). Women and ethnic minorities or culturally disadvantaged persons are encouraged to apply. Information regarding AADSAS application, supplementary application materials, selection criteria, and selection process is available from the University of Washington School of Dentistry, Office of Academic Affairs, SC-62, D323 Health Sciences, Seattle, Washington 98195, or the College of Arts and Sciences Advisory Office, Padelford Hall, GN-10. Information on the Dental Admission Test is available from both the above and the American Dental Association, 211 East Chicago Avenue, Chicago, Illinois 60611.

Students who wish to transfer may be considered only after the completion of the first year of dental school, with permission based on space availability and mitigating circumstances.

Dental student quarterly tuition for 1983/84: residents $1,016, nonresidents $2,576. In addition, each dental student is required to purchase the dental issue of equipment and materials each quarter. Current estimates of the cost and information on loans and scholarships may be obtained from the Office of Student Affairs, D323 Health Sciences, SC-62. Also available in this office is information relating to student life, including the Student Dress Code, Academic Regulations Manual, and Student Ethics Code.

Residency Training

Residency training programs are available in oral and maxillofacial surgery, the general practice of dentistry, and pedodontics. Programs vary in duration and are integrated, providing for rotation through several of the University-affiliated hospitals. Application, selection, and administration of the oral surgery residency is provided through the Department of Oral and Maxillofacial Surgery; the general practice residency is provided through the Division of Hospital Dentistry at the University, and the pedodontics residency is administered through the dental department at the Children's Orthopedic Hospital and Medical Center.

Graduate Programs

Through their respective departments, the graduate faculty members of the school offer programs leading to the degree of Master of Science in Dentistry, Master of Science, and Doctor of Philosophy, as well as postgraduate certificate programs.

Master of Science in Dentistry Degree/ Postgraduate Certificates

Fields of study for the M.S.D. programs are endodontics, fixed prosthodontics, oral biology (oral pathology), oral medicine, orthodontics, periodontics, and removable prosthodontics. The programs are planned to prepare students to think independently, to evaluate their own services and the literature of the programs, and to develop their clinical operative skills to a level to permit the successful practice of their chosen specialty. Emphasis is placed on the basic principles of diagnosis and treatment that compose one of the clinician's most valuable assets. The purpose of the programs is not only to train students in the art of their respective specialties but also to encourage possible preparation for academic careers or for research. Research may be undertaken in basic or applied science. Opportunities for collaborative research are available with the cooperation of other colleges, schools, or departments of the University.

Applicants for admission to the M.S.D. and certificate programs must be graduates of a school of dentistry approved by the Council of Dental Education of the American Dental Association or a university dental school located outside the North American continent whose curriculum and admission requirements are similar to those of the UW School of Dentistry. Applications must be submitted to the appropriate department, School of Dentistry, University of Washington, Seattle, Washington 98195, on or before November 1 for consideration for entrance in the following Autumn Quarter. A concurrent Application for Admission to the Graduate School also must be filed. International students must submit financial statements before the November 1 deadline and must demonstrate competency in the English language, for which TOEFL scores may be required as evidence. Requests for information or application forms may be forwarded to the department of the specialty field at the above address.

Minimum consecutive full-time quarters of residence are required for the fields as follows: endodontics and fixed prosthodontics—eight (twenty-four months); oral biology (oral pathology), orthodontics, and removable prosthodontics—seven (twenty-one months); oral medicine—eight for the M.S.D. and seven for the certificate; periodontics—nine (twenty-seven months) for the M.S.D. and eight for the certificate. For the graduate program to be continuous, registration is required during the Summer Quarter that conforms to the University schedule. Foreign-language study is not required for graduation.

Although a student may enroll in a postgraduate certificate program only, students enrolled in the M.S.D. program also will be awarded a postgraduate certificate in the specialty. Postgraduate certificate programs are not administered by the Graduate School, and no thesis is required. The course content may vary somewhat from the M.S.D. program, although the same academic standards are applied in both programs. Tuition and fees are assessed at the graduate level for both programs.

Master of Science, Doctor of Philosophy Degrees

Curriculums for the M.S. and Ph.D. programs are offered through the Department of Oral Biology.

Oral biology is concerned with the nature of the oral and paraoral tissues and with the applicability of basic scientific knowledge to oral tissues in health and disease. The courses and research programs in the department deal with the origin, growth and development, structure, and functions of oral tissues, as well as with the etiology and pathogenesis of oral diseases and malfunctions. By its nature, oral biology overlaps the basic medical sciences and clinical dental sciences.

The department contains well-equipped laboratories actively engaged in various aspects of research involving the following approaches: biochemical, including studies on protein synthesis and secretion and the structure of salivary macromolecules; physiological, such as studies on ion fluxes in secretory tissues; microbiological, including studies on the nature of oral pathogens and the effects of salivary factors on the oral microbiota; embryological, such as studies on the formation of the oral and paraoral structures, and developmental anomalies, such as palatal and lip clefting; and morphological, including various studies on oral tissues at the light and electron microscopic levels. Facilities and personnel of the Center for Research in Oral Biology are available for the training of graduate students with appropriate interests.

Several programs are available through the Department of Oral Biology to accommodate students with different educational objectives.

A program of study and research leading to the Doctor of Philosophy degree is available for those students desiring extensive research training as well as in-depth course work in oral biology. In addition to the courses offered by this department, students in the Ph.D. program are expected to gain proficiency in one of the biomedical sciences.

A separate program of study and research leading to the Master of Science degree is available for those students who want less training than the Ph.D. program affords.

A nonthesis option exists in the Master of Science program for the purpose of training dental hygiene educators to instruct in certain basic and applied sciences as well as in the clinic.

For the more clinically oriented students, the school offers a program leading to the degree of Master of Science in Dentistry with specialization in oral pathology. Students enrolled in this program receive training that includes experience in the school's extensive biopsy service, participation in the teaching of oral pathology to dental students, participation in a residency program, and enrollment in a series of advanced courses in general and oral pathology.

Clinical specialty training (e.g., oral pathology, oral medicine, periodontics) can also be obtained in conjunction with either the M.S. or Ph.D. programs.

Applicants for all programs must have either a baccalaureate or professional degree from a dental or medical school. Acceptance into the programs requires approval of both the Department of Oral Biology and the Graduate School. For information or application materials, contact the graduate program adviser, Department of Oral Biology, B147 Health Sciences, SB-22, University of Washington, Seattle, Washington 98195.

United States Public Health Service traineeships may be available to students who are United States citizens or permanent residents. These begin at $13,380 at the postdoctoral level. An allowance for tuition and fees is normally included. The M.S. and Ph.D. programs, including the nonthesis M.S. for dental hygienists, are identified as WICHE Regional Graduate Programs, making students from WICHE-participating states eligible to receive support while pursuing these degree programs.

Community Dentistry

Faculty

Acting Chairperson

Devereaux Petersoh

Associate Professors

Milgrom, Peter,* D.D.S., 1972, California (San Francisco); quality of care, cost and quality of care for elderly, health services.

Sharp, Lawrence J., Ph.D., 1964, Washington State; community dentistry.

Weinstein, Philip,* Ph.D., 1971, Kentucky; behavioral science.

Assistant Professors

Chapko, Michael K.* (Research), Ph.D., 1972, New York; evaluation research, health behavior.

Grembowski, David (Research), Ph.D., 1982, Washington; urban planning.

Lecturer

Getz, Tracy B., M.S., 1972, Oregon; community dentistry.

Course Descriptions

COM D 201 Planning a Career in Dentistry for the Future (2) ASp Future-oriented overview of important concepts in dental science, contemporary modes of patient treatment, and dental-care delivery systems. Provides firsthand exposure to practice of dentistry and prerequisite materials in oral anatomy, epidemiology, and other basic science subjects. Open to first-, second-, and third-year undergraduate students throughout the University.

COM D 449 Directed Studies in Community Dentistry (*) AWSpS Students and faculty with common academic interests pursue them together within the curriculum by means of independent study and a tutorial student-faculty relationship. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

COM D 525P Detection and Management of Human Disease (1) W Core course in management considerations in treatment of dental patients with diverse disabilities. Includes health, social, and economics problems; communication, attitudinal, and legal issues; utilization of community resources; medical and orofacial characteristics of prevalent disabilities; problem planning, modifications in treatment, and preventive care. Offered on credit/no credit basis only.

COM D 530P Practicum in Management of Patient Behavior (2) W Designed to enhance student skill in patient management with an emphasis on strategies to alter patient oral health-care habits. Techniques and principles learned as applied by each student in a project involving the management of a preventive care behavior.

COM D 541P Policy Issues in Financing, Regulating, and Organizing Dental Care (2) W Provides information on private and public involvement in financing, regulating, and organizing dental care. Stresses analysis of public policy matters directly influencing professional environment of the practicing dentist.

COM D 575 Behavioral Dental Research (1) AWSpS Survey of behavioral science research and methodology in dentistry and related fields. Emphasis in various quarters varies: literature review, research design, instrumentation, data analysis. Designed for advanced student who plans a research career. Offered on credit/no credit basis only. Prerequisite: doctoral degree or permission of instructor.

COM D 660 Dental Fear Clinic (2) AWSpS Clinical instruction in the care of the severely anxious or phobic adult or child. Strategies from behavioral and cognitive psychology. Offered on credit/no credit basis only. Prerequisite: graduate standing in dentistry or permission of instructor.

Dental Hygiene

Faculty

Chairperson

Martha H. Fales

Professor

Fales, Martha H.,* Ph.D., 1975, Michigan; dental hygiene.

Associate Professor

Wells, Norma J., (Community Dentistry),† M.P.H., 1966, California (Los Angeles); dental hygiene.

Assistant Professor

Cameron, Cheryl A., (Oral Biology), Ph.C., 1983, Washington; dental hygiene.

Course Descriptions

D HYG 401 Professional Interactions (2) W Seminars, discussions of professional responsibilities, preparing students for entry into dental hygiene practice. Emphasis on ethics; job interviewing and varied employment opportunities. Offered on credit/no credit basis only.

D HYG 402 Community Dental Health (3) W Field experience in community health, with emphasis on dental hygiene care in specific community health programs. Includes methods of identifying community health problems, use of dental epidemiological survey techniques, elements of community analysis and organization, and influence of legislation on patterns of dental-care delivery systems.

D HYG 403 Principles and Practices of Dental Health Education (1-1) AW Presents information on personal control of dental health; interviewing techniques; learning and teaching processes and methods; and behavior management for the normal and the disabled.

D HYG 404 Field Practice (2) Sp Application of dental health principles and practices to field experience in the educational system. Includes experience in the dynamics of the interrelationships between health professional and other school personnel.

D HYG 456 Community Dental Hygiene Practice (1-6, max. 6) WSp Application of dental health principles and practices in hospitals or special community clinics. Includes population not normally present in student's University practice. Offered on credit/no credit basis only.

D HYG 465 Advanced Clinical Dental Hygiene Practice (3, max. 9) AWSpS Advanced instrumentation and clinical procedures for certificated dental hygienists. Seminars and clinical experience. Prerequisites: certificate in dental hygiene from an accredited program and permission of instructor.

D HYG 466 Advanced Preventive Dental Hygiene Patient Care (3, max. 9) AWSpS Continuation of 465 to enhance clinical skills in patient management, curettage, and root planing. Seminars concentrate on planning patient dental hygiene treatment and patient evaluation. Offered on credit/no credit basis only. Prerequisites: 465 and permission of instructor.

D HYG 475 Orientation to Hospital Dentistry for Dental Hygienists (4) AWSpS Operation of dental profession within hospital setting. Hospital rounds, surgical observation, participation in emergency dental treatment, clinic operations and management, and clinical dental hygiene.

D HYG 480 Restorative Dentistry for Dental Auxiliary Educators (2) S Designed to develop dental auxiliary faculty persons skilled in performing and teaching the following restorative procedures: utilization of rubber dam; placement and removal of matrix and wedge; polishing of amalgam restorations; application of cavity liners, bases, and varnish; placement of temporary crowns and restorations. Clinical experience with patients required. Prerequisite: permission of instructor.

D HYG 481 Restorative Dentistry for Dental Hygiene Educators (2) S Designed to develop dental auxiliary faculty persons skilled in performing and teaching the following procedures: condensing and carving of amalgam restorations; placement and finishing of tooth-colored restorative materials. Prerequisite: 480.

D HYG 482 Local Anesthesia for Dental Hygiene Educators (3) S Develops dental hygiene faculty persons skilled in performing and teaching techniques of field and nerve-block anesthesia. Topics include head and neck anatomy, anesthetic pharmacology, pain physiology, prevention and management of anesthetic complications and emergencies as well as techniques administration. Clinical experience with patients is required. Prerequisite: permission of instructor.

D HYG 483 Clinical Practice of Restorative Dentistry for Dental Hygiene Educators (2) S Clinical application of 481. Offered on credit/no credit basis only. Prerequisite: 481.

D HYG 491 Seminar in Dental Hygiene (2) AWSp Study of professional education, accreditation, legislation, organization, and literature and responsibilities of the dental hygienist to the community. Prerequisite: permission of instructor.

D HYG 492 Principles of Scientific Investigation for the Dental Hygienist (2) ASp Introduction to principles of scientific investigation, emphasis on biostatistics and application to dental hygiene literature.

D HYG 493 Dental Hygiene Literature Review (2-4) Seminar-discussion analysis of the recent literature concerning dental hygiene practice and related fields. Prerequisite: 492 or permission of instructor.

D HYG 494 Principles of Teaching in Dental Hygiene (3) AWSpS Application of principles of learning to teaching methods and techniques effective in dental hygiene, with opportunity for course planning, demonstration, and practice teaching. Prerequisite: permission of instructor.

D HYG 497 Directed Studies in Dental Hygiene (*, max. 14) AWSpS Elective course based on student interest in special areas of preventive dentistry or dental hygiene education. The course allows independent study and a tutorial student-faculty relationship. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

D HYG 499 Dental Hygiene Extended Learning (*) S Supplemental work in dental hygiene to correct an area of student deficiency. Offered on credit/no credit basis only.

D HYG 565 Advanced Clinical Dental Hygiene Practice (3) AWSpS Self-assessment of clinical skills to determine individual student goals. Clinical patient care on periodontal graduate student patients. Student initiative develops content most suitable for individual groups. Dental hygienists not recently in practice can anticipate more than one quarter to prove proficiency. Offered on credit/no credit basis only. Prerequisites: graduate program admission, license to practice dental hygiene, permission of instructor.

D HYG 594 Principles of Teaching in Dental Hygiene (3) A Application of principles of learning to teaching methods and techniques effective in dental auxiliary education, with opportunity for course planning, demonstration, and practice teaching. Prerequisites: graduate program admission and permission of instructor.

D HYG 595 Internship in Dental Hygiene Education (3-10, max. 10) AWSpS Clinical and/or didactic teaching experience or program administration. Teaching and administration responsibilities assigned according to student's previous experience, education needs, and interest. Seminar required. Prerequisites: 494, status as registered dental hygienist licensed in at least one state, and permission of instructor.

Dentistry

Course Descriptions

DENT 534P Geriatric Dentistry (1) W Special needs of older persons seeking dental care: oral health; psychology of aging; socioeconomic problems; effective communications; dental management; special problems in home health care; and problems with institutional and long-term care. Offered on credit/no credit basis only.

DENT 537P Hospital Dentistry (1) Sp Introductory course presenting hospital procedures and protocol and specific patient types.

DENT 541P Review of Patient Management in Pediatric Dentistry (1) W Through observation, discussion, and problem solving, students develop their own approach to rapport building, interviewing, and management of routine problems (crying child, struggling child, etc.). Offered on credit/no credit basis only.

DENT 550P Special Studies in Dentistry (*, max. 12) AWSpS Series of courses offered by the various departments from which students may elect study in areas of special interest to them. These courses include subject matter applicable to all phases of dentistry. Offered on credit/no credit basis only.

DENT 551P, 552P, 553P, 554P Patient Management System (1,1,1,1) Small groups, with representation from each dental and dental hygiene class, meet together in seminar sessions to discuss patients assigned them. In this vertical group setting, the goal is to achieve acceptable levels of management of patient care. Tasks are delegated to group members to achieve this goal. Offered on credit/no credit basis only.

DENT 564 Data Entry Through SPSS (1) Introduction to entering and managing experimental or clinical alphanumeric and numeric data through the save-file capabilities of SPSS, utilizing SPSS control cards, data transformations, and documentation.

DENT 565 Dental Photography (2) Provides student with sufficient knowledge and experience to select and use correct photographic equipment for photographing patients (facial and interoral), casts, instruments, x-rays, charts, and objects.

DENT 568 Biostatistics and Research Design (2) Sp Instruction in basic biostatistics, emphasizing the integration of statistics with research design and including measures of central tendency, regression, correlation, Chi-square, and comparison of samples. Offered on credit/no credit basis only.

DENT 569 Design and Interpretation of Dental Research (3) Basic introduction to the usage, application, and interpretation of nonparametric and parametric statistical tests in dental research. Statistical package for the social sciences is used to provide examples of the statistical tests discussed. Prerequisite: permission of instructor.

DENT 645P Hospital Rotation (2) AWSpS Clinical experience that puts into practice the material presented in 537P. The student is involved in hospital procedures and protocol and in dental care of the hospital patient.

DENT 650P Extramurals (*, max. 12) AWSpS Extramural sites arranged to provide dental students, at varying levels of their education, with opportunities to treat a wide variety of patients in the delivery systems outside the school. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

DENT 651P Anesthesia Rotation (6) AWSpS 1½-month rotation in anesthesia at one of three local hospitals. Objectives: administration of anesthesia, management of emergency situations and airway problems, familiarization with pharmacology of anesthetic drugs; increased efficiency with venipuncture. Offered on credit/no credit basis only.

DENT 652P Clinical Medicine Clerkship (4) AWSpS One-month clinical rotation in clinical medicine at a local hospital. Objective is to increase the student's ability in physical evaluation of patients as well as to give in-depth knowledge of hospital procedures and commonly prescribed medications. Offered on credit/no credit basis only.

DENT 660 Temporomandibular Joint Diagnosis and Treatment (2, max. 8) A Seminar and clinic sequence for comprehensive examination, diagnosis, and treatment of patients with temporomandibular joint problems. Includes management of dysfunction and morphologic alterations in associated muscles and occlusion. Prerequisite: permission of instructor.

DENT 700 Master's Thesis (*)

Endodontics

Faculty

Chairperson

Robert J. Oswald

Professors

Harrington, Gerald W.,* D.D.S., 1959, St. Louis, M.S.D., 1969, Washington; endodontics.

Natkin, Eugene,* D.D.S., 1957, New York, M.S.D., 1962, Washington; endodontics.

Pitts, David L.,* M.S.D., 1977, Washington; endodontics.

Associate Professor

Oswald, Robert J.,* D.D.S., 1969, Virginia; endodontics.

Course Descriptions

ENDO 520P Introduction to Endodontics (2) Sp Lecture course dealing with the differential diagnosis and the treatment of pulp pathosis and associated periapical pathosis.

ENDO 531P Endodontic Technic (4) A Lecture-laboratory course in root canal therapy in terms of present-day concepts, with emphasis on a definite simplified technique. Treatment of extracted teeth as practice for clinical cases.

ENDO 534P Endodontics (1) W Lecture course dealing with diagnosis and treatment of impact injuries to teeth; treatment of endodontic emergencies; surgical management of endodontic problems.

ENDO 535P Clinical Management of Endodontic Treatment Problems (1) Sp Management of a variety of technical problems frequently encountered in the treatment of endodontic cases.

ENDO 550P Directed Studies in Endodontics (*, max. 6) AWSp See COM D 449 for course description and prerequisite.

ENDO 560 Advanced Endodontic Diagnosis and Treatment (2) W Current concepts are presented and discussed relating to the diagnosis and treatment of pulpal and periapical pathology. Criteria for evaluation of success or failure of root canal therapy are presented.

ENDO 562 Advanced Endodontic Treatment Planning (2) Sp Diagnosis and treatment of acute symptoms of dental origin, surgical endodontic therapy, traumatic dental injuries, and the relationship between periodontal and pulpal pathology, including differential diagnosis and appropriate treatment planning, are discussed.

ENDO 563 Radiographic Interpretation (2) A Various aspects of radiographic interpretation of particular relevance to endodontics, including interpretation of normal structures, acquired and developmental abnormalities, infection, cysts, benign tumors, and diseases other than tumors.

ENDO 566 Advanced Radiographic Interpretation (2) W Various aspects of radiographic interpretation of particular relevance to endodontics, including malignant lesions, benign tumors, diseases other than tumors, temporomandibular joint disease, sialoliths and other soft-tissue calcifications, radiographic technique, and radiation safety.

ENDO 580, 581, 582, 583, 584, 585, 586, 587 Endodontic Seminar (2,2,2,2,2,2,2,2) A,W,Sp,S Continuous weekly seminar devoted to review of endodontic and related literature and discussion of research methods.

ENDO 590 Treatment Planning Seminar (2, max. 16) AWSpS Weekly seminar to discuss controversial treatment problems and difficult diagnostic cases.

ENDO 593 Clinical Practice Teaching (1, max. 3) Closely supervised experience in teaching clinical endodontics to the undergraduate dental student.

ENDO 597, 598 Endodontics Teaching Seminar (2,2) W,W Weekly seminars devoted to an examination of general problems of teaching and learning and specific problems of endodontics teaching.

ENDO 600 Independent Study or Research (*) Prerequisite: permission of graduate program adviser.

ENDO 630P- Clinical Endodontics (1-, max. 7) AWSpS Student is required to complete endodontic treatment of anterior, premolar, and molar teeth. In addition to conservative treatment of several endodontic cases, the student performs periapical surgery for one case. Student must complete at least six quarters of 630P and all course requirements before any grade is awarded.

ENDO 659P Endodontics Extended Learning (*, max. 4) S Supplemental work in endodontics to correct an area of student deficiency. Offered on credit/no credit basis only.

ENDO 660 Clinical Endodontics (4, max. 32) AWSpS Clinical diagnosis and treatment of the pulpless tooth.

Oral and Maxillofacial Surgery

Faculty

Chairperson

Philip Worthington

Professor

Gehrig, John D.,* (Biological Structure), D.D.S., 1946, M.S.D., 1951, Minnesota; oral and maxillofacial surgery.

Associate Professors

Bloomquist, Dale S.,* M.S., 1972, Georgetown; oral and maxillofacial surgery.

Hohl, Thomas H.,* D.D.S., 1971, Loyola; oral and maxillofacial surgery.

Kiyak, Asuman H.,* Ph.D., 1977, Wayne State; gerontology, geriatric dentistry, behavioral aspects of health care.

Myall, Robert W. T.,* B.D.S., 1964, Guy's Hospital (England), M.D., 1975, British Columbia (Canada), oral and maxillofacial surgery.

Worthington, Philip, M.D., 1980, Washington, F.D.S.R.C.S., 1965, England; oral and maxillofacial surgery.

Assistant Professors

Rothwell, Bruce R., M.S.D., 1977, Washington; hospital dentistry.

Trimble, L. Douglas, D.M.D., 1973, M.D., 1978, Manitoba (Canada); oral and maxillofacial surgery.

Course Descriptions

O S 520P Sedation, Pain Control, and Emergencies (4) S Diagnosis and initial management of emergencies in the dental office; comprehensive survey of techniques of sedation (oral, inhalational, and intravenous); techniques of local anesthesia and administration and other methods of pain control.

O S 530P- Oral Surgery (Didactic) (2-, max. 6) AWS Theory of major and minor oral surgery, using a medicated autotutorial approach covering extraction of teeth, impaction surgery, preprosthetic surgery, medications, surgical complications and postoperative care, biopsy, infections and principles of incision and drainage, bone cysts, maxillary sinus, salivary glands, treatment of facial trauma and deformities.

O S 550P Directed Studies in Oral Surgery (*, max.16) AWSpS See COM D 449 for course description and prerequisite.

O S 560 Dental Sedation (2) A For graduates of the various dental specialties on the theory, application, and techniques of dental sedation. All forms of sedation, including oral, intramuscular, intravenous, and inhalation, are covered. Clinical experience is provided in the second half of the quarter.

O S 600 Independent Study or Research (*) Prerequisite: permission of instructor.

O S 630P- Oral Surgery Clinic (1-, max. 3) AWSpS Clinical application of 530P-.

O S 651P Harborview Clerkship (2-10) AWSpS Six-week rotation at Harborview Medical Center, including intensive instruction in oral surgery procedures and observing and assisting oral and maxillofacial surgery in the operating room. Offered on credit/no credit basis only. Prerequisite: permission of department Chairperson.

O S 652P Smith Hospital, Texas, Rotation (2-12) AWSpS Six-week rotation at John Peter Smith Hospital in Fort Worth, Texas, including intensive instruction in oral surgery procedures and observing and assisting oral and maxillofacial surgery in the operating room. Offered on credit/no credit basis only. Prerequisite: permission of department Chairperson.

Oral Biology

Faculty

Chairperson

Murray R. Robinovitch

Professors

Birdsell, Dale C.,* (Microbiology and Immunology),† Ph.D., 1967, California (Riverside); oral microbiology and immunology.

Keller, Patricia J. (Emeritus), Ph.D., 1953, Washington (St. Louis); protein structure and function.

Robinovitch, Murray R.,* Ph.D., 1967, Washington, D.D.S., 1969, Minnesota, salivary biochemistry and saliva-bacterial interactions.

Tamarin, Arnold,* (Biological Structure) M.S.D., 1961, Washington; oral embryology and histology, electron microscopy.

Associate Professors

Dale, Beverly A.* (Research), (Periodontics),† Ph.D., 1968, Michigan; keratin biochemistry.

Gordon, Herbert P.,* D.D.S., 1954, Pittsburgh, Ph.D., 1966, Pennsylvania; developmental biology, pathology.

Howard, Guy A.* (Research), (Medicine),† Ph.D., 1970, Oregon; mineral metabolism.

Izutsu, Kenneth T.* (Research), (Oral Medicine),† Ph.D., 1970, Washington; salivary gland physiology and pathophysiology.

Kashiwa, Herbert K.,*‡ (Biological Structure), Ph.D., 1960, George Washington; gross anatomy, cytochemistry, calcium metabolism.

Morton, Thomas H.,* (Oral Medicine),† M.S.D., 1976, Washington; oral pathology.

Watson, Eileen L.* (Research), (Pharmacology),† Ph.D., 1970, Utah; salivary gland pharmacology and regulation.

Assistant Professors

Cameron, Cheryl A.,‡ (Dental Hygiene), M.Ed., 1978, Kentucky; dental hygiene.

Hall, Stanton H.,‡ D.D.S., Ph.D., 1974, Washington; craniofacial development.

Course Descriptions

ORALB 407 General and Oral Pathology for Dental Hygienists (5) Sp Study of diseases and abnormalities of the hard and soft tissues of the oral cavity and pathologic processes that underlie disease, including inflammation, neoplasia, cellular alterations. Correlation of the gross, functional, and biochemical alterations.

ORALB 449 Undergraduate Research Topics in Oral Biology (*) AWSpS Individual research on topics selected in collaboration with a faculty member. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

ORALB 510P Oral Histology and Embryology (5) W Development of microscopic anatomy of enamel, dentin, dental pulp, cementum, periodontal membrane, alveolar bone, oral mucous membrane, maxillary sinus and temporomandibular articulation. Embryonic development of the head and neck with emphasis on morphodifferentiation of the face and oral structures.

ORALB 520P Asepsis, Oral Microbiota, and Disease (3) A Applies students' background knowledge in basic sciences to an understanding of specific microbiology of various niches in oral cavity, formation and metabolic activity of dental plaque, and etiology, pathogenesis, histopathology, and clinical characteristics of dental diseases. Principles involved in prevention of cross-contamination and diagnosis of clinical infections.

ORALB 521P Oral Pathology (2-3) AW Survey of the diseases of the oral-facial regions in lecture and laboratory sessions. Among the conditions discussed are diseases of teeth and their supporting structures and diseases of the oral and paraoral soft tissues and bones. Correlations between clinical findings, etiologic factors, and histopathologic features are stressed. Attendance in the laboratory is required.

ORALB 550P Directed Studies in Oral Biology (*, max. 12) AWSpS Selected readings and seminars on a topic chosen by individual arrangement in collaboration with a faculty member. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

ORALB 560 Dental Caries (2-3) A Series of lectures outlining the morphological, biochemical, and microbiological aspects of dental plaque and caries with the additional requirement of participation in a seminar for purposes of review of the current literature and discussion of research in this field. Prerequisites: course in general mammalian histology, or its equivalent, and permission of instructor.

ORALB 561 Oral History and Embryology (5) W Deals with embryonic development of the head and neck, with emphasis on the morphodifferentiation of the face and oral structures. Development and microscopic anatomy of enamel, dentin, dental pulp, cementum, periodontal membrane, alveolar bone, oral mucous, membrane, maxillary sinus, temporomandibular articulation, and other relevant oral and paraoral structures. Prerequisite: permission of instructor.

ORALB 562 Supervised Teaching in Oral Biology (1-5, max. 10) AWSp Directed and guided experience in selected topics in teaching techniques, teaching philosophy, and course design of courses given by the Department of Oral Biology. Students are required to participate in lecture and laboratory teaching under the supervision of the course director. Prerequisite: permission of instructor.

ORALB 565 Clinical Oral Pathology (1-3, max. 10) AWSpS Presentation of interesting oral lesions from the dental school and the University Hospital and the correlation of the clinical findings with the underlying morphologic and biochemical changes in the tissues. The relation of these oral lesions to systemic disease is stressed. Primarily designed for students with D.D.S., M.D., or D.V.M. degrees. Prerequisite: permission of instructor.

ORALB 566 Surgical Oral Pathology (2-4, max. 16) AWSpS Students are trained to interpret microscopic slides of lesions from the oral cavity and related areas, and to correlate these with the clinical findings. Each student is responsible for the grossing of specimens and the preparation of histology reports. Primarily designed for students with D.D.S., M.D., or D.V.M. degrees. Prerequisite: permission of instructor.

ORALB 568 Biomineralization (2) A Ontogeny, microscopic, and submicroscopic organization and chemistry of bones and teeth in mammals. Mineral metabolism, crystallographic structure, mechanical properties, and experimental models of biomineralization. For graduate students and advanced students in dentistry and medicine; senior undergraduates with permission of instructor.

ORALB 570 Seminar in Oral Pathology (1-3, max. 9) Consists of in-depth studies of specific oral diseases through use of seminar and discussion. Students are required to present literature reviews and to act as discussion leaders. Primarily designed for students with D.D.S., M.D., or D.V.M. degrees. Prerequisite: permission of instructor.

ORALB 572 Oral Pathology (5) S Survey of the diseases of the oral facial regions in lecture and laboratory sessions. Diseases of teeth and their supporting structures and diseases of the oral and paraoral soft tissues and bones. Correlations between clinical findings and histopathologic features. Attendance in the laboratory is required.

ORALB 574 Clinical Stomatology (3) Sp Diseases of the oral cavity and jaw are presented as the practitioner encounters them—detailed clinical pictures, laboratory tests, radiographic findings, surgical exploration for the establishment of a therapeutic diagnosis.

ORALB 575 Oral Biology Seminar (1-3, max. 10) AWSp Presentation and discussion of current research problems by members of the staff, investigators from other departments in the University, visiting scientists, and trainees. Prerequisite: permission of instructor.

ORALB 578 Research Techniques in Oral Biology (2-4, max. 15) AWSpS Introduction to biochemical, analytical, or morphological techniques employed in biochemical cytology or molecular pathology as well as *in vitro* techniques of tissue and organ culture. Prerequisite: permission of instructor.

ORALB 581-582-583 Secretory Process in Exocrine Glands (1-3)-(1-3)-(1-3) A,W,Sp Biostructural, physiological, and biochemical aspects of individual secretory systems as integrated units. Faculty members with appropriate expertise participate in discussions and presentations during each of the three quarters.

ORALB 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

ORALB 700 Master's Thesis (*) AWSpS

ORALB 800 Doctoral Dissertation (*) AWSpS

Oral Medicine

Faculty

Chairperson

Edmond L. Truelove

Professors

Dworkin, Samuel F.,* (Psychiatry and Behavioral Sciences), Ph.D., 1969, New York; dentistry and clinical psychology, pain, psychosomatic and illness-related behavior.

Omnell, Karl-Åke,* D.D.S., 1950, Royal Dental School (Stockholm), OdontD., 1957, Malmo; oral radiology.

Associate Professors

Izutsu, Kenneth T.* (Research), (Oral Biology),† Ph.D., 1970, Washington; salivary gland function in health and disease.

Middaugh, Dan G., M.D.A., 1972, Washington; oral medicine.

Morton, Thomas H.,* (Oral Biology),† M.S.D., 1976, Washington; oral pathology.

Truelove, Edmond L.,* M.S.D., 1971, Indiana; oral medicine.

Assistant Professors

Chen, Andrew C. N. (Research), (Psychiatry and Behavioral Sciences), Ph.D., 1980, Washington; neuropsychophysiology, brain/behavior, pain.

Stiefel, Doris J., M.S., 1971, Washington; dental education, care of disabled, oral medicine.

Lecturers

Miller, Rosalie R., M.P.H., 1972, Washington; oral medicine.

Schubert, Mark M., M.S.D., 1980, Washington; oral medicine.

Soltero, Donald J., M.S.D., 1977, Washington; oral medicine.

Sommers, Earl E., M.S.D., 1977, Washington; oral medicine.

Course Descriptions

ORALM 525P- Detection and Management of Human Disease ((1-13)-, max. 17) AWSpS Interviewing, history-taking, physical diagnostic techniques, use of medications, physical therapy, and clinical nonsurgical management and treatment of patients in dental setting. Medical factors in treatment of dental and specific oral diseases and chronic pain. Treatment planning of oral, medical, and behavioral problems.

ORALM 540P Oral Medicine Clinical Conference (3) AWSp Clinical conference devoted to case presentations of patients with dental treatment needs and complicating medical problems.

ORALM 550P Directed Studies in Oral Diagnosis (*, max. 12) AWSpS See COM D 449 for course description and prerequisite.

ORALM 560 Advanced Diagnostic Techniques (3) A Advanced diagnostic procedures used to identify oral and perioral diseases. Included are in-depth discussions of history analysis, methods for psychologic evaluation, soft and hard tissue diagnostic procedures, neurologic, salivary gland, and other tissue analyses requiring special procedures.

ORALM 565 Oral Medicine Clinical Conference (*, max. 16) AWSpS Clinical conference in which diagnostic data concerning patients seen in the oral medicine clinic are presented for evaluation. When possible, the patient is present with laboratory findings, radiographs, and the results of special tests.

ORALM 567 Behavioral Management of Acute and Chronic Orofacial Pain (1) AWSpS Overview of psychosomatic concepts, as related to acute and chronic pain. Behavioral management strategies for acute and chronic pain integrated into clinical care provided by primary dentist. Review biofeedbacks, relaxation, hypnosis, placebos, and related psychophysiological approaches. Open to graduate students, postdoctoral fellows, residents in dentistry, medicine, psychology.

ORALM 570- Oral Medicine and Therapeutics (3-, max. 6) AW Lecture directed toward the presentation and discussion of oral diseases and oral manifestations of systemic disease. Primarily the clinical manifestations' relationship to generalized disease processes and patient management with in-depth discussions of therapy.

ORALM 576 Oral Medicine Literature Review Seminar (2, max. 16) AWSpS Seminar analyzes the recent literature concerning the area of oral medicine, diagnosis, and therapy for oral disease.

ORALM 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

ORALM 630P- Clinical Oral Diagnosis and Treatment Planning (1- or 2-, max. 3) WSp Opportunity for examining, performing x-ray survey, and planning treatment for less involved patients. Students also participate in rendering diagnosis and emergency treatment.

ORALM 640P- Advanced Clinical Oral Diagnosis and Treatment Planning (1- or 2-, max. 3) AWS Advanced instruction in diagnosis and in the examination and handling of patients. Students are in block assignment and perform radiographic surveys, oral diagnosis, and treatment plans for prospective patients.

ORALM 650P Oral Medicine Clinical Elective (*, max. 12) AWSpS Opportunities for students to work in various clinical activities at local hospitals or other sites outside the school. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

ORALM 660 Rotations in Medical Disciplines (1-4, max. 24) AWSpS Clinic, oriented to the hospital practice of oral medicine, deals with examination and nonsurgical therapy of hospital patients. The conditions treated include primary oral diseases, oral manifestations of systemic diseases, and oral defects resulting from medical treatment of serious systemic disease. Offered on credit/no credit basis only.

ORALM 665 Clinical Oral Medicine (*, max. 33) AWSpS Clinic involving the diagnostic evaluation of patients with difficult and unusual oral diseases. The student diagnoses and treats the patient. Types of therapy include medications and chemical agents, functional physical therapy, and counseling.

ORALM 670 Clinical Oral Medicine Teaching (1-4, max. 16) AWSpS Clinic designed to give the student experience and instruction in the teaching of clinical oral diagnosis. Treatment of emergency dental problems as well as routine and special diagnostic procedures is emphasized.

Orthodontics

Faculty

Chairperson

Donald R. Joondeph

Professors

Little, Robert M.,* D.D.S., 1966, Northwestern, M.S.D., 1970, Ph.D., 1974, Washington; orthodontics.

Moffett, Benjamin C.,* Ph.D., 1952, New York; anatomy.

Moore, Alton W. (Emeritus), D.D.S., 1941, California, M.S., 1948, Illinois; orthodontics.

Riedel, Richard A. (Emeritus), D.D.S., 1945, Marquette; M.S.D., 1948, Northwestern; orthodontics.

Associate Professors

Joondeph, Donald R.* M.S., 1969, D.D.S., 1967, Northwestern; orthodontics.

Kokich, Vincent G.,* D.D.S., 1971, M.S.D., 1974, Washington; orthodontics.

Shapiro, Peter A.,* D.D.S., 1970, Howard, M.S.D., 1973, Washington; orthodontics.

Assistant Professors

Fey, Michael R., D.D.S., 1975, M.S.D., 1978, Washington; orthodontics.

Hall, Stanton H., M.S., 1967, D.D.S., 1967, Northwestern; D.D.S., Ph.D., 1974, Washington; orthodontics.

Joondeph, Marc R., D.D.S., 1971, Northwestern, M.S.D., 1976, Washington; orthodontics.

Course Descriptions

ORTHO 449 Directed Studies in Orthodontics (*) AWSp See COM D 449 for course description and prerequisite. Offered on credit/no credit basis only.

ORTHO 520P Craniofacial Growth and Development in Orthodontic Diagnosis and Treatment (4) Sp Basic principles of pre- and post-natal growth and development integrated with the recognition, analysis, and treatment planning of problems encountered in dental and skeletal malocclusions.

ORTHO 522P Beginning Adjunctive Orthodontics (2) S Lecture/laboratory instruction in indications for, and techniques of, simple orthodontic tipping, rotational and extrusive movements often necessary in preparation for restorative and periodontal therapy. Prerequisite: 520P.

ORTHO 550P Directed Studies in Orthodontics (*, max. 6) S See COM D 449 for course description and prerequisite.

ORTHO 560 Orthodontics Seminar (1-5, max. 25) AWSpS Methods of diagnosis, analysis, and treatment planning of malocclusion; analysis of methods and theoretical principles used in the treatment of malocclusion. The student presents a detailed case analysis and plan of treatment for each clinical patient supervised.

ORTHO 562, 563, 564, 565 Orthodontic Theory (2,2,2,2) A,W,Sp,S Lecture-seminar sequence dealing with interpretation and application of orthodontic principles and concepts. Pertinent literature, research findings, and current orthodontic theory are analyzed in depth.

ORTHO 567 Scientific Methodology in Dental Research (2) W Review of the scientific method. Evaluation of dental literature. Discussion of proposed master's degree research projects. Procedure in scientific writing. Formulation and discussion of hypothetical research projects related to orthodontics.

ORTHO 570 Roentgenographic Cephalometry (2) A Basic principles, history, and techniques of roentgenographic cephalometry.

ORTHO 575 Post-Retention Seminar (1, max. 2) AW Each student is required to locate one or more former orthodontic patient(s) with at least ten years postretention. Complete orthodontic records must be obtained, analyzed, and discussed in the seminar. The instructor critiques the presentation and offers similar or contrasting cases for comparison.

ORTHO 580 Orofacial Biology (4, max. 12) AW Comprehensive evaluation seminar of the literature relative to the growth and development of the craniofacial complex. Anthropology, embryology, morphogenesis, genetics, and anatomy are integrated to give the student an appreciation of facial development. Outside reading assignments by the student are discussed and critiqued during the seminar discussion.

ORTHO 581 Introduction to Adjunctive Orthodontics (1) Basic principles of multidisciplinary treatment planning, orthodontic diagnosis, biomechanics, and appliance therapy.

ORTHO 582 Orthodontic Diagnosis and Treatment Planning for the Adult Dental Patient (3) AWSpS Seminar and clinic for orthodontic, periodontic, and restorative dentistry graduate students in comprehensive, integrated diagnosis, treatment planning, and treatment of the dental problems of the adult patient.

ORTHO 585 Surgical Orthodontic Diagnosis and Treatment Planning (3) AWSpS Seminar and clinic for orthodontic graduate students and oral surgery residents in comprehensive, integrated diagnosis, and treatment planning for patients with major facial deformities.

ORTHO 599 Preclinical Technique (4) A Techniques of construction and manipulation of the edgewise arch mechanism.

ORTHO 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

ORTHO 630P- Orthodontic Clinic (1-, max. 6) AWSpS Direct clinical application of principles of orthodontic diagnosis and treatment planning for the child/adolescent patient.

ORTHO 651P Adjunctive Orthodontic Clinic (1) AWSp Clinical course in which patients are treated with simple orthodontic appliances to achieve modifications in tooth position. Prerequisites: 520P, 551P, and permission of instructor.

ORTHO 659P Orthodontics Extended Learning (*) AWSpS Supplemental course that may involve any area of orthodontics in which a student requires extra work to correct an area of deficiency. Offered on credit/no credit basis only.

ORTHO 660P Clinical Orthodontics (1-6, max. 24) AWSpS Clinical application of the techniques in the treatment of malocclusion.

Pedodontics

Faculty

Chairperson

Peter K. Domoto

Professors

Lewis, Thompson M.,* D.D.S., 1950, Northwestern, M.S.D., 1955, Washington; pedodontics.

Peterson, Devereaux,* Ph.D., 1980, Pittsburgh; pedodontics.

Associate Professors

Davis, John M.,* D.D.S., 1961, M.S.D., 1967, Washington; pedodontics.

Domoto, Peter K., D.D.S., 1964, California (San Francisco), M.P.H., 1975, Washington; pedodontics.

Assistant Professors

Barriga, Bertha, D.M.D., 1966, Oregon, M.S.D., 1971, Washington; pedodontics.

Blancher, Robert B., D.D.S., 1950, Washington; pedodontics.

Lecturer

Rolla, Richard R., D.D.S., 1961, Washington; pedodontics.

Course Descriptions

PEDO 520P Pediatric Dentistry (4) S Lecture, laboratory, seminar, and clinical course to introduce clinical pediatric dentistry. Behavior management, oral diagnosis, preventive dentistry, communication skills, dental anomalies, radiography, anesthesia, restorative procedures, pulpal therapy, interceptive orthodontics, and traumatic dental injuries of the child patient.

PEDO 550P Directed Studies in Pedodontics (*, max. 6) AWSpS See COM D 449 for course description and prerequisite.

PEDO 600 Independent Study or Research (*) Prerequisite: permission of instructor.

PEDO 630P- Clinical Pedodontics (1-, max. 3) AWSpS Diagnosis and treatment planning for the child patient, including preventive dentistry procedures and primary and mixed dentition restorative procedures.

PEDO 640P Joe Whiting Clinic Rotation (1) AWSp Three-day rotation at Joe Whiting Memorial Dental Clinic.

PEDO 650P Pedodontics Extramurals (*, max. 12) AWSpS Structured fieldwork in the comprehensive treatment of the disabled child. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PEDO 659P Pedodontics Extended Learning (*) AWSpS Supplemental course that may involve any area of pedodontics in which a student requires extra work to correct an area of deficiency. Offered on a credit/no credit basis only.

Periodontics

Faculty

Chairperson

Robert H. Johnson

Professors

Johnson, Robert H., D.D.S., 1962, McGill, M.S.D., 1964, Indiana; periodontics.

Page, Roy C.,* (Pathology), D.D.S., 1957, Maryland, Ph.D., 1967, Washington; periodontics.

Schluger, Saul (Emeritus), D.D.S., 1931, Louisville; periodontics.

Associate Professors

Ammons, William F.,* D.D.S., 1959, Texas, M.S.D., 1970, Washington; periodontics.

Clagett, James A.,* (Microbiology and Immunology),† Ph.D., 1970, Nebraska; immunology.

Dale, Beverly A.* (Research), (Oral Biology),† Ph.D., 1968, Michigan; keratin biochemistry.

Engel, L. David,* (Pathology), Ph.D., 1976, Washington; cellular immunology, regulation of three lymphocyte responses.

Selipsky, Herbert,* M.S.D., 1973, Washington; periodontics.

Williams, Betsy L.* (Research), Ph.D., 1974, Washington; microbiology.

Assistant Professors

Baab, David A., M.S.D., 1975, Washington; periodontics.

Osterberg, Stig K-A, M.S.D., 1974, Minnesota; periodontics.

Sapkos, Stanley W.,* D.D.S., 1965, Alberta; periodontics.

Spektor, Michael D., D.D.S., 1975, Illinois; periodontics.

Lecturer

Quinn, Richard S., D.D.S., 1974, Washington; periodontics.

Course Descriptions

PERIO 449 Directed Studies in Periodontics (*) AWSpS See COM D 449 for course description and prerequisite.

PERIO 520P Introduction to Periodontics (2) S Clinical, histopathologic, and radiographic features of various periodontal diseases and principles of preventive periodontics and initial examination of periodontium.

PERIO 530P Periodontics (2) A Principles of examination, consultation, instrumentation, occlusal therapy, and treatment planning of the periodontal patient.

PERIO 531P Periodontics (2) W Principles of periodontal surgery, recall, and referral procedures, medications in periodontal therapy, and the interrelationship of restorative dentistry and periodontics. Treatment of acute periodontal disease. Extensive experience in treatment planning of complex cases.

PERIO 550P Directed Studies in Periodontics (*, max. 6) AWSp See COM D 449 for course description and prerequisite.

PERIO 561- Periodontal Case Management (2-, max. 6) AW Didactic presentation of clinical periodontics to provide a comprehensive view of the field and a grasp of modern therapeutics.

PERIO 570 Review of Current Literature (2) Weekly seminar-discussion devoted to literature published within the past three years and confined to material not covered in previous subject matter. Prepares the graduate student for oral and written examination for certification by the American Academy of Periodontology.

PERIO 574 Oral Microbiology and the Normal Periodontium (2) A Basic bacterial structure and pathogenesis, the general oral microbial flora, and the bacteria associated with periodontal diseases, caries, endodontic abscesses, and other dental diseases; management of asepsis in the dental office and means of controlling dental bacterial plaque infections; normal structural, biochemical, and functional properties of the periodontal tissues, and the interaction between these structures, bacterial, and host defense mechanisms.

PERIO 575 Immunologic Aspects of Oral Diseases (2) W Lecture course designed to acquaint students with basic concepts of immunology and immunopathology. Topics include cellular immunology, antibody structure and function, complement system, immunopathologic mechanisms, tumor immunology and immunologic manifestations in mucocutaneous oral lesions as well as immunology of caries and periodontal disease.

PERIO 576 Pathogenesis of Periodontitis (2) Sp Lecture course concerned with sequence of events in development of periodontitis. Topics include the microscopic and ultrastructural characteristics of the periodontal lesion, immunopathologic and other pathogenic mechanisms involved in the progression of the disease, and etiologic and epidemiologic aspects of human periodontitis; and historic views of the disease as well as current research findings regarding the etiology and pathogenesis.

PERIO 577 Review of Literature (2, max. 14) AWSpS Continuous weekly seminar devoted to review of periodontic and related literature and the discussion of teaching methods and philosophy of teaching and treatment.

PERIO 580 Orthodontic Principles in Periodontic Therapy (1) S Seminar in treatment planning of periodontally involved orthodontic cases and mechanics of minor adult tooth movement.

PERIO 582- Periodontic Treatment Planning Seminars (1-, max. 8) AWSpS Weekly seminar involved with the presentation, discussion, and tentative solution of moderate to complex problems in diagnosis and treatment.

PERIO 585- Periodontal Therapy Seminars (1-, max. 8) AWSpS Weekly seminar utilizing the case review method and dealing with the treatment of moderate to advanced periodontal disease.

PERIO 586- Longitudinal Evaluation of Periodontal Therapy (1-, max. 8) AWSp Close examination of case progress from initial therapy to most recent maintenance visits to determine efficacy of method, demands upon patient, and temporal effect of therapy and survival.

PERIO 587 Periodontal Diseases Research Seminar (1, max. 12) Weekly seminar devoted to advances in periodontal research. Topics include research design, methodology, and data derived from recent and/or ongoing periodontal research. Offered on credit/no credit basis only.

PERIO 592 Prescription Surgery (1-1-1) AWSp Clinical course in periodontal surgery in which surgical procedures are performed on prescription basis for patients undergoing therapy in the undergraduate dental clinic. Exposes student to a wider spectrum of patients and to stimulate an environment in which the student can encounter the problems in communication and patient management that occur in the private sector.

PERIO 600 Independent Study or Research (*) AWSpS Prerequisite: permission of graduate program adviser.

PERIO 630P-631P-632P Clinical Periodontics (1-1-1) A,W,Sp Clinical experience in examination, preventive periodontics, instrumentation, and treatment planning of periodontal therapy in patients with mild to moderate periodontal disease.

PERIO 640P-641P-642P Advanced Clinical Periodontics (1-1-1) A,W,Sp Treatment of patient with more complex periodontal involvement. Development of skill in comprehensive treatment planning and execution by the individual student. Allowance made for surgical periodontics and experience in assisting in the treatment of advanced cases.

PERIO 655P-656P-657P-658P Senior Periodontics Elective (2-2-2-2) A,W,Sp Clinic-seminar experience for selected fourth-year dental students that allows for clinical independence and individual responsibility in periodontal treatment and case analysis. Substitutes for 640P series.

PERIO 659P Periodontics Extended Learning (*, max. 4) S Supplemental work in periodontics to correct an area of student deficiency. Offered on credit/no credit basis only.

PERIO 660- Clinical Periodontics ((2-6)-, max. 48) AWSpS Clinical experience in diagnosis and treatment of periodontal disease.

PERIO 665 Clinical Practice Teaching (*) AWSp Supervised experience in teaching clinical periodontics to undergraduate dental students.

PERIO 685 Hospital Periodontics (1) Sp Preparation in periodontics to practice in hospital situations, including experience in operation of nitrous oxide analgesia, general anesthesia, intravenous premedication, treating of out- and inpatients.

Prosthodontics

Faculty

Chairperson

Charles L. Bolender

Professors

Beder, Oscar E.,* D.D.S., 1941, Columbia; maxillofacial prosthodontics.

Bolender, Charles L.,* D.D.S., 1956, M.S., 1957, Iowa; removable prosthodontics.

Brudvik, James S.,* D.D.S., 1957, Minnesota; removable prosthodontics.

Frank, Richard P.,* D.D.S., 1962, Iowa, M.S.D., 1971, Washington; removable prosthodontics.

Smith, Dale E.,* D.D.S., 1952, Pittsburgh, M.S.D., 1962, Washington; removable prosthodontics.

Associate Professor

Toolson, L. Brian,* D.D.S., 1967, M.S.D., 1977, Washington; removable prosthodontics.

Assistant Professors

Morton, Judy, M.Ed., 1973, Boston; removable prosthodontics.

Nash, Brent L., D.D.S., 1958, Washington; prosthodontics.

Stern, Mitchell D., D.D.S., 1975, Washington; prosthodontics.

Lecturer

Faine, Mary P., M.S., 1975, Washington; prosthodontics.

Course Descriptions

PROS 520P Introduction to Complete Dentures—Lecture (3) A Didactic course in the treatment of completely edentulous patients. Instruction is provided in diagnostic procedures, complete denture construction, and maintenance care.

PROS 523P Removable Partial Denture Design (2) W Lectures in the basic principles of removable partial denture design; more advanced designs are discussed in seminars; certain technical aspects of design procedures are done in the classroom.

PROS 525P Removable Partial Denture Clinical Preparatory Course (4) Sp Lecture-laboratory course dealing with those procedures the dentist must perform in order to fabricate a physiologically acceptable removable partial denture. The student gains experience via clinically simulated laboratory exercises prior to beginning prosthodontic treatment of a partially edentulous patient.

PROS 530P Management of Immediate Denture Patients (1) A Lecture course describing and illustrating the clinical management of immediate denture patients (typical and overdenture).

PROS 532P Special Topics in Prosthodontics (1) Sp Lecture describing and illustrating the following topics: reline procedure, management of difficult patients, maxillofacial prosthesis, and quality-control problems in private practice.

PROS 550P Directed Studies in Prosthodontics (*, max. 6) AWSpS See COM D 449 for course description and prerequisite.

PROS 560 Complete Dentures (2) A Lecture/seminar devoted to the diagnosis and treatment of the completely edentulous patient, with emphasis on management of patients with difficulties in treatment.

PROS 561 Immediate Dentures (2) Sp Lecture/seminar course concentrating on factors peculiar to fabrication of immediate dentures, with emphasis on the management of transition from natural to artificial dentition.

PROS 562 Removable Partial Dentures (2) W Lecture/seminar concentrating on factors peculiar to fabrication of immediate dentures, with emphasis on management of transition from natural to artificial dentition.

PROS 563 Obturators and Speech Appliances (2) S Seminar-laboratory course devoted to the diagnosis and treatment of the patient with congenital or acquired defects of the palate and contiguous tissue. Various types of appliances are described and constructed.

PROS 564 Definitive and Adjunctive Maxillofacial Appliances (2) A Seminar-laboratory course devoted to the theories and principles in the fabrication of somatoprostheses; appliances for resected or traumatized mandible; vehicle and protective devices in irradiation therapy; stents, alloplastic prostheses; splints and other special prostheses. Various materials and types of appliances are utilized.

PROS 571 Prosthodontics Seminar (2, max. 12) AWSp Continuous weekly seminar devoted to the review of prosthodontic and related literature.

PROS 572 Special Topics Related to Prosthodontics (1) WSp Lecture-seminar dealing with subjects having a bearing on comprehensive treatment of the maxillofacial and regular prosthodontic patient. Topics include surgery, speech, orthodontics, psychology, gerontology, and sociology.

PROS 574 Prosthodontic Visual Aids (1-1) AS Lecture/seminar covering principles of preparation and presentation of essays before dental audiences; emphasis on audiovisual aids. Practical application during Autumn Quarter.

PROS 580 Prosthodontic Dental Materials (2) A Study of common materials utilized in the fabrication of dental appliances. Emphasis on resin systems and various precious and base-metal alloys.

PROS 600 Independent Study or Research (*) AWSpS Prerequisite: permission of graduate program adviser.

PROS 620P Clinical Complete Dentures (3) A Clinical course dealing with the basic principles of complete denture fabrication as well as the diagnosis and treatment of a completely edentulous patient.

PROS 621P Complete Denture Prosthodontics (1-1) WSp Clinical course that uses the didactic material presented in 620P. The student manages a second complete-denture patient during Winter Quarter with less supervision than in 620P, and also provides follow-up care to the 620P and 621P patients during Winter Quarter and Spring Quarter.

PROS 630P Clinical Prosthodontics (1-2-1) AWSp Clinical course involving the diagnosis and management of completely and partially edentulous patients. Removable partial dentures and immediate dentures are fabricated. Follow-up care provided for patients previously treated.

PROS 640P Clinical Prosthodontic Maintenance (1-1-1) AWSp Clinic involving the relining or rebasing of dentures previously made.

PROS 650P Extramurals in Prosthodontics (*, max. 12) AWSpS Elective clinical experiences, including Foss Nursing Home or clinical practice teaching. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PROS 658P Prosthodontics Extended Learning (*, max. 4) S Supplemental work in prosthodontics to correct an area of student deficiency. Offered on credit/no credit basis only.

PROS 660 Clinical Prosthodontics (2, max. 6) AWSp Practical application of material covered in 560, 561, and 562.

PROS 663 Obturators and Speech Appliances (1-1) AS Clinical application of 563. Patients requiring the fabrication of obturators and speech appliances are treated.

PROS 664 Definitive and Adjunctive Maxillofacial Appliances (1-1) WSp Clinical application of 564. Patients requiring the fabrication of a variety of special appliances are treated.

PROS 665- Clinical Practice Teaching (1-, max. 4) AWSp Supervised experience in teaching clinical prosthodontics to the undergraduate dental student.

PROS 670 Advanced Clinical Prosthodontics (4, max. 16) AWSpS Continuation of 660. Patients who present more difficult clinical problems are assigned.

Restorative Dentistry

Faculty

Chairperson

David J. Bales

Professors

Canfield, Robert C.,* (Neurological Surgery), D.D.S., 1951, Washington; restorative dentistry.

Hamilton, A. Ian,* D.D.S., 1936, Toronto, Ph.D., 1968, London; restorative dentistry.

Hodson, Jean T.,* M.S., 1958, Washington; restorative dentistry.

Morrison, Kenneth N.,* D.D.S., 1943, Toronto, M.S.D., 1952, Washington; restorative dentistry.

Nicholls, Jack I.,* Ph.D., 1966, Purdue; dental materials, restorative dentistry.

Stibbs, Gerald D. (Emeritus), D.M.D., 1931, Oregon; restorative dentistry.

Warnick, Myron E.,* D.D.S., 1955, Alberta; restorative dentistry.

Yuodelis, Ralph,* D.D.S., 1955, Alberta; M.S.D., 1962, Washington; restorative dentistry and periodontics.

Associate Professors

Bales, David J., D.D.S., 1957, Washington, M.S.D., 1972, Indiana; restorative dentistry.

Ostlund, Lyle E., D.M.D., 1947, Oregon; restorative dentistry.

Assistant Professors

Drennon, David G., D.D.S., 1967, Temple, M.S., 1976, Iowa; restorative dentistry.

Faucher, Robert T., D.D.S., 1970, Pacific, M.S.D., 1977, Washington; restorative dentistry.

Halpin, E. Cary, D.D.S., 1964, Marquette; restorative dentistry.

Johnson, Glen H., D.D.S., 1978, Washington, M.S., 1983, Michigan, restorative dentistry.

Lillywhite, Jack W., D.D.S., 1965, Washington; restorative dentistry.

Petersen, James T., D.D.S., 1974, Washington; restorative (hospital) dentistry.

Stoddard, James W., D.D.S., 1961, Washington; restorative dentistry.

Weaver, James D., D.D.S., 1965, Ohio; restorative dentistry.

Lecturers

Anderson, J. Martin, D.D.S., 1965, Washington; restorative dentistry.

Rawson, Dearl S., D.D.S., 1959, Washington; restorative dentistry.

Strand, Harvey A., D.D.S., 1957, Washington; restorative dentistry.

Townsend, John D., D.D.S., 1967, McGill, M.S.D., 1973, Washington; restorative dentistry.

Wills, Roland C., D.D.S., 1951, Washington; restorative dentistry.

Course Descriptions

RES D 410 Dental Anatomy (3) W Lecture and laboratory exercises on the morphology and nomenclature of individual human adult and primary teeth. Introduction to function, internal tooth morphology, and the influence of tooth anatomy on selected clinical procedures. For dental hygiene students; others by permission of associate dean.

RES D 449 Directed Studies in Restorative Dentistry (*) See COM D 449 for course description and prerequisite.

RES D 510P Introduction to Dental Materials (2) A Physical and chemical properties of dental materials.

RES D 511P Applied Dental Materials (3) W Lecture/laboratory in use of dental materials relative to restorative dentistry. Clinical application and student self-evaluation of laboratory work emphasized.

RES D 515P Dental Anatomy (3) A Lecture and laboratory on the morphology and nomenclature of individual teeth of the adult human dentition. Introduction to tooth histology and function and the influence of tooth anatomy on clinical dental procedures.

RES D 516P Introduction to Occlusion (3) W Lecture/laboratory in the functional determinants of occlusal morphology. Preparation and waxing techniques for developing opposing quadrants by the additive waxing technique.

RES D 517P Functional Analysis of Occlusion (3) Sp Clinical and laboratory experiences in examination and charting of patient's occlusion, record-taking for analysis of occlusion on a dental articulator, and preclinical diagnostic correction of problems of occlusion on articulated clinical casts. Provides basic background or technique information relative to laboratory and clinical experiences.

RES D 519P Operative Dentistry (4) Sp Preclinical application of principles of cavity preparation, isolation of operating field, instrumentation and restoration of teeth in the natural dentition.

RES D 520P, 521P, 522P Introduction to Operative Dentistry Technique (2,3,4) Introduces processes of restoring diseased or damaged tooth structure to proper health, form, function, and esthetics. Emphasis on basic principles of cavity preparation, preparation and restoration design, proper selection and use of restorative materials, and clinical considerations for restorative treatment planning. Following demonstration of competence in didactic and practical aspects. Limited opportunity available for introduction to restorative care.

RES D 525P, 526P, 527P Fixed Prosthodontics (3,3,3) A,W,Sp Serve as introduction to area of restorative dentistry dealing with indirect restorations. Preclinical experience provided in tooth preparation and restoration, fabrication for various crown designs, singly and in conjunction with various pontic types to serve as fixed partial denture prostheses. Projects emphasize single-tooth preparation/restoration, multiple-tooth preparation/restoration, and esthetic veneer restorations.

RES D 530P, 531P, 532P Restorative Dentistry (2,2,2) A,W,Sp Lecture series related to 630P presenting restorative dentistry principles, including supportive material on clinical procedures.

RES D 550P Directed Studies in Restorative Dentistry (*, max. 6) AWSpS See COM D 449 for course description and prerequisite.

RES D 570 Review of Literature Seminar (1, max. 6) AWSpS Continuous weekly seminar devoted to a review of restorative and related literature, and discussion of teaching methods, philosophy of teaching and treatment.

RES D 580- Restorative Treatment Planning Seminar (1-, max. 8) AWSpS Continuous weekly seminar to discuss controversial treatment problems and difficult diagnostic cases selected for graduate students.

RES D 581- Comprehensive Treatment Planning (2-, max. 4) WSp Seminar devoted to the diagnosis and treatment of comprehensive dental cases with special emphasis given to the relationship of periodontics to restorative dentistry.

RES D 588 Masticatory Functional Analysis and Occlusal Adjustment (2) A Lecture/seminar and clinical sessions in the study of the physiology of occlusion. Pertinent literature reviewed and discussed from the multidisciplinary viewpoint. The clinical sessions include training in masticatory functional analysis and treatment of occlusally related diseases.

RES D 589 Review of Literature in Occlusion (2) W Seminar to review pertinent literature in occlusion.

RES D 590- Gnathology (2-, max. 4) AW Lecture/laboratory/clinical sessions in the study of gnathological principles and procedures as they pertain to the treatment of comprehensive cases assigned to the students. Use and application of several fully adjustable articulators.

RES D 600 Independent Study or Research (*) AWSpS Prerequisite: permission of graduate program adviser.

RES D 630P- Clinical Restorative Dentistry (1- or 2-, max. 6) AWSp Clinical training in fundamental restorative dentistry procedures, including diagnostic, treatment planning, and therapeutic aspects of operative dentistry, fixed prosthodontics, and occlusal treatment.

RES D 640P- Advanced Clinical Restorative Dentistry (1-3-, max. 12) AWSpS Clinical training in restorative dentistry procedures, including diagnostic, treatment planning, and therapeutic aspects of operative dentistry, fixed prosthodontics, and occlusal treatment.

RES D 645P Applied Dental Practice (4) AWSpS Lecture, seminar, and clinical application of material to stimulate a dental practice, including communication with staff, delegation, body mechanics, efficient work systems, practice management knowledge, and skill development.

RES D 659P Restorative Dentistry Extended Learning (*, max. 4) S Supplemental work in restorative dentistry to correct an area of student deficiency. Offered on credit/no credit basis only.

RES D 660- Oral Rehabilitation ((2-6)-, max. 32) AWSpS Clinical course to provide experience in diagnosis and treatment of patients requiring restorative procedures from single restorations to complex oral rehabilitative methods. Special emphasis is directed toward the integration of periodontics and occlusion as they relate to restorative dentistry.

RES D 665 Clinical Practice Teaching (1, max. 4) AWSp Supervised experience in teaching clinical fixed prosthodontics to undergraduate dental students.

College of Education

Dean

James I. Doi
222 Miller

Associate Deans

Theodore Kaltsounis
James K. Morishima

The mission of the College of Education is reflected in the following goals: (1) to conduct systematic study and research on problems, concerns, and policies of education; (2) to conduct programs that will attract and prepare those who will provide excellent leadership for the schools; (3) to experiment, innovate, and develop models for improved training of school personnel; (4) to generate new ideas for the improvement of education; (5) to become intimately involved in cooperative and coordinated research and service activities with the educational enterprise; and (6) to develop systematic procedures for ensuring adequate attention to education for minority groups.

Programs

In order to achieve its mission, the College of Education has two clusters of programs: (1) the undergraduate and professional studies and (2) the graduate studies. Each one of these clusters is administered by an associate dean. The undergraduate and professional studies programs lead to a Bachelor of Arts degree or to any of a number of professional certificates in the field of education. The various graduate programs lead to the Master of Education, Doctor of Education, or Doctor of Philosophy degrees.

Special Facilities and Services

The College of Education maintains a number of special facilities to assist in the fulfillment of its goals. Among these are the Office of Certification and Student Services, the Bureau of Educational Development and Research, and the Experimental Education Unit. In addition, the College of Education maintains formal relationships with a number of school districts in the area to provide research and field experience opportunities for the students in the various programs. The most relevant facilities for undergraduate and professional studies students are the Office of Certification and Student Services and the cooperating schools.

Undergraduate and Professional Studies

Associate Dean
201 Miller, DQ-12

Certification and Student Services
211 Miller, DQ-12

Undergraduate and professional studies consist of two major programs—the Bachelor of Arts program and the programs leading to three types of professional certificates in education: administrator certificates, educational staff associate certificates, and teaching certificates.

Undergraduate, transfer, and postbaccalaureate students may be admitted to the college when they have been accepted into the Teacher Certification Program or when they have received approval from a faculty committee of the Department of Education to begin a course of study leading to a noncertificate degree program. Students must have completed a minimum of 90 approved credits and be in good academic standing, in accordance with University regulations. Admission to the college is dependent upon admissibility to the University.

Prospective applicants to the various College of Education programs should keep in mind that the University of Washington is a research-oriented institution. Consequently, students are expected to participate, within reason, in approved research projects conducted by faculty members or other authorized individuals.

Bachelor of Arts Degree

To qualify for the Bachelor of Arts degree, students in the College of Education, in addition to meeting University requirements, must complete proficiency requirements, distribution requirements, an approved academic major, and at least 10 credits in education courses with a minimum of 2.00 grade-point average in all education courses taken following admission to the college. A minimum 2.00 cumulative grade-point average is required for the degree.

The *basic proficiency* requirements may be satisfied by (1) completion in high school of a minimum of three units (years) of college preparatory mathematics, three units (years) of a single foreign language, and four units (years) of English; or (2) completion of 15 credits at the college level in English composition, foreign-language, and/or mathematics courses; or (3) transfer to the College of Education with 85 or more acceptable transfer credits from another college of the University or from other colleges or universities. Requirements will change Autumn Quarter 1985; the Office of Certification and Student Services should be consulted.

The *distribution* requirements consist of at least 20 credits in each of the broad areas of humanities, social sciences, and natural sciences. Information about the three broad distribution areas is available in the Office of Certification and Student Services, 211 Miller. Students completing secondary-school teacher certification or those completing a degree-only program may not use courses required for the academic major to satisfy distribution requirements. However, students completing elementary-school teacher certification may include courses required for the academic major to satisfy distribution requirements.

The *academic major* may be one of those approved by the College of Education as a teaching major, or an approved individually designed interdisciplinary major consisting of a minimum of 45 approved credits. All individually designed majors must be approved in advance of the taking of course work leading to the major. This approval is given by a faculty committee of the College of Education appointed by the associate dean for Undergraduate and Professional Studies. Complete information and application materials may be obtained in the Office of Certification and Student Services, 211 Miller.

Professional Certificates in Education

Administrator Certificates

The following three kinds of administrator certificates can be pursued in the College of Education: (1) superintendent's certificate; types: Initial, Continuing. (2) principal's certificate; types: Initial, Continuing; levels: elementary, secondary, general. (3) program administrator's certificate; types: Initial, Continuing; specializations: curriculum, special education, pupil personnel services, business officials.

Information concerning admission to, and requirements for, all administrator certification programs may be obtained from the Area of Policy, Governance, and Administration, M219 Miller.

Educational Staff Associate Certificates

The College of Education is authorized by the State Board of Education to issue the following educational staff associate certificates to individuals completing appropriate approved programs in various departments of the University or units of the College of Education: communication disorders specialist, occupational therapist, physical therapist, school counselor, school psychologist, reading resource specialist, and social worker.

Information concerning requirements and admission to the various educational staff associate programs may be obtained from the appropriate departments and/or units as follows: communication disorders specialist—Department of Speech and Hearing Sciences, 1417 Northeast Forty-second Street, JG-15, Seattle, Washington 98105; occupational therapist—application materials and information packets may be purchased from the University Book Store, South Campus Branch, 301 South Campus Center, WF-15, Seattle, Washington 98195; physical therapist—application materials and information packets may be purchased from the University Book Store, South Campus Branch, 301 South Campus Center, WF-15, Seattle, Washington 98195; school counselor and school psychologist—Area of Educational Psychology, College of Education, 312 Miller, DQ-12, University of Washington, Seattle, Washington 98195; reading resource specialist—Area of Curriculum and Instruction, 115 Miller, or Area of Educational Psychology, 312 Miller, College of Education, DQ-12, University of Washington, Seattle, Washington 98195; social worker—School of Social Work, 4101 Fifteenth Avenue Northeast, Seattle, Washington 98195.

Teaching Certificates

The College of Education is authorized by the State Board of Education to prepare and recommend individuals for the Initial Teaching Certificate and the Continuing Teaching Certificate. The Teacher Certification Program is accredited by the National Council for the Accreditation of Teacher Education and by the National Association of State Directors of Teacher Education and Certification. The college also is a member of the University Council for Educational Administration. Graduates are legally qualified for certification in all states party to the Interstate Certification Compact. Information about these states is available in the Office of Certification and Student Services.

Initial Teaching Certificate

The Initial Teaching Certificate is the first level of certification in Washington. It is valid for four years and may be renewed for an additional three years. The initial certificate is available at both the elementary- and secondary-school levels. In some specializations, K-12 certificates are issued.

General Admission Requirements. To be considered for admission to the initial teacher certification program, all students must (1) have a minimum grade-point average greater than, or equal to, the University-wide undergraduate mean grade-point average; (2) obtain a satisfactory score (as defined by the college) on a test of basic skills; (3) remove any University admission deficiencies and complete basic proficiency requirements; (4) satisfy all distribution requirements; (5) complete most of an approved major (at least seventy percent required prior to admission); (6) have a grade of at least 2.0 in each course specifically required for the certificate; (7) not have a physical, mental, or sensory handicap that would preclude ability to teach successfully; (8) provide a record of documented instructional experience at the appropriate level and in the appropriate area (EDUC 301, Introductory Practicum in Community Service Activity, may be used). Items 3 and 4 do not apply to applicants who already hold a baccalaureate degree. Admission may depend on enrollment restrictions imposed by the University, availability of faculty, resources, and appropriate field placement.

Elementary-School Teacher Certification Admission Requirements. In addition to the general requirements, students applying for the elementary-school Teacher Certification Program must complete the following prerequisite courses: 3 credits in an approved arts course, GEOG 100 or approved substitute, MATH 170, 5 credits in an approved laboratory natural science course (e.g., biology, chemistry, physics). Information on additional requirements for special emphasis areas (American Indian Teacher Education, Bilingual/Bicultural Studies, Special Education) may be obtained from the Office of Certification and Student Services.

Applications are accepted during the first two weeks of the quarter preceding the desired quarter of entry. Specifically: Autumn Quarter, the first two weeks of Spring Quarter; Winter Quarter, the first two weeks of Autumn Quarter; Spring Quarter, the first two weeks of Winter Quarter. There is no Summer Quarter admission. Application forms are available in 211 Miller and must be completed and returned to an education adviser by the appropriate deadline.

Selection is based on successful completion of prerequisites and interviews with University faculty members and with public school personnel. Interviews are arranged after the application is accepted.

Secondary-School Teacher Certification Admission Requirements. Admission to the secondary-school Teacher Certification Program involves a two-phase process. Completion of the first phase (field committee recommendation) establishes eligibility to proceed to the second phase (application to the Teacher Certification Program). Procedures for both phases follow.

In addition to the previously specified general requirements, students applying to the secondary-school Teacher Certification Program must meet specific requirements established by subject-area field committees, be recommended by their academic department, and be approved by the appropriate field committee. Although application for departmental recommendation generally is made by the first week of the quarter immediately preceding the entry quarter, deadlines vary among departments. Students are urged to verify the deadline date with their departments. After recommendation by the appropriate field committee, forms for application to the Teacher Certification Program may be obtained in the Office of Certification and Student Services. Completed applications must be submitted to an education adviser by the end of the fourth week of the quarter immediately preceding the entry quarter. There is no admission Summer Quarter. Selection is based on successful completion of prerequisites and interviews with University faculty members and public school personnel arranged after the application is received.

For specific requirements established by the various subject-area committees and application procedures, candidates for secondary-level certification should address themselves to the appropriate advisory office as indicated in the following list:

Fine Arts: Art, 104 Art; Music, 331 Music.

Foreign Languages: Asian Languages and Literature, 225 Gowen; Germanics, 304C Denny; Latin, 218 Denny; Romance Languages and Literature, C108 Padelford; Scandinavian Languages and Literature, C88 Padelford; Slavic Languages and Literature, 111 Thomson.

Language Arts: Communications (Journalism), 118 Communications; Comparative Literature, B536 Padelford; Drama, 115B Drama-TV; English, A2B Padelford; Linguistics, A210 Padelford; Speech Communication, 107 Parrington.

Natural Sciences and Mathematics: Biology, 212 Johnson; Chemistry, 109 Bagley; Earth Sciences and Geological Sciences, 115 Miller; Mathematics, C36 Padelford; Physics, 215 Physics.

Social Studies: Black Studies, Bilingual-Bicultural Studies, Economics, Geography, History, International Studies, Political Science, Psychology, Society and Justice, Sociology. Information on all social studies majors is available at 211 Miller.

General Program Requirements for the Initial Certificate. With the exception of students in experimental projects, initial teacher certification at the University of Washington requires completion of a multiquarter (four quarters for elementary and three quarters for secondary), performance-based, field-oriented program. In addition to taking courses on campus, students are placed in the field and work under close supervision in various schools in Seattle or the general Seattle metropolitan area.

To qualify for an Initial Teaching Certificate, a student must hold or be eligible for a baccalaureate degree; complete an academic teaching major; complete the certification program for elementary, secondary, or K-12; and finish related requirements as explained in the following paragraphs.

Teaching certificates may be earned by students registered in colleges of the University other than Education, provided all requirements for both the teaching certificate and the degree requirements of the other college are met.

Students seeking an Initial Teaching Certificate must complete 6 credits in socioethnic studies prior to the final quarter of the teaching practicum. A minimum of 3 credits must be in a course(s) that examines the general features of ethnic diversity, cultural pluralism, economic deprivation, and cultural differences. The other 3 credits must be in a course(s) that addresses the characteristics, contributions, and problems of a particular social or ethnic group in the United States. Additional information and a list of suggested courses that fulfill the requirements may be obtained from the Office of Certification and Student Services. Students are urged to complete the socioethnic requirements prior to admission to the certification program in order to concentrate on the professional sequence after admission.

Students may earn an elementary teaching certificate with an emphasis on American Indian education, bilingual/bicultural education, or special education by completing all the requirements for the elementary teaching certificate, plus specified course work in the areas of emphasis.

Prior to the final quarter of the teaching practicum, each student must pass a performance test on the use of audiovisual equipment.

The Initial Teaching Certificate at the elementary-school level requires completion of a professional minor in elementary education.

At the secondary-school level, the Initial Teaching Certificate for science and mathematics majors requires completion of an academic minor. Although academic minors are not required, students with other majors are encouraged to broaden their teacher preparation by completing one or more minors or an area of teaching competence. Information on what course work can qualify as an area of teaching competence is available in the Office of Certification and Student Services.

At the secondary-school level, the Initial Teaching Certificate for majors in a social studies field requires completion of course work in geography, economics, world history, United States history, and Washington State history prior to the final quarter of the teaching practicum.

Students who believe they can demonstrate competencies equivalent to any of the stipulated requirements, as indicated by previous experience or by the successful completion of advanced credit examinations, should see an education adviser for assistance. Courses in professional education completed more than ten years before admission or readmission to the Teacher Certification Program are not applicable. The applicability of such courses may be reestablished by examination.

Complete details on the programs for the Initial Teaching Certificate are contained in brochures available at the Office of Certification and Student Services or may be obtained from an adviser in 211 Miller.

Majors and Minors Approved for Teaching Certificates. Listed below are the major and minor academic fields for students preparing to be elementary- or secondary-level teachers. It is the responsibility of the student to consult the selected department for requirements and course approval where requested.

AFRO-AMERICAN STUDIES—*Secondary or Elementary Major:* 60-65 approved credits from Track A or Track B. Track A—Social Studies: AFRAM 105; ECON 200; GEOG 100; HST 113; HSTAA 201, 432; POL S 210; plus 25 approved credits from the following Afro-American Studies core courses: AFRAM 250; AFRAM 362; GEOG 227; HST 361, 362; PSYCH 250, 260; SOC 463; ENGL 358. Track B—Language Arts: ENGL 271, 277, 358, 444, 391 or 393, 351 or 352 or 353. In addition, 30 approved credits from the following Afro-American Studies core courses: C LIT 261, 262, 263; DRAMA 490; ENGL 355 (Afro-American literature given special emphasis; consult with an adviser); SPHSC 100; SPCH 140, 329. *Secondary Minor:* 35 approved credits from Track A or Track B.

AMERICAN INDIAN STUDIES—*Secondary or Elementary Major:* 65 approved credits distributed as follows: Indian Studies Basic Core (30 credits): ANTH 333 or 334 or 335, 310 or 311; AIS 230, 335; EDC&I 464; plus 13 credits selected by the student and the Director of Indian Teacher Education. Social Studies Core (30 credits): ECON 200; GEOG 100; HST 113; HSTAA 201, 432; POL S 210. Elective Support Courses (5 credits minimum): AFRAM 362; AIS 313, 314, 315, 475, 499; ANTH 202; ARCHY 304, 320; GEOG 342; POL S 211; PSYCH 250, 443; EDUC 401; SOC W 501. *Secondary Minor:* 30 approved credits; same as Indian Studies Basic Core. *Elementary Minor:* See Elementary Education, American Indian Studies Emphasis.

ANTHROPOLOGY—*Secondary or Elementary Major:* 50 credits, including ANTH 202; ARCHY 205; PHY A 201; and one from ANTH 445, ARCHY 496, STAT 220, 301, or 311. A minimum of 25 credits of the required 50 must be with a grade of 3.0 or above. Students must complete at least 15 upper-division anthropology credits at this university. *Secondary Minor:* 30 credits, including ANTH 202; ARCHY 205; and PHY A 201. A minimum of 15 credits of the required 30 with a grade of 3.0 or above. (NOTE: Courses in which a student receives a 1.6 or below may not be counted toward the major or minor. ANTH 100 and ARCHY 105 may not count toward either program.)

ASIAN AMERICAN STUDIES—*Secondary or Elementary Major:* 69 approved credits, distributed as follows: Asian American Studies Core: AAS 205 and 14-22 approved credits from AAS 206, 305, 360, 370, 400, 442, 443, 490, 499. Related social science courses: ECON 200; GEOG 100, 313; HST 113; HSTAA 201, 432; POL S 210; PSYCH 448 (only when taught with an Asian American emphasis); SISEA 210 or HSTAS 211 or 212. *Secondary Minor:* 22 approved credits from the Asian American Studies Core listed above.

BILINGUAL/BICULTURAL TEACHER EDUCATION—*Elementary Major:* LING 200 or 400; EDC&I 424, 453, 456, 457; two of the following: LING 445, 447, 449, or PSYCH 457; and option A or B: Option A (Pacific/Asian): AAS 206, 305, 400; and 8 additional approved credits in AAS or Pacific/Asian languages. Option B (Spanish): SPAN 231, 465; HSTAA 180, 181; CHSTU 102; and 3 additional approved upper-division credits. *Secondary Minor:* LING 200 or 400; EDC&I 424, 454, 457; two of the following: LING 445, 447, 449, or PSYCH 457; plus option A or B: Option A (Pacific/Asian): AAS 206, 305, 400; and 3 additional approved credits in Asian American Studies or Pacific/Asian languages. Option B (Spanish): SPAN 231, 465; HSTAA 180, 181; and 3 additional approved upper-division credits.

BIOLOGY—*Secondary Major:* 47-54 approved credits, including introductory sequence A or B: Sequence A: BIOL 101-102; BOT 320, 113; Sequence B: BIOL 210, 211, 212; and either BOT 320 or 113. Either CHEM 102, or 231 and 232 and 241 (only 5 credits allowed toward 47-54 required); GENET 451; MICRO 301, 302, or 400, 401, 402; and four approved courses from the five following categories (three must have laboratories): animal physiology, plant physiology, vertebrate zoology, invertebrate zoology, ecology/ethology. A grade of 2.5 or better must be achieved in each required course. *Elementary Major:* 45-50 approved credits, including introductory sequence A or B: Sequence A: BIOL 101-102; BOT 320 or ZOOL 220; BOT 113; Sequence B: BIOL 210, 211, 212. Either CHEM 102, or 231 and 232 and 241; 25 credits of upper-division courses including 5 credits in botany and 10 credits in zoology (also see natural sciences teaching major). *Secondary Minor:* 29-30 approved credits, including 14-15 credits of upper-divison courses that include 5 credits in zoology, 5 credits in botany, and 4-5 credits in genetics or microbiology. A grade of 2.5 or better must be achieved in each required course.

CHEMISTRY—*Secondary or Elementary Major:* 60 credits, including CHEM 140, 150, 151, 160, 231, 232, 241, 242, 321, 350, 351; 414 or 416; PHYS 114, 115, 116, 117, 118, 119 or approved equivalent series; MATH 124; EDC&I 373. *Secondary Minor:* 46 credits, including CHEM 140, 150, 151, 160, 231, 232 (CHEM 351 may be substituted for CHEM 232), 241, 321, 350; PHYS 110, 111, 112, or approved equivalent series; EDC&I 373. (NOTE: For both programs, a grade of 2.5 or higher must be achieved in each required chemistry course.)

CHINESE—*Secondary Minor:* 28 approved credits. Proficiency in oral and written Chinese must be demonstrated by examination. Required courses: CHIN 311, 312, 313, or 334; a 3-credit methods course in Chinese language; elective courses to include 10 credits of the following: CHIN 293; GEOG 336; ECON 493; HSTAS 454; PHIL 414; POL S 414 or 442.

CLASSICAL STUDIES—*Elementary Major:* 64-66 approved credits, including GRK 101, 102, 103, 305, 306, 307 or 308; 310, 311, 312; or LAT 101, 102, 103, 305, 306, 307, 310, 311, 312; plus 36 credits chosen with the approval of the department from courses in 400-level Greek, 400-level Latin, classics in English, classical art and archaeology, ancient history, history of ancient philosophy, and history of ancient science. CLAS 101 and 205 and HST 111 are not acceptable.

COMPARATIVE LITERATURE—*Secondary Major:* 50 approved credits,* including C LIT 300, 301, 302; CLAS 210 or any upper-division classics course; at least two additional courses in comparative literature; at least one course in a literature other than English, studied in the original language; one of EDC&I 331, 332, 333, 334, 336, 338, 339, or 356; remaining credits to be selected from the offerings of comparative literature and the eight participating language and literature departments. *Elementary Major:* 50 approved credits,* including C LIT 300, 301, 302; CLAS 210 or any upper-division classics course; at least two additional courses in comparative literature; at least one course in a literature other than English, studied in the original language; LIBR 450 or 451; one of EDC&I 330, 335, 336, 338, or 339; remaining credits to be selected from the same as secondary major. *Secondary Minor:* 35 approved credits,* including C LIT 300, 301, 302; CLAS 210 or any upper-division classics course; at least one course in a literature other than English, studied in the original language; one of EDC&I 331, 332, 333, 334, 336, 338, 339, or 356; remaining credits to be selected from the same as secondary major.

* Ordinarily, only 300- and 400-level literature courses may be applied toward the degree.

DRAMA—*Secondary Major:* 61 credits, including DRAMA 102; 251, 252, 253, or 351, 352, 353, or 451, 452, 453; 3 credits of 298 or 498;* 230; 210, 211, 212, 290, 291, 292; 371, 372, 373; and one from 416, 475, 476, or 494. Approved upper-division electives to complete the balance. *Elementary Major:* 50 credits, including DRAMA 102; 251, 252, 253, or 351, 352, 353, or 451, 452, 453; 210, 290, or 211, 291, or 212, 292; 230, 330, 331; one from 373, 473, 475, or 476; 431 or 436; LIBR 450; ENGL 415; balance chosen from 316, 338, 433, 435, 436. EDC&I 318 is required in addition to the 50 credits. *Secondary Minor:* 33 credits, including DRAMA 102; 251, 252, 253, or 351, 352, 353, or 451, 452, 453; 210, 211, 212, 230, 316, 460.

* If 251, 252, 253 is the only acting series taken, students may substitute three production experiences for 298 or 498.

EARTH SCIENCES—(Geological Sciences Emphasis) *Secondary Major:* 64 credits, including GEOL 205, 206, 311, 320, 321, 340; CHEM 140, 150; PHYS 114, 115, 116 or 121, 122, 123; ATM S 101 or 301; ASTR 101 or 201 or 301; OCEAN 101 or 203. (Oceanography Emphasis) *Secondary Major:* 60 credits, including either OCEAN 401, 402, or 417, 418, 419; 406; 421; 433, or 434, 435; 450; MATH 124, 125, 126; CHEM 140, 150, 151, 160; PHYS 121, 122, 123; ASTR 101 or 102 or 201 or 301; ATM S 301; GEOL 205. (Astronomy Emphasis) *Secondary Major:* 60 approved credits, including 15 approved credits in astronomy; MATH 124, 125, 126; PHYS 114, 115, 116, 117, 118, 119, or 121, 122, 123, 131, 132, 133; ATM S 101; GEOL 101 or 205; OCEAN 101 or 203. (Atmospheric Sciences Emphasis) *Secondary Major:* 50-54 approved credits, including ATM S 101 or 201 or 301; 321; PHYS 114, 115, 116, 117, 118, 119, or 121, 122, 123, 131, 132, 133; ASTR 101 or 102 or 201 or 301; GEOL 101 or 205; OCEAN 101 or 203; 10-14 elective credits in atmospheric sciences and mathematics. (General Emphasis) *Secondary Major:* 60 approved credits, including ASTR 101 or 102 or 201 or 301; ATM S 101 or 301; GEOL 101 or 205 or 206; OCEAN 101 or 203; 5-credit elective in one of the above departments; BIOL 101-102 or 210, 211, 212, or equivalent; PHYS 114, 115, 116, 117, 118, 119, or 121, 122, 123, 131, 132, 133; either CHEM 101, 102, or 140, 150, 151, 160. *Secondary Minor:* 25 approved credits, including courses in each of the earth science departments: astronomy, atmospheric sciences, geological sciences, and oceanography. Available only to students with a teaching major in a science field.

ECONOMICS—*Secondary Major:* 57-60 approved credits, including ECON 200, 201, 281, 300, 301; four electives in economics chosen from a minimum of three fields of specialization other than theory (20 credits); MATH 124 or 157; and two courses to be chosen from the following list: MATH 125, 126, 305; PHIL 120, 370, 470; ACCTG 210. Remaining credits in upper-division economics courses. *Elementary Major:* 44-45 approved credits, including ECON 200, 201, 281, 300, 301; three electives in economics chosen from a minimum of two different fields of specialization (15 credits); MATH 124 or 157. *Secondary Minor:* 35 approved credits, including ECON 200, 201, 300, 301; three electives in economics chosen from a minimum of two different fields of specialization, or ECON 281 and two electives in economics chosen from two fields of specialization (15 credits).

ELEMENTARY EDUCATION—*General Teaching Minor:* 21 approved credits, including EDC&I 317 or 318 or 319; 355, 360, 361, 365, 370, 375. Prior admission to the Teacher Certification Program required. American Indian Studies Emphasis: 29-32 approved credits, including all courses listed for the General Teaching Minor plus EDC&I 464; H ED 250; EDPSY 447. Prior admission to Indian Teacher Education Program and the Teacher Certification Program required. Special Education Emphasis: 33 approved credits, including all courses listed for the General Teaching Minor plus EDSPE 404, 499, 510; and 541 or 542 or 543.

ENGLISH—*Secondary Major, College of Arts and Sciences:* 55 credits, including ENGL 390; 271 or 379 or 441; and 30 credits of approved literature courses distributed as follows: Beowulf to 1600, including Shakespeare, 5-10 credits, 1600-1780 English literature, 5-10 credits (15 credits total from each period, with at least one course from each period); nineteenth-century English literature, 5 credits; American literature before 1917, 5 credits; twentieth-century British or American literature, 5 credits. The remaining 15 credits must be in language or literature, not writing. 40 of the 55 English credits must be upper-division. EDC&I 356 is also required. Strongly recommended: 10 credits from ENGL 267, 301, 302. *Secondary Major, College of Education:* 55-56 credits, including ENGL 271 or 379 or advanced creative writing (upper-division); or 441; 390; one from 391, 392, 393, or 442; and 35-36 credits of approved literature courses distributed as follows: 10 credits from 267, 301, 302; 5 credits from 200, 201, 202, 203, 204, 221, 309, 231, 416; HSS 480; 5 credits from 311, 314, 315, 322, 396, 10 credits from 351, 352, 353, 354, 355, 356, 395; 5-6 credits from 358, 371, 372, 373, 375, 376, 444; LIBR 451; CLAS 430 or approved literature in translation. EDC&I 356 also is required. *Elementary Major:* 45-46 credits, including ENGL 271; 379 or 441; 390; one from 391, 392, or 442; and 25 credits of approved literature courses distributed as follows: 5 credits from 200, 202, 203, 204, 221, 223; 10 credits from 267, 301, 302; 10 credits from any two of the following four groups: ENGL 309, 369, 370, 416, HSS 480; ENGL 351, 352, 353, 354, 355, 356, 395; ENGL 301, 302 (if not used above), 311, 314, 315, 322, 325, 396; ENGL 372, 373, 375, 376, LIBR 450 or 451, CLAS 430. *Secondary Minor:* 30 credits, including ENGL 267; 231 or 314 or 315; 301 or 302; 271 or 379; 390, 441. EDC&I 356 also is required.

ENGLISH AS A SECOND LANGUAGE (ESL)—*Secondary or Elementary Major:* 48-54 approved credits. Prerequisite: competency in a language other than English, demonstrated by proficiency through the third-year college level or by special examination. This program is based on the availability of appropriate courses for the language preferred by the student. This major is limited to only those students who are seeking ESL certification. Language Learning Core (20 credits): SPHSC 302; LING 400, 445; PSYCH 457/LING 447; LING 449; ANTH/LING 461. Special requirements (28-34 credits): SPAN 231; AAS 205 or 206; ANTH 310 or 311; EDC&I 457; EDC&I 474 or equivalent; two approved courses on ethnic minorities; an approved course in structure or history of a language other than one's first language (a course in pedagogy is not acceptable).

FRENCH—*Secondary Major:* FREN 301, 302, 303, 304, 305, 306, 350, 351, 352, and four approved French courses at the 400 level; EDC&I 329; EDC&I 330 or 331 or 332 when available. Satisfaction of requirements must be certified by the departmental adviser before the student begins the teaching practicum (EDUC 403 or 404). *Elementary Major:* Requirements the same as for the secondary major, except the four approved electives at the 400 level are not required. *Secondary Minor:* Requirements the same as for elementary major. (NOTE: A grade-point average of at least 3.00 required for FREN 301, 302, 303; and a grade-point average of at least 3.00 required for all upper-division French courses in the major.)

GEOGRAPHY—*Secondary Major:* 50 approved credits, including GEOG 100 or 202; 205; 200 or 207; 258, 277 or 335; one from 300, 303, 342, 350, or 370; 302 or 402; one systematic and two regional geography upper-division elective courses approved by the geography adviser (15 credits). *Elementary Major:* 45 approved credits, including GEOG 100 or 202; 205; 200 or 207; 258; 277 or 335; 300 or 370; 302 or 402; one systematic and two regional geography upper-division elective courses approved by the geography adviser (15 credits). *Secondary Minor:* 25 approved credits, including GEOG 100 or 202; 200 or 207 or 277; 205 or 370; 300 or 302 or 402; one upper-division elective course approved by the geography adviser (5 credits).

GEOLOGICAL SCIENCES—*Secondary Major:* see Earth Sciences, Geological Sciences Emphasis. *Elementary Major:* 48 approved credits, including CHEM 140, 150; BIOL 101-102; GEOL 101 or 205, 206, 320, 340; 10 credits of approved upper-division geological sciences electives or approved courses in related fields.

GERMAN—*Secondary Major:* 52 approved credits, including GERM 301, 302, 303, 401, 402, 403, 310, 311, 312, 405; two from 413, 414, or 415, remaining credits upper-divison. EDC&I 336 also is required. *Elementary Major:* 24 approved upper-division credits, including GERM 301, 302, 303, 310, 311, 312, 405. EDC&I 337 also is required. *Secondary Minor:* 30 approved upper-division credits, including GERM 301, 302, 303, 310, 311, 312, 401, 402, 403. EDC&I 336 also is required.

HISTORY—*Secondary Major:* 58 approved credits, including HST 111, or HSTAM 201 or 202; HST 112 or HSTAM 203; HST 113; HSTAA 432; three additional U.S. history courses, at least two of which must be upper-division; one upper-divison modern European history course (HSTEU); one 5-credit non-Western history course; one undergraduate seminar or colloquium; one major research paper in an upper-division history course; and EDC&I 366. Sufficient electives to bring this total to 58, of which 25 must be upper-division history courses. 2.50 grade-point average in history courses taken at this university. *Elementary Major:* 58 approved credits. Requirements same as for secondary major, except that an elective may be substituted for the upper-division modern European history course, and EDC&I 366 is not required. *Secondary Minor:* 38 approved credits, including HST 111, or HSTAM 201 or 202; HST 112 or HSTAM 203; HST 113; HSTAA 201, 432; one 5-credit non-Western history course; one undergraduate seminar or colloquium; one major research paper in an upper-division history course; and EDC&I 366. 2.50 grade-point average in history courses taken at this university.

INTERNATIONAL STUDIES—*Secondary Major:* 45 approved credits in one of the following regional studies programs. The program elected should be pursued only after consultation with the appropriate undergraduate adviser. Chinese Regional Studies: HSTAS 211, 212, 213; SISEA 455; 25 credits in upper-division courses on China, including HSTAS 454; one course each in premodern China, and Chinese arts and literature. Specialization (at least three courses) in one of the following three fields: modern China, premodern China, or Chinese arts and literature. Language training through the second year (30 credits or equivalent) strongly recommended. Japanese Regional Studies: HSTAS 211, 212 (or a 5-credit course dealing with East Asia or some aspects of it that must not be entirely on Japan), 213; 25-credits in upper-division courses on East Asia, of which 15 credits must deal with Japan; SISEA 451. Language training through the second year (30 credits or equivalent) strongly recommended. Korean Regional Studies: HSTAS 211, 212, 213, 481, 482; 25 credits in upper-division courses on East Asia. Language training through the second year (30 credits or equivalent) strongly recommended. Russian and East European Studies: (Russian Regional Option) Four SISRE courses on Russia, of which one is at the 200 level, two at the 300 level, and one at the 400 level; 15 credits in a selected discipline of the area; 15 credits in upper-divison courses on Russia distributed in social science and humanities disciplines and approved by the departmental adviser. Russian language through the second year (30 credits or equivalent) strongly recommended. (East European Regional Option) Four SISRE courses on Eastern Europe, of which two are at the 200 level, one at the 300 level, and one at the 400 level; 15 credits in a selected discipline of the area; 15 credits in upper-division courses on Eastern Europe distributed in social science and humanities disciplines. Language training in one East European language (Bulgarian, Czech, Hungarian, Polish, Romanian, Serbo-Croatian) through the second year (30 credits or equivalent) strongly recommended. South Asian Regional Studies: HSTAS 201, 202; SISSA 498; 30 credits in one of the following disciplines: Asian languages and literature, anthropology, comparative religion, economics, ethnomusicology, history, linguistics, philosophy, or political science. Generally, courses relating to South Asia taught within the discipline of concentration are considered as fulfilling the 30-credit requirement. Language training in one of the languages of South Asia (Hindi, Sanskrit, Tamil, or Tibetan) through the second year (30 credits or equivalent) strongly recommended. *Secondary Minor:* 30 approved credits, selected from one of the regional programs above.

JAPANESE—*Secondary Minor:* 37 approved credits, including JAPAN 311, 312, 313; HSTAS 213; GEOG 437; POL S 435; HSTAS 423; and a methods course in teaching Japanese. Proficiency in oral and written Japanese must be demonstrated by examination.

JOURNALISM—*Secondary and Elementary Major:* 47-50 approved credits, including 15 credits from CMU 201, 202, 203; 315, 320, 324, 417, 421, 479 or 481; and 9-12 credits taken from the following electives: CMU 391, 325, 350, 400, 411, 419, 474, 479, 481, 483. *Secondary Minor:* 27 approved credits, including 15 credits from CMU 201, 202, 203; 315; and at least 13 credits from the following electives: CMU 400, 411, 417, 419, 421, 474, 479, 481, 483.

LATIN—*Secondary or Elementary Major:* 36 approved credits, including 27 credits in 400-level Latin courses, and 9 credits chosen with the approval of the Department of Classics from courses in Greek, 400-level Latin, classics in English, classical archaeology, ancient history, history of ancient philosophy, and history of ancient science. *Secondary Minor:* 18 approved credits in 400-level Latin courses.

MATHEMATICS—*Secondary Major:* 50 credits, including MATH 124, 125, 126, 205 or 302, 327, 411, 412, 444, 445; STAT 341, 342; QMETH 200 or ENGR 141 or C SCI 241 or equivalent programming experience. EDC&I 378 also is required. *Elementary Major:* 36 approved credits, including MATH 124, 125, 126, 170, 171, 205 or 302, 411, 412; and two courses from 301, 305, or STAT 341 or 342. *Secondary Minor:* 30 credits, including MATH 124, 125, 126, 205 or 302, 411, 412, 444, 445. EDC&I 378 also is required. (NOTE: The student must obtain grades of 2.0 or better in all mathematics courses presented to satisfy the mathematics requirement, and a grade-point average of 2.00 or higher must be obtained in all mathematics courses taken.)

MUSIC—Under revision. Check with departmental adviser for current requirements.

NATURAL SCIENCES—*Elementary Major:* 65-69 approved credits, including CHEM 101, 102, or CHEM 140, 150, 151, 160; PHYS 101-102, 103 (preferred) or 114, 115, 116, 117, 118, 119 or 121,

122, 123, 131, 132, 133; ASTR 101; ATM S 101; GEOL 101; OCEAN 101; and either Track A or Track B: Track A—BIOL 101-102; BOT 320 or ZOOL 220; ZOOL 118. Track B—BIOL 210, 211, 212; BOT 371 or ZOOL 330 or 362. A grade of 2.0 or better must be obtained for each course. This program is administered jointly by the departments of Botany, Chemistry, Geological Sciences, Physics, and Zoology. Approval of the major may be obtained by the student from any one of the following: chemistry adviser, geological sciences adviser, physics adviser, or Dr. Leonie Pitemick, Office of Biology Education. The office giving original authorization must continue to supervise until the approved program is completed.

NORWEGIAN—*Elementary Major:* 36 approved credits, including NORW 201, 202, 203; 300, 301, 302 or 350, 351, 352; 303, 304, 305; SCAND 450 or 455; EDC&I 339. *Secondary Minor:* 42 approved credits, including NORW 201, 202, 203; 300, 301, 302 or 350, 351, 352; 303, 304, 490; SCAND 450, 455; EDC&I 339.

PHYSICS—*Secondary Major:* 64 approved credits, including MATH 124, 125, 126 or 134, 135, 136; PHYS 121, 122, 123, 131, 132, 133, 224, 225, 334, 335, 407, 408; approved electives in mathematics, physics, or other natural sciences (minimum of 12 credits). *Secondary Minor:* biological science or nonscience majors complete Track A; physical science or mathematics majors complete Track B: Track A—35 approved credits, including PHYS 114, 115, 116, 117, 118, 119, 210, 211, 212, 407. Track B—31 approved credits, including PHYS 121, 122, 123, 131, 132, 133, 224, 225, 407, 408. (NOTE: A grade of 2.0 or better must be earned in each required course, and grades of 3.0 or better in PHYS 407 and 408, where required. Grade-point average of 2.50 or better at certification.) *Elementary Major:* see Natural Sciences.

POLITICAL SCIENCE—*Secondary and Elementary Major:* 50 approved credits, including 15 credits from POL S 101, 201, 202, 203, 204, 205; a minimum of 35 upper-division credits from three of the department's five subfields: political theory, comparative politics, international relations, American politics, and political methodology. POL S 351, American Democracy, is recommended for teachers in the state of Washington. A minimum grade-point average of 2.25 in the major is required at the time of certification. The department strongly recommends that a student intending to teach in senior high school elect a minor in history, and that a student intending to teach in junior high school complete HSTAA 201 and elect a minor in geography. *Secondary Minor:* 30 approved credits, including POL S 101, 202; one approved 5-credit upper-division elective; one course from each of three of the department's five subfields: political theory, comparative politics, international relations, American politics, and political methodology.

PSYCHOLOGY—*Secondary and Elementary Major:* 50 approved credits, including PSYCH 101 or 102; 209; 231 or 232 or 233 or 361; 213, or 217 and 218. One and one-half years of high school algebra are prerequisite for PSYCH 213; MATH 157 or 124 is prerequisite for PSYCH 217. *Secondary Minor:* 30 approved credits, including the same required courses as the major.

RUSSIAN—*Secondary and Elementary Major:* 47-57 approved credits, including RUSS 203 or equivalent; 301, 302, 303 or equivalent; 401, 402, 403 or equivalent; EDC&I 338; 10 credits from the following list of electives: SISRE 243; RUSS 321, 322, 323, 351, 352, 421, 461, 463; HSTAM 443; HSTEU 442, 444, 445; SLAV 351. *Secondary Minor:* 23 approved credits, including RUSS 301, 302, 303 or equivalent; EDC&I 338; and 6 credits from the above list of electives.

SOCIETY AND JUSTICE—*Secondary and Elementary Major:* Requirements the same as the Society and Justice major in the College of Arts and Sciences; see departmental adviser for a list of required courses. *Secondary Minor:* 29-30 approved credits, including one from BG&S 200, POL S 462, or SO JU 440; one from SOC 270, 271, 371, 472, PSYCH 305; SOC 372 or POL S 464; SOC 473 or SO JU 430; and 10 approved credits in the social sciences or humanities.

SOCIOLOGY—*Secondary and Elementary Major:* Under revision. Check with department adviser for current requirements.

SPANISH—*Secondary Major:* 56 approved credits above SPAN 203, including SPAN 301, 302, 304, 305, 306, 307, 350, 351, 352; 25 credits of 400-level Spanish (ROM 401 may also be counted); EDC&I 329, and one from 333, 334, or 335. *Elementary Major:* 41 approved credits above SPAN 203, including SPAN 301, 302, 304, 305, 306, 307, 350, 351, 352; two 400-level Spanish courses (ROM 401 may also be counted); EDC&I 333 or 334 or 335. *Secondary Minor:* 36 approved credits, same as for elementary major.

SPECIAL EDUCATION—*Elementary Minor:* see Elementary Education, Special Education Emphasis. Other special education minors are available to students combining a master's degree in special education with teaching certification. See an education certification adviser for required courses.

SPEECH AND HEARING SCIENCES—*Elementary Major:* 51-55 approved credits, including SPHSC 201, 250, 302, 303, 307, 310, 311; 25 credits selected from the following: SPHSC 315, 330, 332, 380, 401, 402, 410, 420, 430, 431, 450, 454, 484, 499.

SPEECH COMMUNICATION—*Secondary Major:* 60 approved credits, including SPCH 102, 140, 203, 220, 270, 334, 368, 369, 373, 456; EDC&I 357; 13 credits in approved electives in speech, including 5 credits at the 400 level (excluding SPCH 499). *Elementary Major:* 48 approved credits, including SPCH 102, 140, 203, 341, 368 (or approved substitute), 369, 373, 455, SPHSC 250; 15 credits of approved electives, including 5 credits at the 400 level (excluding SPCH 499). *Secondary Minor:* 35 approved credits, including SPCH 102, 203, 220; 373, or 368 and 369; 456; EDC&I 357; 8 credits of approved electives in speech, of which 5 credits must be upper-division. (NOTE: Grade-point average of 2.60 required. After two or more quarters at this university, the grade-point average of transfer students will be based on courses taken here only. A 2.50 grade-point average required in all speech communication courses.)

SWEDISH—*Elementary Major:* 36 approved credits, including SWED 201, 202, 203; 300, 301, 302 or 350, 351, 352; 303, 304, 305; SCAND 312 or 455; EDC&I 339. *Secondary Minor:* 42 approved credits, including SWED 201, 202, 203; 300, 301, 302 or 350, 351, 352; 490; SCAND 312, 455; EDC&I 339. (NOTE: Grade-point average of 2.50 required for both programs.)

Continuing Teaching Certificate

Renewing the Initial Teaching Certificate. The Initial Teaching Certificate is valid for a four-year period and may be renewed once for an additional three years by meeting the following requirements: (1) Complete 15 credits applicable to the requirements for the Continuing Teaching Certificate. An official transcript of renewal credits must be on file in the Office of Certification and Student Services. The credits must be earned in the seven years immediately preceding the date of application for renewal, provided that no more than ten years have passed since completion of an approved preparation program for the Initial Teaching Certificate. (If more than ten years have passed since completion of that program, the State Department of Public Instruction should be consulted about reinstatement requirements and procedures.) (2) File an approved Continuing Teaching Certificate Study Plan in the Office of Certification and Student Services, 211 Miller. (3) Complete the renewal application form and send it to the Educational Service District with the $15 renewal fee (a check or money order should be made payable to the Educational Service District). Instruct that office to send the completed form to the Office of Certification and Student Services, 211 Miller, DQ-12, University of Washington, Seattle, Washington 98195.

Converting to the Continuing Teaching Certificate. The Continuing Teaching Certificate is valid in grades K-12 while the teacher is in educational service and for a period of seven years thereafter.

Requirements

Teaching Experience. The candidate must complete three years of service as a teacher, of which at least two years must be in grades K-12. A valid teaching certificate must be held while meeting this requirement.

Course Work. (1) A minimum of 45 quarter (30 semester) credits of course work must be completed after receiving the baccalaureate degree, distributed as follows: (a) A minimum of 3 credits is required in each of the following five generic standards—staff development and supervision, professional development and scholarship, research and evaluation, referral agencies and resource personnel, knowledge of alternate grade level. (b) A minimum of 15 credits in an area of concentration. (c) Elective credits (1-15) to attain the required 45 credits. Numerous courses, including regular, extension, and summer school offerings, are available. Suitable professional equivalents, if approved, may be included in the Continuing Teaching Certificate Study Plan. (2) 30 credits must be earned after at least one year (180 days) of teaching. (3) Credits must include academic and education course work. (4) At least half the course work (22½ credits) must be taken at the University of Washington. (5) A minimum grade of 2.0 is required in each course taken for the certificate (*Cr* and *S* grades are acceptable). (6) All course work must be upper-division (300 and 400 series) or graduate level. (7) A maximum of 5 credits of correspondence study may be approved. (8) No distinction will be made between extension and residence credits. (9) All courses are to be taken through an approved four-year institution. (10) Education courses taught in Washington by out-of-state institutions or agencies that do not have the approval of the State Board of Education are not acceptable for the Continuing Teaching Certificate.

Recency. Candidates must have served in an educational setting or have completed 15 quarter (10 semester) credits at an accredited four-year institution within the seven years immediately preceding application for a certificate.

Procedures for Applying. (1) Apply for admission to the University of Washington: (a) as a postbaccalaureate student, at 320 Schmitz, or (b) as a graduate student, at 98 Administration. Persons interested in working toward a master's degree and a Continuing Teaching Certificate concurrently should contact the Education Graduate Office, 206 Miller, or the department from which they plan to obtain a graduate degree. (2) File an approved Continuing Teaching Certificate Study Plan in the Office of Certification and Student Services, 211 Miller. (3) Submit to the certification office verification of one year of teaching experience completed prior to taking the last 30 credits. (4) Complete the state of Washington Institutional Application for a Teacher's Certificate and send it to your Educational Service District with the $15 fee (a check or money order should be made payable to the Educational Service District). Instruct that office to send the completed application, with attached receipt, to the Office of Certification and Student Services, 211 Miller, DQ-12, University of Washington, Seattle, Washington 98195.

Endorsements to Four-Year Initial Teaching Certificate

Individuals preparing for or holding a four-year initial teaching certificate under the 1978 guidelines may add endorsements to their certificates indicating that they are minimally prepared to teach in subjects and/or at levels other than those in which they are principally endorsed.

Certificates for administrators under the 1978 guidelines also may be endorsed for the role of principal, program administrator, or superintendent. Certificates for educational staff associates may be endorsed for the role of communication disorders specialist, counselor, psychologist, social worker, occupational therapist, physical therapist, or reading resource specialist.

For more information on available endorsements through the University of Washington and on specific requirements for each available endorsement, interested individuals should contact the Office of Certification and Student Services, 211 Miller.

Graduate Degree Programs

James K. Morishima, Associate Dean for Graduate Studies and Research, Graduate Program Coordinator

The College of Education offers three advanced degrees: Master of Education, Doctor of Education, and Doctor of Philosophy. Graduate students may specialize their degree studies in curriculum and instruction; educational psychology; policy, governance, and administration; or special education. Questions regarding graduate study in education should be directed to the Office of Graduate Studies and Research, 206 Miller, DQ-12, College of Education, University of Washington, Seattle, Washington 98195.

Master of Education Degree

The Master of Education degree requires a minimum of 45 credits, including at least 15 credits in a special area of study in education; 9 credits related to but outside of the specialization; 9 thesis credits or, for the nonthesis option, 9 credits in a field study or other approved project; and a final examination.

Doctor of Education Degree

The Doctor of Education degree is designed to prepare professionals whose primary interest is to deal directly with problems of educational practice. The program of study leading to the Doctor of Education degree, as a professional degree, focuses on the utilization of research knowledge and practitioners' knowledge, rather than on the production of research knowledge. Those who aspire to positions as master teachers, curriculum designers, or learning resource specialists, for example, would appropriately seek the Doctor of Education degree.

This professional degree requires at least two years of resident study, 48 credits of specialized study, sufficient preparation in research methodology to interpret research findings for use in practice, an internship and other practica, a General Examination, a dissertation on a problem of educational practice, and a Final Examination.

Doctor of Philosophy Degree

The Doctor of Philosophy degree in education is specifically a research degree. While the typical recipient of the Doctor of Education degree becomes an educational practitioner in the schools or other educative agencies, the holder of the Doctor of Philosophy degree is prepared for a career of research on issues fundamental to the conduct of education—issues that range from fairly narrow questions about human learning to macroquestions regarding the form of societies' educational institutions.

Degree requirements include minimally two years of resident study, a program of specialized study with credits both in education and in other academic units, preparation in research methodology adequate to design and assess research in the field of specialization, sufficient study in cognate fields inside and outside of education to ensure that the candidate can place the specialized research in a broader context, a General Examination, a research dissertation, and a Final Examination.

Admission Requirements

Admission to graduate degree programs in education is competitive, with space limited by faculty size and facilities. To be considered in the competition for admission to the Master of Education programs, the applicant must have earned a baccalaureate degree from an accredited institution, have been admitted to the Graduate School, have submitted a score on the Miller Analogies Test or the Graduate Record Examination Aptitude Test, and have satisfied additional prerequisites specified by the area of specialization.

Consideration for admission to either doctoral program requires a master's degree or equivalent preparation in a field appropriate to the area of specialization, usually at least a 3.50 grade-point average in the master's program, satisfaction of special prerequisites specified by the area of specialization, and completion of the application steps outlined in *The Doctor's Degree in Education: Summary of Procedures* (available in the Office of Graduate Studies and Research, 206 Miller, DQ-12).

Financial Aid

Research and teaching assistantships in the College of Education are available on a competitive basis. To be considered for an appointment, the graduate student must show exceptional academic promise. Doctoral applicants are given priority.

Specific information on the various types of remunerative appointments for graduate students in education, amounts of stipends, application procedures, and deadlines may be obtained from the University of Washington College of Education, Office of Graduate Studies and Research, 206 Miller, DQ-12, Washington 98195.

Special Research Facilities

Within the College of Education are opportunities for students to gain research experience through four organizations. The Bureau of Educational Development and Research provides support service to the college in its generation of new knowledge that enchances the quality of education throughout the state and nation. The Clinical Service and Research Center, operating under the aegis of Educational Psychology, offers research facilities ranging from observation rooms equipped with videorecorders to central computer terminals, microcomputers, and a library. The world-renowned Experimental Education Unit offers an interdisciplinary approach to research, training, and service provision for handicapped children and their families. The Institute for the Study of Educational Policy, which promotes interdisciplinary research that bears on education policy, provides a point of contact between the University and the educational policy researchers and analysts throughout the state. The Teacher Education Research Center assists faculty members and graduate students in conducting research and evaluation on teacher education.

Faculty

Professors

Abbott, Robert D.,* Ph.D., 1970, Washington; measurement, statistics and research design.

Affleck, James Q.,* Ed.D., 1968, Columbia; special education (severely handicapped).

Anderson, Robert A.,* Ph.D., 1964, Minnesota; educational administration.

Banks, James A.,* Ph.D., 1969, Michigan State; studies and multiethnic education.

Bolton, Dale L.,* Ph.D., 1958, Wisconsin; educational administration.

Borgatta, Edgar F.,*‡ (Sociology), Ph.D., 1952, New York; Director, Institute on Aging; methodology, social psychology, demography-ecology.

Boroughs, Homer, Jr. (Emeritus), Ph.D., 1949, Washington; history and philosophy of education.

Brammer, Lawrence M.,* Ph.D., 1950, Stanford; counseling, adult development.

Briggs, J. Robert (Emeritus), Ed.D., 1954, Stanford; business education.

Brown, Frances A. (Emeritus), M.A., 1950, Columbia; business education.

Burgess, Charles O.,* (History), Ph.D., 1962, Wisconsin; history of education.

Butterfield, Earl C.,* (Psychology), Ph.D., 1963, George Peabody; human development and cognition.

Dohner, Charles W.,* (Medicine),† Ph.D., 1966, Ohio State; educational psychology/research in medical education.

Dol, James I.,* Ph.D., 1952, Chicago; finance and management of colleges and universities.

Driscoll, John P.,* Ph.D., 1957, Pennsylvania State; educational communications.

Edgar, Eugene B.,* Ph.D., 1972, George Peabody; special education (early childhood).

Evans, Ellis D.,* Ed.D., 1964, Indiana; human development and cognition.

Fea, Henry R. (Emeritus), Ph.D., 1950, California (Berkeley); educational psychology.

Fewell, Rebecca R.,* Ph.D., 1972, George Peabody; special education (early childhood).

Foster, Clifford D. (Emeritus), Ph.D., 1957, Washington; elementary education (curriculum).

Freehill, Maurice F.,* Ed.D., 1948, Stanford; school psychology/human development and cognition.

Gites, Frederic T. (Emeritus), Ed.D., 1961, Washington State; higher education.

Haring, Norris G.,* Ed.D., 1956, Syracuse; special education (early childhood).

Hawk, Richard L.,* Ed.D., 1965, Washington State; educational communications.

Hayden, Alice H. (Emeritus), Ph.D., 1932, Purdue; special education.

Hunkins, Francis P.,* Ph.D., 1966, Kent State; curriculum.

Jarolimek, John,* Ph.D., 1955, Minnesota; social studies.

Jenkins, Joseph R.,* Ph.D., 1967, Minnesota; special education (mildly handicapped).

Kaltsounis, Theodore,* Ph.D., 1961, Illinois; social studies.

Kerr, Donna H.,* Ph.D., 1973, Columbia; philosophy of education.

Klockars, Alan J.,* Ph.D., 1967, Washington; measurement, statistics and research design.

Legters, Lyman H.,*‡ (International Studies), Ph.D., 1958, Free University (Berlin); educational policy studies and Russian and East European studies.

Lovitt, Thomas C.,* Ed.D., 1966, Kansas; special education (mildly handicapped).

Lowenbraun, Sheila,* Ph.D., 1969, Columbia; special education (hearing impaired).

Lumsdaine, Arthur A. (Emeritus), (Psychology),† Ph.D., 1949, Stanford; educational psychology, psychology.

Madsen, David L.,* Ph.D., 1961, Chicago; history of education.

McCartin, Rosemarie E.,* Ph.D., 1964, Southern California; school psychology/human development and cognition.

Meacham, Merle L.,* Ed.D., 1965, Washington State; school psychology.

Morishima, James K.,* Ph.D., 1967, Washington; human development and cognition.

Morris, Arval A.,*‡ (Law), LL.D., 1972, Colorado College; educational policy studies, law.

Neel, Richard S.,* Ph.D., 1972, Southern California; special education.

Odegaard, Charles E.* (Emeritus), Ph.D., 1937, Harvard; higher education.

Olstad, Roger G.,* (Environmental Studies), Ph.D., 1963, Minnesota; science education.

Peckham, Percy D.,* Ph.D., 1968, Colorado; measurement, statistics and research design.

Powers, Francis F. (Emeritus), Ph.D., 1928, Washington; educational psychology.

Reitan, Henry M.,* Ph.D., 1950, North Dakota; higher education.

Salyer, Rufus C., Jr. (Emeritus), Ph.D., 1955, Washington; educational psychology.

Sax, Gilbert,* (Psychology),† Ph.D., 1958, Southern California; measurement, statistics and research design.

Schill, William J.,* Ed.D., 1963, California (Los Angeles); higher education.

Sebesta, Sam L.,* Ed.D., 1963, Stanford; reading/language arts.

Strayer, George D., Jr. (Emeritus), Ph.D., 1934, Columbia; educational administration.

Torkelson, Gerald M.,* Ed.D., 1953, Pennsylvania State; educational communications.

Tostberg, Robert E.,* Ph.D., 1960, Wisconsin; philosophy of education.

Associate Professors

Andrews, Richard L.,* Ph.D., 1968, Purdue; policy, governance, and administration.

Beal, Jack L.,* Ph.D., 1972, Nebraska; secondary mathematics education.

Billingsley, Felix F.,* Ph.D., 1974, Washington; special education (severely handicapped).

Broedel, John W.,* (Psychology),† Ed.D., 1958, Illinois; school psychology, psychology.

Brown, Robert L.,* Ed.D., 1961, Arkansas; school psychology.

Cope, Robert G.,* Ph.D., 1967, Michigan; higher education.

Dimmitt, Norma M.,* Ed.D., 1970, Stanford; teacher education/curriculum.

Forster, Jerald R.,* Ph.D., 1966, Minnesota; counseling.

Frerichs, Alberta J., M.Ed., 1951, Nebraska; business education.

Gonzales, Phillip C.,* Ed.D., 1974, Oklahoma State; reading/language arts (bilingual).

Gray, Carol Ann,* Ph.D., 1971, Washington; school psychology/human development and cognition.

Hansen-Krening, Nancy M.,* Ph.D., 1974, Oregon; reading/language arts.

Jussila, Clyde F.,*‡ (Music), M.S., 1951, Kansas; music.

Kelly, Samuel E. (Emeritus), Ph.D., 1971, Washington; higher education.

Kersh, Mildred E.,* Ph.D., 1971, Chicago; mathematics education, gifted education.

Lawrence, George L.,* Ed.D., 1968, George Peabody; counseling.

Mizokawa, Donald T.,* Ph.D., 1974, Indiana; human development and cognition.

Nolen, Patricia A.,* Ph.D., 1970, Washington; school psychology/human development and cognition.

Olch, Doris,* Ph.D., 1968, Washington; school psychology.

Ostrander, Kenneth H.,* Ed.D., 1968, Tennessee; educational administration.

Ryckman, David B.,* Ed.D., 1966, Illinois; special education (mildly handicapped).

Smith, John P.,* Ed.D., 1969, Stanford; science education.

Standal, Timothy C.,* Ph.D., 1976, Minnesota; reading/language arts.

Sulzbacher, Stephen I.,‡ (Psychiatry and Behavioral Sciences, Pediatrics), Ph.D., 1971, Washington; special education.

Thalberg, Stanton P.,* Ph.D., 1964, Iowa; school psychology.

Thompson, Marie D.,* Ph.D., 1970, Washington; special education (hearing impaired).

Vasquez, James A.,* Ph.D., 1973, California (Los Angeles); learning (minority youth)/bilingual education.

Williams, Donald T., Jr.,* Ph.D., 1963, Stanford; higher education.

Assistant Professors

Bashey, Husain I., Ph.D., 1975, Oregon; counseling.

Batie, Harriett V. (Emeritus), Ph.D., 1953, Washington; educational psychology.

Estler, Suzanne E.,* Ph.D., 1978, Stanford; higher education.

Fenner, Robert H., Ph.D., 1965, Colorado; counseling.

Gehrke, Nathalie J.,* Ph.D., 1976, Arizona State; curriculum.

Lavelle, Judith K., Ph.D., 1974, Purdue; counseling.

White, Owen R.,* Ph.D., 1971, Oregon; special education (severely handicapped).

Lecturer

Settles, Ivan L., Ed.D., 1967, Washington State; educational administration.

Course Descriptions

Policy, Governance, and Administration—Educational Administration

EDADM 430 Public School Administration (3) AWSpS Introduction to theories and practices of administering public schools; designed for persons who are not majoring in educational administration. Structure of school organizations, supervision of personnel, planning problems encountered at various levels, interpretation of the school program to the public, formation of policies, decision making, administration of the instructional program, finance and business management, school housing, appraisal of the school system, and leadership in democratizing school administration.

EDADM 450 Workshop: Educational Administration Processes (1-6, max. 6) AWSpS Reality-based materials and activities are used in a workshop situation: students have the opportunity to develop materials and share resources in a variety of current topic areas such as: selection of teachers, evaluation of teachers, supervisory techniques, administration of negotiated agreements, improvement of organizational climates, business management procedures, planning processes, evaluation of school programs, school-community relationships, functioning of teachers and administrative teams.

EDADM 499 Undergraduate Research (*) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program. Prerequisite: permission of instructor.

EDADM 500 Field Study (*) Individual study of an educational problem in the field under the direction of a faculty member. Prerequisites: approved plan of study, and permission of the instructor filed in the Office of Educational Administration in the College of Education.

EDADM 501 Administration of School Programs (3) AWSpS *Anderson, Bolton* Information and management techniques useful for setting priorities and goals for educational organizations, for providing procedures for allocation of human resources, and for evaluating educational programs. Topics include bases for educational programs, needs assessment, goal setting, administering the curriculum and school programs, staff utilization and development, staff morale, and program evaluation. Prerequisite: graduate standing.

EDADM 502 Leadership in Personnel Systems in Schools (3) AWSpS Emphasizes the human elements of educational administration, including such topics as adult motivation and learning, leadership, change strategies, managerial styles, selection and evaluation of personnel, and personnel systems. Prerequisite: graduate standing.

EDADM 504 Social Power in the Educational Environment (3) AWSpS *Ostrander* Factors contributing to the development and use of social power: conflict between organizational expectations and individual needs; self-esteem; the dynamics of collective action. Impact of social power on administrative roles and processes, including due process as managed in a school setting. Prerequisite: graduate standing.

EDADM 505 Environmental Setting for Educational Administration (3) AWSpS *Andrews* Theoretical bases and practical integration of schools within the social/environmental context. Topics include schools as complex organizations, schools as open systems interacting with other open systems, power, and consensus mechanisms. Prerequisite: graduate standing.

EDADM 507 School Finance (3) AWSpS Objective is to aid students to acquire knowledge and understanding of the technical aspects of educational administration. Financial practices and problems, including state and federal support plans, school plant planning, school business management, resource allocation, and budgeting and educational accountability. Prerequisite: graduate standing.

EDADM 508 School Planning and Evaluation (3) AWSpS Firsthand experience in applying planning and evaluation methods to sample educational programs. Includes school scheduling, network planning, information systems, program planning and budgeting, school-plant planning, and enrollment projections. Prerequisite: graduate standing.

EDADM 519 Laboratory in Educational Administration (1-3, max. 3) AWSpS Series of extended class sessions that engages students in building skills related to concepts taught in the regular courses. Skill building activities parallel the tasks facing building-level and central office administrators in the public and private schools. Prerequisites: completion of all other requirements for principal or program administrator certificate and permission of instructor.

EDADM 537 Special Problems in Educational Administration and Supervision (3, max. 9) AWSpS *Anderson, Andrews, Bolton, Ostrander* Readings, lectures, and discussions of topics of special and current interest to school administrators or supervisors. Reports on new developments in research. Topics vary each year. Prerequisite: master's degree or permission of instructor.

EDADM 551 Seminar in School Supervision (3) AWSpS *Anderson, Bolton* Theory of the process of supervising school personnel, including an analysis of the techniques of supervision, theory of leadership and group process, interpersonal relations, and evaluation of teacher effectiveness. Prerequisite: master's degree or permission of instructor.

EDADM 552 Seminar in School Personnel Administration (3) AWSpS *Bolton* Major emphasis on the analysis of factors to be considered in the selection and evaluation of teachers, including determination of relevant criteria, acquisition and analysis of data, planning and decision processes. Less emphasis is given to other school personnel topics. Prerequisite: master's degree or permission of instructor.

EDADM 554 School-Community Relations (3) AWSpS *Andrews, Ostrander* Examines the dynamics of the interface between the public schools and the community. Special attention is given to the findings of research in relation to school-community power, types, and organizational influences. Offered on credit/no credit basis only. Prerequisite: master's degree or permission of instructor.

EDADM 555 The Law and Education (3) AWSpS *Ostrander* Examination of court cases associated with the rights of individuals and groups in educational organizations. Attention is given to the understanding of administrative due process requirements and to the growing body of administrative law affecting student and personnel management. Prerequisite: master's degree or permission of instructor.

EDADM 556 Seminar in Conflict Management (3) AWSpS *Ostrander* Examination of procedures and techniques pertinent to the management of organizational conflict. Among the areas covered are collective bargaining, grievance procedures, mediation, fact finding, and arbitration. Prerequisite: master's degree or permission of instructor.

EDADM 557 Seminar in Administration: Finance (3) AWSpS Current problems in school finance, including costs, ability to support schools, and financial implications of educational principles. The economics of public education. Problems of federal, state, and local school support. Financing capital outlay, research, and public relations. Prerequisite: master's degree or permission of instructor.

EDADM 558 Seminar in Administration: School Buildings (3) AWSpS *Schneider* Survey of problems and issues faced by educational administrators that are impacting on educational facilities. Directed readings and informal discussion of the people, processes, programming, planning, and evaluation of ways and means of accommodating changes due to identifiable problems and issues. Prerequisite: master's degree or permission of instructor.

EDADM 570 Workshop in Educational Administration (2-6) AWSpS Workshop focuses on current problems facing educational administration. Topics may include personnel management, supervision of personnel, professional negotiations, selection and planning procedures, power relationships, school-community relationships. Prerequisite: master's degree or permission of instructor.

EDADM 571 Seminar in Human Relations in Educational Administration (3) AWSpS *Anderson, Bolton* Analysis of factors involved in human relations problems related to operation of public schools. Motivation, perception, communication, role analysis, and dynamics of groups are studied through use of cases and simulated situations. Offered on credit/no credit basis only. Prerequisite: master's degree or permission of instructor.

EDADM 577 Seminar in Educational Planning and Organization (3) AWSpS Application of principles utilized in planning and organizing public schools. Formation of policy and procedures; formal and informal organization; power, authority, and responsibility; utilization of people, time, and space. Offered on credit/no credit basis only. Prerequisite: master's degree or permission of instructor.

EDADM 578 Seminar in Educational Decision Making (3) AWSpS *Andrews, Bolton* Analysis of nature of decisions in educational setting. Consideration of theory of decisions, social and psychological constraints, and application in simulated situations. Offered on credit/no credit basis only. Prerequisite: master's degree or permission of instructor.

EDADM 579 Internship in Educational Administration: Superintendent (1-6, max. 6) AWSpS *Anderson, Andrews, Bolton, Ostrander* Recommended for candidates preparing for superintendent positions other than those having sufficient experience in central offices of school districts. Half-time work in a school district or districts for one, two, or three quarters, depending upon the student's previous experience. Supervision by staff members of the College of Education and the superintendent of schools in the selected school district. Prerequisites: completion of all other requirements for superintendent's credential and permission of instructor.

EDADM 599 Independent Studies in Education (*) Independent studies or readings of specialized aspects of education. Registration must be accompanied by a study prospectus endorsed by the appropriate faculty adviser for the work proposed, and which, with permission of the instructor, must be filed with the Office of Educational Administration in the College of Education. Prerequisite: permission of instructor.

EDADM 601 Internship (3-9, max. 9) AWSpS *Anderson, Andrews, Bolton, Ostrander, Settles*

Educational Curriculum and Instruction

EDC&I 132 Spanish for the Elementary School (5) Practice in the basic language skills is combined with demonstration and analysis of methods and techniques appropriate to the Foreign Languages in Elementary Schools program. Emphasis is given to the language structures and vocabulary that normally occur in elementary school Spanish. Offered jointly with SPAN 128.

EDC&I 317 Art in Childhood Education (3) *Koenig, Solberg* Provides the general elementary student with a theoretical and practical background for teaching art to children. Prerequisites: ART 200, DRAMA 200, or MUSIC 200 and admission to the Teacher Certification Program.

EDC&I 318 Drama in Childhood Education (3) Provides the student with a theoretical and practical introductory background of fundamentals for teaching drama to children as a creative process and mode of learning. Prerequisites: ART 200, DRAMA 200, or MUSIC 200 and admission to the Teacher Certification Program.

EDC&I 319 Music in Childhood Education (3) AWSp *Cooper* Provides the student with a theoretical and practical introductory background to the fundamentals of music and for teaching music to children as a creative process and mode of learning. Prerequisites: ART 200, DRAMA 200, or MUSIC 200 and admission to the Teacher Certification Program.

EDC&I 320 Organization of School Programs in Communication Disorders (3) *Willett* Study of the organization and management of school programs designed to alleviate disorders of communication, K-12. Special emphasis on field experiences. Open only to majors in communication disorders. Prerequisites: EDPSY 304, SPHSC 350 and 351, or SPHSC 391.

EDC&I 329 Teaching Foreign Language in the Secondary School (2) Basic course in the methods of teaching foreign languages in the secondary school. Prerequisite: EDPSY 304.

EDC&I 330, 331, 332 The Teaching of French (3,3,3) Elementary, junior high, and senior high emphases. Prerequisites: EDPSY 304 and demonstration of language proficiency.

EDC&I 333, 334, 335 The Teaching of Spanish: Secondary Emphasis, Elementary and Junior High School Emphasis, Elementary Emphasis (3,3,3) Prerequisite to teaching practicum. Elementary, junior high, and secondary emphases. Prerequisites: 329, EDPSY 304, and demonstration of language proficiency.

EDC&I 336 The Teaching of German in Secondary Schools (3) *Rabura* Taught concurrently with GERM 576. Prerequisites: 329, EDPSY 304, GERM 303, or permission of instructor.

EDC&I 337 The Teaching of German in Elementary Schools (3) *Rabura* Objectives and methods of the Foreign Languages in Elementary Schools program. Taught concurrently with GERM 576. Prerequisites: 329, EDPSY 304, GERM 303, or permission of instructor.

EDC&I 338 The Teaching of Russian (2) Special methods in the teaching of Russian to acquaint prospective teachers with materials, methods, and problems. Prerequisites: 329, EDPSY 304, and permission of instructor.

EDC&I 339 The Teaching of Scandinavian (Norwegian, Swedish) (2) Special methods in the teaching of Norwegian and Swedish to acquaint prospective teachers with materials, methods, and problems. Prerequisites: 329, EDPSY 304, and permission of instructor.

EDC&I 340 Elementary Art Education (3) Study of the stages of development in the art of the young child as expressed through the child's creative and mental growth.

EDC&I 341 The Teaching of Art in the Secondary School (3) For majors in secondary art education planning to teach on the junior or senior high school level. Prerequisite: EDPSY 304.

EDC&I 343 Music in the Elementary School: Intermediate Grades (3) For students majoring in elementary education (not open to music specialists). A study of music in the development of children, with attention to musical activity and the growth of related concepts and skills. Prerequisites: EDPSY 304 and MUSIC 119.

EDC&I 344 Materials and Methods of Teaching Chinese (3) Methods specifically pertaining to the teaching of Chinese language are discussed. Existing textbooks are reviewed. Each student is required to write a lesson, draw up a teaching plan, and teach a class before the end of the quarter. Prerequisites: 329, EDPSY 304, and CHIN 313, or equivalent.

EDC&I 353 Teaching in the Elementary School (3) Emphasizes selected teaching modes; classroom management procedures; grouping to accommodate pupils with special needs; utilization of learning resources; evaluation of teaching.

EDC&I 354 Teaching in the Secondary School (3) Development of basic skills in instructional methods, lesson planning, classroom management procedures, evaluation of teaching.

EDC&I 355 Language Arts in the Elementary School (3) *Hansen-Krening* Basic course in planning and teaching elementary language arts: listening and speaking, written composition, handwriting, spelling, creative and practical writing. Prerequisite: EDPSY 304.

EDC&I 356 The Teaching of English (3) Combines theoretical understanding of teaching with specific techniques and materials for literature, language, composition, and mass media at the secondary level; coordinated with concurrent experience in schools. Prerequisite: EDPSY 304.

EDC&I 357 The Teaching of Speech (3) *Staton-Spicer* Special methods course in the teaching of speech communication at the secondary level. Prerequisites for majors in speech communication: EDPSY 304, at least 20 credits in speech communication; for nonmajors: permission of instructor.

EDC&I 360 Reading in the Elementary School (3) *Gonzales, Sebesta, Standal* Basic course in methods, techniques, and materials used in the teaching of reading from the readiness period through decoding and comprehension skills teaching in primary and intermediate grades. Prerequisite: EDPSY 304.

EDC&I 361 Basic Skills in Reading (3) *Gonzales, Standal* Developmental readiness for reading; diagnostic teaching of reading in the classroom; reading instruction for bilingual learners; reading for special learners; developing the least restrictive environment; teaching functional reading and study skills; and materials and approaches for teaching reading. Prerequisites: 360 and EDPSY 304.

EDC&I 365 Social Studies in the Elementary School (3) *Banks, Foster, Jarolimek* Basic course in the planning and teaching of social studies in the elementary school. Prerequisites: EDPSY 304 and GEOG 100.

EDC&I 366 The Teaching of Social Studies in Secondary Schools (3) *Banks, Jarolimek* Application of educational principles and methods to the teaching of social studies on the junior and senior high school levels. Prerequisite: EDPSY 304. (Offered alternate years by the Department of History, beginning 1984-85.)

EDC&I 370 Science in the Elementary School (3) *Olstad, Smith* Basic course in the teaching of science in the elementary school with special emphasis on the nature of science as a process of inquiry. Prerequisites: EDPSY 304 and 5 credits in an approved laboratory natural science course (biology, chemistry, or physics).

EDC&I 371 Teaching Science in the Secondary School (3) *Olstad* Basic course in the teaching of science in the secondary school with special emphasis on the nature of science as a process of inquiry. Prerequisite: EDPSY 304.

EDC&I 372 The Teaching of Biology (2) *Deyrup-Olsen* Prerequisites: 371, EDPSY 304, and 25 credits in biology.

EDC&I 373 The Teaching of Chemistry (3) Prerequisites: 371, EDPSY 304, and at least 20 credits in college chemistry.

EDC&I 375 Mathematics in the Elementary School (3) *Beal, Kersh* Examination of the learning and teaching of elementary mathematics (grades K-6); in light of recent theoretical and pedagogical developments. Prerequisites: EDPSY 304, MATH 170.

EDC&I 378 Teaching Mathematics in the Secondary School (3) *Beal, Kersh* Basic course in the teaching of mathematics in the secondary school for preservice teachers. Prerequisite: EDPSY 304 or permission of instructor.

EDC&I 424 Multiethnic Curriculum and Instruction (3) *Banks* Primarily for preservice and in-service teachers who have little or no previous exposure to issues related to ethnicity and schooling. Designed to help teachers better understand the school's role in the ethnic education of students and acquire the insights, understandings, and skills needed to design and implement curricular and instructional strategies that reflect ethnic diversity. Prerequisite: admission to Teacher Education Program, teaching experience, or permission of instructor.

EDC&I 432 Educational Soundtrack Production (3) Theory and operation of soundtrack production equipment, including microphones, mixers, tape recorders, and signal-processing equipment. Practice in narration, field and studio recording, mixing, and final soundtrack mix-down. Covers soundtracking for sound-slide and filmstrip, audiotape, motion picture, and television. Offered on credit/no credit basis only.

EDC&I 433 Educational Sound-Slide Production (3) Theory and techniques of sound-slide production, including planning, scripting, slide photography, titling, macrophotography, story-line posing, soundtrack production, and slide-tape synchronization. Introduction of multi-image production. Offered on credit/no credit basis only.

EDC&I 434 Introduction to Computers in the Classroom (3) Computer technology and applications of computers to education. Aspects of computer-assisted instruction and computer-managed instruction. Evaluation and selection of software. Opportunity to work with representative course ware. Prior experience not required.

EDC&I 435 Uses of LOGO in the Classroom (3) Role of LOGO in the classroom. Use of LOGO to teach about computer programming, problem solving, and various mathematical concepts. Elementary education is primary focus but some topics and applications in secondary education are addressed. Laboratory time with LOGO. Prerequisite: 434 or equivalent.

EDC&I 436 Issues in Programming and Instructional Design of CAI (3) Programming and instructional design issues related to the use of computer-assisted instruction. Construction of menus, writing of educational programs that use data files, modification of existing educational software, use of authoring systems, and issues in CAI design and implementation. Prerequisites: 434 or equivalent and knowlege of BASIC.

EDC&I 438 Improvement of Teaching: Latin (3) Examination and evaluation of the various methods of teaching Latin; audiovisual aids; testing materials; textbooks; relation of Latin to other languages. Latin derivatives in English vocabulary. Offered jointly with LAT 475.

EDC&I 439 Caesar and Vergil for High School Teachers (3) S *Pascal* Interpretation of the works of Caesar and Vergil with special reference to the problems of high school teaching. Offered jointly with LAT 476.

EDC&I 441 Improvement of Teaching: Art Appreciation in the Schools (3) Survey of the history of art to promote an appreciation of the nation's cultural heritage; designed for teachers at all levels of instruction and subject matter areas. (1) Development of content in sequential or unit plan studies to incorporate art history in general studies curricula. (2) Development of methods and preparation of materials for classroom presentation. Illustrated lectures. Prerequisite: teaching experience.

EDC&I 443 Improvement of Teaching: Elementary School Music (3) Advanced studies in the teaching of music in the elementary school. Prerequisite: teaching experience.

EDC&I 445 Theory and Practice of Kindergarten and Primary Teaching (3) Systematic treatment of the content, teaching processes, and learning resources appropriate to kindergarten and primary education with particular emphasis on current research and developments. Prerequisite: EDPSY 304 or permission.

EDC&I 453 Teaching the Bilingual-Bicultural Child in the Elementary School (3) W *Gonzales, Vasquez* Educational needs of bilingual child and ways they can be met. The differences between the metropolitan, the rural, and the migrant bilingual with emphasis on the educational difficulties the bilingual faces in all three settings. A major component is bilingual-bicultural education—research findings and special programs, materials, and methodologies. Prerequisite: concurrent registration in EDUC 302.

EDC&I 454 Teaching the Bilingual-Bicultural Student in the Secondary School (3) W *Gonzales, Vasquez* Provides prospective secondary-school teachers with the knowledge and skill to integrate bilingual-bicultural studies into the curricular offerings of the secondary school. Focus on the cultural contributions of bilingual populations to the American culture and the historical, social, and linguistic factors affecting the education of the bilingual. Emphasis on methods and resources for teaching separate subjects bilingually.

EDC&I 455 The Language Arts: Instructional Problems and Practices in the Elementary School (3) *Hansen-Krening* Study of important and recent research in elementary school language arts and consideration of its practical implications for teaching. Prerequisite: teaching experience.

EDC&I 456 Workshop in Instructional Improvement: Language Arts (1-6, max. 15) Individual or group study projects on the improvement of instruction in language arts.

EDC&I 457 Methods in Teaching English as a Second Language (3) *Gonzales* Prepares preservice and in-service teachers to teach English as a second language and to meet the educational and linguistic needs of students who have little or no English language skills. Emphasis on a survey of first- and second-language acquisition research and its educational implications, as well as instructional strategies consistent with the audiolingual, cognitive, and creative construction approaches to second-language learning. Includes diagnostic-prescriptive strategies for classroom application.

EDC&I 459 Workshop in Instructional Improvement: Reading (1-6, max. 15) Projects on the improvement of instruction in reading. Prerequisite: minimum of one course in methods of teaching reading.

EDC&I 460 The Teaching of Reading (3) *Gonzales, Sebesta* Improvement of teaching reading in the elementary school, including comprehension and decoding, reading in the content fields, motivation of voluntary reading. Prerequisite: teaching experience or prior course work in the teaching of reading.

EDC&I 461 Materials for Teaching Reading (3) *Hansen-Krening, Sebesta* Designed to provide acquaintance with materials used in the teaching of reading. Basal readers, materials from content areas, children's trade books, and supplementary practice materials are examined, as are the organization of learning centers and other schemes for teaching reading. Prerequisite: one prior course in the teaching of reading.

EDC&I 462 Reading in the Secondary School (3) *Standal* Teaching of reading in the secondary schools, including vocabulary development, comprehension, speed reading in the content fields, and organization of reading programs at the secondary level. Prerequisite: teaching experience or concurrent internship.

EDC&I 464 Educating Native American Youth (3) Assists students in understanding the North American Indian child from cultural, socioeconomic, and psychological points of view. Provides opportunities for the student to apply knowledge and skills gained in other courses to prepare programs and learning aids relevant to the educational situation of the Indian child.

EDC&I 465 Social Studies Education: Elementary School Programs and Practices (3) *Banks, Jarolimek, Kalfsounis* Stresses curriculum patterns, instructional procedures, resource materials, and the selection of content in social studies. For elementary and junior high school teachers. Prerequisite: teaching experience.

EDC&I 466 Social Studies Education: Secondary School Programs and Practices (3) *Jarolimek* Stresses curriculum patterns, instructional procedures, resource materials, and a selection of content in social studies for junior and senior high school teachers. Prerequisite: teaching experience.

EDC&I 467 Geography in the Social Studies Curriculum (3) Discussion of the concepts and content of geography essential to effective social studies curricula. Offered jointly with GEOG 467.

EDC&I 468 Workshop in Instructional Improvement: Social Studies (1-6, max. 15) Individual or group study projects on the improvement of instruction in social studies.

EDC&I 469 Educating the Black Inner-City Child (3) *Banks* Intensive analysis and review of the research and literature, both theoretical and empirical, relevant to curriculum patterns and programs designed especially for Black inner-city children. Special attention is given to the implications of the research reviewed for devising effective teaching strategies for Black inner-city children.

EDC&I 470 Science Education: Elementary School Programs and Practices (3) *Olstad, Smith* Designed for classroom teachers with reference to the teaching and learning of science from kindergarten through grade 6. Emphasis is placed on objectives, methods, and materials as related to the concepts and processes of science. Prerequisite: teaching experience.

EDC&I 471 Science Education: Secondary School Programs and Practices (3) *Olstad, Smith* Survey of the status and potential role of science in education; trends and their implications for the teaching of both biological and physical sciences in the junior and senior high schools; representative curricula and related teaching procedures; the psychology of concept formation and problem solving; and organization of science programs. Prerequisite: teaching experience.

EDC&I 473 Workshop in Instructional Improvement: Science (1-6, max. 15) Individual or group study projects on the improvement of instruction in science.

EDC&I 474 Multi-Ethnic Studies: Methods, Content, and Materials (3) *Banks* Designed to help preservice and in-service teachers identify content and materials and devise methods for implementing ethnic studies programs and for incorporating ethnic content into regular K-12 social studies, language arts, and humanities curricula. Special attention is given to teaching about American Indians, Mexican-Americans, Black Americans, Asian-Americans, Puerto Rican-Americans, and White ethnic groups. Prerequisite: admission to Teacher Education Program or teaching experience.

EDC&I 475 Improvement of Teaching: Elementary School Mathematics (3) *Beal, Kersh* Designed for elementary teachers (grades K-6). Emphasis is placed on the contributions of research to the improvement of the teaching of mathematics in the elementary school. Prerequisite: teaching experience.

EDC&I 476 Improvement of Teaching: Junior High School Mathematics (5) Exploration of some modern mathematical concepts for the purpose of improving the teaching of junior high school mathematics. Prerequisite: 1½ years of high school algebra or equivalent.

EDC&I 477 Improvement of Teaching: Secondary School Mathematics (5) Exploration of some modern mathematical concepts for the purpose of improving the teaching of secondary-school mathematics. Prerequisite: teaching experience.

EDC&I 478 Special Topics in Mathematics for Teachers (2-5, max. 15) Study of selected areas of mathematics. Designed for the improvement of teachers of mathematics. Offered jointly with MATH 497.

EDC&I 479 Workshop in Instructional Improvement: Mathematics (1-6, max. 15) Individual or group study projects on the improvement of instruction in mathematics.

EDC&I 480 Introduction to Learning Resources in Teaching (3) *Driscoll, Hawk, Torkelson* Factors influencing the selection and use of learning resources in instruction, with special emphasis on planning for the uses of messages, message forms, and message carriers.

EDC&I 482 Still Photography in Education (3) *Driscoll, Hawk* Theory and practice in producing still photographs and slides for teaching purposes; camera and darkroom techniques. Producing photographic materials to meet specific learning problems.

EDC&I 483 Basic Motion Picture Production (4) *Driscoll* Basic motion-picture techniques, emphasizing cinematography and editing.

EDC&I 484 Educational Film Production (3) *Driscoll* Advanced film techniques, including instructional-film design, narration writing, sound editing, and rerecording. Prerequisite: 483.

EDC&I 485 Workshop in Instructional Improvement: Learning Resources (2-6) *Driscoll, Hawk, Torkelson* Individual or group study projects on the improvement of instruction in learning resources.

EDC&I 486 Screen Education (3) *Driscoll* Workshop course in screen education for secondary-school teachers and others interested in the history and esthetics of the motion picture; preparation for teaching about film as a communication medium.

EDC&I 487 Cinematic Animation Techniques (3) *Driscoll* For teachers and others interested in understanding animation techniques in educational television and films. Relationships of rhythm, graphic design, and sound. In addition to lecture demonstrations, opportunity is given for experimentation in simple animation and special effects cinematography.

EDC&I 489 Television Production Workshop for Teachers (5) *Hawk* Working in University studios under laboratory conditions involving production on-camera methods, teachers learn to present instructional subject matter through television. Especially for those who expect to work with television as instructors or as supervisors of school-oriented television activities. Open to nonmajors; not open to graduate students in communications or to students with credit for CMU 361. Offered jointly with CMU 463. (Offered Summer Quarter only.)

EDC&I 490 Single Camera System School Television Production (3) Techniques of TV production utilizing a single camera. Includes TV hardware theory and vocabulary, experience in connecting and handling equipment, planning, scripting, production, and editing techniques. Offered on credit/no credit basis only.

EDC&I 491 Small Studio Television Production (3) Techniques of TV production utilizing a two-camera simple studio. Includes TV equipment theory and vocabulary, experience in planning, scripting, equipment operation, lighting, final production. Emphasis on utilization of nonbroadcast standard facilities. Offered on credit/no credit basis only.

EDC&I 492 Educational and Documentary Film Editing (3) Techniques of 16-mm. film editing. Includes theory and practice in editing motion picture sequences; creating pace, rhythm, montage, lucid continuity, compilation, and sound synchronization. Offered on credit/no credit basis only. Prerequisite: 483 or equivalent.

EDC&I 493 Educational and Documentary Film Cinematography (3) Theory and practice in composition, lighting, effects, and laboratory practices. Special attention given to camera movement, exposure control, location shooting. Offered on credit/no credit basis only. Prerequisite: 483 or equivalent.

EDC&I 494 Workshop in Improvement of Curriculum (1-6, max. 15) Stresses the application of procedures for curriculum development, maintenance, and evaluation. Opportunities to develop and perfect strategies for program development and to have occasions to utilize the strategies in master plan and materials preparation for simulated or real school situations. Specific focus of workshop is determined by instructor or by arrangement with district. Prerequisite: permission of instructor.

EDC&I 495 Workshop in Improvement of Teaching: Selected Topics, Issues, or Problems (1-6, max. 15) Individual or group projects to help teachers adapt instruction to selected topics, issues, or problems and to identify the approaches and instructional resources that will provide the soundest learning experiences.

EDC&I 496 Workshop in Instructional Improvement (2-6, max. 6) Individual or group study projects on the improvement of instruction and attention to designing instructional plans.

EDC&I 499 Undergraduate Research (2-5, max. 5) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program.

EDC&I 500 Field Study (3 or 6, max. 9) Individual study of an educational problem in the field under the direction of a faculty member. Prerequisites: approved plan of study and permission of the instructor must be filed in the Office of Educational Curriculum and Instruction in the College of Education.

EDC&I 501 Curriculum for the Gifted (3) A *Kersh* Investigation of curriculum and instruction appropriate for gifted students of the elementary- or secondary-school level. Prerequisites: teaching experience and permission of instructor.

EDC&I 520 Current Models in Early Childhood Education (3) *Hansen-Krening* In-depth analysis of current program models for the education of young children, with an emphasis on specification of objectives, practices, and evaluation of model effectiveness. Models emphasized are those developed in this country, but the course also includes a study of models developed in other countries as they have influenced practice here.

EDC&I 521 Problems and Issues in Early Childhood Education (3) *Hansen-Krening* Study of issues currently facing the field of early childhood education, emphasizing the rationale, impact, and management of child-care programs. Relationship of local child-care programs to state and federal agencies is included. Prerequisite: 520 or permission of instructor.

EDC&I 522 Practicum in the Training of Early Childhood Instructional Personnel (3) *Hansen-Krening* Directed experience in educational training conducted in the field. Design and implementation of a training program for early childhood education instructional personnel. Prerequisites: graduate standing and permission of instructor.

EDC&I 524 Seminar in Teacher Education (3) W *Foster* Focus on recent trends, issues, and proposals for future development in teacher education and certification. Prerequisite: permission of instructor.

EDC&I 530 Seminar in Analysis of Approaches for Teaching Reading (3) AWS *Sebesta, Standal* Designed to aid experienced teachers who possess background in the teaching of reading, this course presents a variety of approaches with implications of research for analyzing the effectiveness of individualized reading, individually guided instruction, computer-assisted instruction, eclectic methodology, and others. Prerequisites: teaching experience and a basic course in the teaching of reading.

EDC&I 531 Seminar: Analysis of Reading Materials (3) WS *Gonzales, Sebesta* Students formulate and apply criteria for assessing materials, with emphasis on linguistic, cultural, and psychological factors; instruction effectiveness, interest level; and educational objectives. Prerequisites: teaching experience and one basic course in the teaching of reading.

EDC&I 532 Seminar in Research in Reading (3) *Gonzales, Sebesta, Standal* Primary focus on those aspects of the reading process that are of concern in a developmental reading program. Emphasis is on research design, evaluation of research, and research findings dealing with factors influencing reading ability, problems in skill development, and recreational reading. Course work includes group and individual analysis of studies with attention to research design and measurement. Prerequisite: permission of instructor.

EDC&I 533 Seminar: Conducting Research in Reading (3, max. 6) SpS *Sebesta, Standal* Students design and conduct original research studies in the field of reading. Emphasis on research rationale, choice of productive research types, and reporting of research results and implications. Prerequisite: 532.

EDC&I 534 Seminar in the Reading of Literature (3) *Sebesta* Reading of literature and its effect on reading skills, language development, social values, and literary judgment of children and adolescents. Emphasis on analysis of research in these areas and on the development of action research designed to study response to literature. Prerequisite: one 400- or 500-level educational curriculum and instruction course in reading or language arts or one graduate course in literature for children or young adults.

EDC&I 535 Seminar: Conducting Research in Response to Literature (3, max. 6) SpS *Sebesta* Students design, conduct, and interpret original research studies in the field of reading literature within the context of the school curriculum. Emphasis on the analysis of literary content and structure and the relationship of those qualities to the literary experience. Prerequisite: 534.

EDC&I 541 Seminar in Bilingual Education: Organization and Structure (4) A *Gonzales* Study of the structure and organization of bilingual programs. Includes study of the developmental and organizational factors affecting bilingual education. Assists graduate students in reviewing the historical antecedents in bilingual education and in developing a personal philosophy about bilingual education.

EDC&I 542 Seminar in Bilingual Education: Instructional Foundations and Issues (4) W *Vasquez* Study of the theoretical foundations and instructional implications of psychology and linguistics as they apply to bilingual education. Assists graduate students in exploring learning styles of bilingual children and in becoming familiar with the crucial issues in bilingual education.

EDC&I 543 Seminar in Bilingual Education: Instructional Strategies (4) Sp *Gonzales, Vasquez* Study of instructional factors affecting bilingual education. Particular emphasis is given to research related to the variables involved in teaching in a bilingual environment. Assists graduate students in exploring instructional methodologies and formats as they apply to bilingual education and in becoming familiar with the current issues in bilingual education.

EDC&I 555 Educational Futures (3) *Hunkins* Concept of alternative futures stressing manageability of the future. Current and future events that can and could impact education. Acquaintance with basic future studies methods and opportunity to apply such methods within educational arena. Prerequisite: prior graduate course work or experience in education.

EDC&I 556 Elementary School Curriculum (3) *Hunkins* Study of elementary school curriculum, its design, rationale, and delivery. Current trends and issues affecting elementary school curriculum.

EDC&I 558 Secondary School Curriculum (3) *Gehrke* Systematic description and analysis of the current curriculum practices, with particular emphasis on the factors and forces affecting secondary-school curriculum.

EDC&I 559 Principles and Procedures of Curriculum Development (3) *Gehrke, Hunkins* Intensive study of basic principles and procedures utilized in development of curricula. Participants have opportunities to apply such procedures in class activities.

EDC&I 561 Seminar in Language Arts (3) *Hansen-Krening* Study of recent research in language structure with special attention to research pertaining to the teaching of language skills: auding, speech, and written composition. Course work includes group and individual analysis of language arts studies with attention to research design and measurement. Prerequisite: permission of instructor.

EDC&I 562 Seminar in Reading and Language Arts: Secondary Emphasis (3) *Standal* Study of recent research in listening, oral language, reading, and written language, emphasizing psychological and interrelated aspects. Prerequisite: permission of instructor.

EDC&I 563 Current Issues in Language Arts Education (1-3, max. 6) *Hansen-Krening* Discussion of problems and issues of current interest and importance in language arts education.

EDC&I 564 Seminar: Issues in American Indian/Alaskan Native Education (3) Current social and political issues as they relate to American Indian/Alaskan native education. Educational implications of state and federal legislation, judicial decisions, and politically controversial issues. Prerequisite: 464 or permission of instructor.

EDC&I 565 Seminar in Social Studies Education: Elementary Emphasis (3) *Banks, Jarolimek, Kaltsounis* Intensive study of the social studies curriculum, with particular emphasis on current literature and research. Prerequisite: 465 or equivalent.

EDC&I 566 Seminar in Social Studies Education: Secondary Emphasis (3) *Banks, Jarolimek, Kaltsounis* Intensive study of the social studies curriculum, with particular emphasis on current literature and research. Prerequisite: 466 or equivalent.

EDC&I 567 Current Issues in Social Studies Education (1, max. 6) *Banks, Jarolimek, Kaltsounis* Discussion of problems and issues of current interest and importance in social studies education.

EDC&I 568 Seminar on Instruction and Curriculum for Minority Youth (3) *Vasquez* Examines research related to curriculum and instruction for minority youth for purpose of preparing teachers, administrators, and other educators working with students who differ from mainstream students in value and motivational systems, learning styles, and socialization practices. Prerequisite: EDPSY 513, 591, or permission of instructor.

EDC&I 569 Educating Ethnic Minority Youths (4) *Banks* Intensive analysis and review of the research and curricular programs related to the social, psychological, and political factors that influence the school experiences of ethnic minority youths. Special attention given to instructional and curricular programs for Afro-American, American Indian, Mexican-American, Puerto Rican-American, and Asian-American students. Prerequisite: successful completion of 464, 469, or 474, or permission of instructor.

EDC&I 570 Seminar in Science Education: Elementary Emphasis (3) *Olstad, Smith* Investigation of curriculum and instruction in science at elementary-school levels, with particular emphasis on current literature and research. Prerequisite: 470 or equivalent.

EDC&I 571 Seminar in Science Education: Secondary Emphasis (3) *Olstad, Smith* Investigation of curriculum and instruction in science at secondary-school levels, with particular emphasis on current literature and research. Prerequisite: 471 or equivalent.

EDC&I 572 Current Issues in Science Education (1, max. 6) *Olsted, Smith* Discussion of topics and problems of current interest and importance in science education. Prerequisite: graduate standing.

EDC&I 575 Seminar in Mathematics Education: Elementary Emphasis (3) *Kersh* Investigation of curriculum and instruction in mathematics at the elementary-school level; review of research and preparation of proposals. Prerequisite: 475 or equivalent.

EDC&I 576 Seminar in Mathematics Education: Secondary Emphasis (3) *Kersh* Investigation of curriculum and instruction in mathematics at the secondary-school level; review of research and preparation of proposals. Prerequisite: 476 or 477, or equivalent.

EDC&I 577 Current Issues in Mathematics Education (1, max. 6) *Beal, Kersh* Discussion of problems and issues of current interest and importance in mathematics education.

EDC&I 580 Seminar in Learning Resources (3) *Driscoll, Torkelson* Advanced analysis of communications in educational settings: concepts, terminology, trends, research directions, factors affecting uses of messages, message forms, and message carriers for instructional purposes. Prerequisite: 480 or permission of instructor.

EDC&I 581 Management of Educational Technology and Microcomputers (3) *Hawk* Study of factors affecting management of educational programs involving production, programming, storage, distribution, and use of visual, auditory, and microcomputer hardware and software. Prerequisite: 480 or equivalent.

EDC&I 582 Learning Resources Systems of Instruction (3) *Torkelson* Study of principles, practices, literature, media, and their relevance to the systematic planning of self-instructional materials, and the comprehensive sequencing of instructional experiences. Students develop projects of practical use in areas of their own choice.

EDC&I 583 Learning Resources and Learning Domains (5) *Driscoll, Torkelson* Research and relevant literature concerning various message forms and message carriers as these affect instructional practice in achieving traditional kinds of learning goals, cognitive, affective, and perceptual-psychomotor.

EDC&I 585 Seminar: International and Cross-Cultural Education (3) *Driscoll* Treats selected instructional problems, innovation strategies, and the management of learning resources in various emerging countries.

EDC&I 586 Current Issues for Computers in the Classroom (1, max. 6) Addresses many of the current topics in computer-related education. Issues and research related to computer uses in curriculum, instruction, and management of instruction.

EDC&I 588 Seminar: Computers in Education (3) Provides opportunity for graduate students to analyze, discuss, and design research in areas of computers in education. Includes historical development of research in this area as well as a platform for the development of research proposals and refinement of ongoing research. Prerequisite: 434 or equivalent.

EDC&I 589 Current Issues in Educational Communications (1, max. 9) AWSp *Driscoll, Hawk, Torkelson* Discussion of problems and issues of current interest and importance in the field of educational communications. Serves also as a forum for discussion of doctoral research. Designed for master's and doctoral candidates in educational communications. Offered on credit/no credit basis only. Prerequisite: graduate standing.

EDC&I 590 Seminar in Elementary Education (3) *Hunkins, Jarolimek* Exploration of the philosophy, history, purposes, curriculum, methods, school organization, and evaluation in elementary education, with emphasis on individual research. Prerequisites: elementary-school teaching experience, 556, and EDPSY 520.

EDC&I 591 Seminar in Curriculum Research (3) *Gehrke, Hunkins* Analysis of past and current empirical, historical, ethnographic research, and philosophical analysis of the curriculum field. Studies considered include research in curriculum development, the curriculum plan, contextual characteristics, and factors related to curriculum participants. Group and individual analyses focus on theory generation and practical applications of research. Prerequisite: 559 or permission of instructor.

EDC&I 592 Seminar in Secondary Education (3) *Gehrke* Research and study of secondary education. Primary focus on factors involving change in secondary-school curriculum and organization. Prerequisite: 558.

EDC&I 593 Seminar in Curriculum: Theory and Practice (3) *Hunkins* Investigation of curriculum theory and practice. Consideration is given to models that explain the relationships between various curricular variables. These theoretical models are related to curricular practices and innovations. Prerequisite: 559.

EDC&I 594 Seminar in Curriculum: Issues, Systems, Models (3) *Gehrke, Hunkins* Emphasis, from a systems and futuristic view, on the current approaches to curriculum, curriculum innovation, and major educational issues as they affect curricular activity. Prerequisite: 559.

EDC&I 595 Seminar in Analysis of Teaching (3) Analyzing the teaching act. Psychological, sociological, and philosophical factors impacting teaching. Emphasis given to research dealing specifically with teaching. Prerequisite: teaching experience.

EDC&I 596 Seminar in Strategies of Instruction (3) *Hunkins* Various instructional models applicable to all levels of schooling. Theoretical and philosophical bases for these instructional models are considered. Participants have opportunities to practice particular models.

EDC&I 597 Curriculum Evaluation Seminar (3, max. 6) WSp *Kersh, Smith* Offered each year as a two-quarter sequence. The first quarter focuses on the evaluator's roles, evaluation theory and models, and selected curricular evaluations. Examples are drawn from the several disciplines commonly offered in the elementary and secondary schools. In the second quarter, students are expected to identify an evaluation problem and to develop an evaluation design that can be implemented as a practical solution to the problem. Prerequisites: 559 and permission of instructor.

EDC&I 599 Independent Studies in Education (*) Independent studies or readings of specialized aspects of education. Prerequisite: permission of instructor.

EDC&I 600 Independent Study or Research (*) Prerequisite: permission of instructor.

EDC&I 601 Internship (3-9, max. 9) Offered on credit/no credit basis only. Prerequisites: graduate standing and permission based on approval of proposal submitted during quarter preceding the internship.

Policy, Governance, and Administration—Educational Policy Studies

EDEPS 444 Constitutional Freedom and American Education (3-6, max. 6) *Morris* Emphasis on the principles, processes, and content of constitutional law in an effort to provide new insights and new tools with which school administrators and teachers may examine questions involving political and civil rights in the United States, especially as these affect the conduct of education. Specific topics on constitutional freedom include the obligation to go to school; legal controls over curriculum, teachers, and students; and racial integration and equal financing of public schools. Open to law students and to nonlaw students enrolled as graduate students or as upper-division undergraduates. Offered jointly with LAW 444. Satisfactory/not satisfactory option available to nonlaw students only.

EDEPS 458 History of American Education to 1865 (3) *Burgess* Development of American education in cultural context; colonial period, influence of Enlightenment, and common school movement. Offered jointly with HSTAA 458.

EDEPS 459 History of American Education Since 1865 (3) *Burgess* Development of American education in cultural context: progressive education, recent criticism, continuing issues and trends. Offered jointly with HSTAA 459.

EDEPS 479 Crucial Issues in Education (3) AWSpS Selected educational issues, policies, and contexts. Evolution of the American education enterprise, legal issues, professionalism, finance, and other vital educational concerns. Prerequisite: admission to the Teacher Certification Program or permission of instructor.

EDEPS 492 History of European Education Through the Reformation (3) *Burgess* Development of European education in cultural context: Greece, Rome, Middle Ages, Renaissance, and Reformation.

EDEPS 493 History of European Education Since the Reformation (3) *Madsen* Development of European education in cultural context: pedagogical reformers, national systems, and recent trends.

EDEPS 496 Comparative Education (3) International efforts in education, primarily the role of the United States in overseas programs. Analysis of the relation of school and society in foreign areas, stressing social change and conflict.

EDEPS 498 Educational History and Utopian Thought (3) *Burgess* Selected studies of education as a key to the good society.

EDEPS 499 Undergraduate Research (*) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program.

EDEPS 500 Field Study (3 or 6, max. 6) Individual study of an educational problem in the field under the direction of a faculty member. Prerequisites: approved plan of study and permission of the instructor must be filed in the Office of Educational Policy Studies in the College of Education.

EDEPS 501 The Study of Educational Policies (3) *Kerr* Systematic consideration of the structure and function of educational policies and problems of research and evaluation of those policies. Includes survey of resources for description of particular types of policies.

EDEPS 502 Sociology of Education (3) Examination of education and educational institutions by using the major conceptual tools of sociology. Emphasis on sociological thought and findings that have particular bearing on the understandings and judgments of educators.

EDEPS 503 History of Educational Thought (3) *Burgess, Madsen* Study of educational theory and practice in Western culture.

EDEPS 504 Philosophy of Education (3) *Kerr, Tostberg* Philosophy of education considered as a study of the conceptual basis for educational policy and practice. Emphasis on relationships between enduring educational problems and fundamental philosophic issues; concepts that feature centrally in educational discourse; and conceptual analysis as a means for clarifying decisions regarding educational policy and practice.

EDEPS 510 Seminar in Educational Sociology (3) Application of sociological principles to school problems; individual problems and investigations. For teachers, administrators, and those using educational sociology as a field for advanced degrees.

EDEPS 559 Seminar: American Education in the Twentieth Century (3, max. 6) *Burgess* Selected problems in American education over the last century, with special emphasis on contemporary issues and trends.

EDEPS 571, 572, 573 Public and Educational Policy Issues in the Development of Human Talent (3,3,3) A,W,Sp *Brown, Wolfle* Higher education and the nation's human resources: trends, future projections, policy issues, and national and personal goals in the relations between education and the utilization of professional and specialized personnel. Offered jointly with PB AF 571, 572, 573. Prerequisite: permission of instructor.

EDEPS 580 Seminar: Research in History of Education (3, max. 6) *Burgess, Madsen* Study of the literature, bibliography, sources, and critiques of history of education. Research methods analyzed and demonstrated in seminar papers. Prerequisite: graduate standing.

EDEPS 582 Seminar in Philosophy of Education: Modes of Inquiry (3, max. 6) W *Tostberg* Philosophical examination of ways in which education might be studied. Uses and limits of conventional scientific approaches in education inquiry. Consideration of alternatives. Prerequisites: 504 and permission of instructor.

EDEPS 583 Seminar: Research in Educational Sociology (3) Theory, concept, and method of sociological inquiry as applied to problems in education. Prerequisite: permission of instructor.

EDEPS 586 Seminar in Educational Classics (3) *Burgess* Analysis in depth and in the context of the relevant history of several major works in educational thought from Plato to Dewey.

EDEPS 587 Contemporary Philosophies of Education (3) *Kerr, Tostberg* Intensive study of the writings of selected contemporary philosophers of education. Prerequisite: graduate standing.

EDEPS 588 Analysis of Educational Concepts (3) *Kerr, Tostberg* Selected concepts central to conduct and understanding of education. Prerequisite: permission of instructor.

EDEPS 589 Special Topics in History, Philosophy, and Sociology of Education (3, max. 18) For advanced degree candidates majoring in history, philosophy, and sociology of education. Prerequisite: permission of instructor.

EDEPS 594 History of the Modern University (3) *Madsen* Growth of the modern university with attention to intellectual trends as well as organizational and curricular changes. Special attention is given to nine American universities in the twentieth century.

EDEPS 599 Independent Studies in Education (*) Independent studies or readings of specialized aspects of education. Registration must be accompanied by a study prospectus endorsed by the appropriate faculty adviser for the work proposed, and, with permission of the instructor, must be filed with the Office of Educational Policy Studies. Prerequisite: permission of instructor.

EDEPS 600 Independent Study or Research (*)

EDEPS 601 Internship (3-9, max. 9) Prerequisites: permission of supervisory committee chairperson and area Chairperson.

Educational Psychology

EDPSY 304 Educational Psychology (5) *Williams* Human learning in the educational setting. Cognition, development, learning, motivation, affective processes, and socialization. Emphasis on skills in influencing classroom learning and discipline. Prerequisites: admission to Teacher Certification Program and concurrent enrollment in EDUC 302. Entry card required.

EDPSY 308 Evaluation in Education (3) *Abbott, Bashey, Mizokawa, Peckham, Sax* Fundamentals of measurement, construction of achievement tests, selection and administration of standardized tests and scales, and evaluation and application of test results. Prerequisite: admission to Teacher Certification Program. Entry card required.

EDPSY 407 Teaching the Gifted Child (3) *Freehill* The role of the teacher and the school in the identification and development of the special abilities and talents of gifted children. Prerequisite: teaching experience.

EDPSY 408 Mental Hygiene for Teachers and Administrators (3) Principles of mental health; normal personality development and functioning; relation of school environment to mental health of students, teachers, and administrators. Background in educational psychology is recommended, but is not a prerequisite.

EDPSY 421 Remedial Education (3) Experience in, and study of, analysis of difficulties in school subjects with special reference to language arts and mathematics. Experience in, and study of, appropriate remedial instruction. Analysis and instruction that is considered both feasible and practical for the teacher working with individuals or with a group.

EDPSY 425 Reading Disability: Remedial Techniques (3) *Nolen, Standal, Thalberg* Evaluation of methods for diagnosing and minimizing reading retardation. Descriptions of in-class and clinical procedures supplemented by classroom observations. Prerequisite: EDC&I 360 or equivalent.

EDPSY 447 Principles of Guidance (3) *Lavelle* Study of guidance programs in elementary and secondary schools. Attention is given the roles of specialists with emphasis on the role of the classroom teacher in school guidance programs. This course is designed for teachers, administrators, and prospective teachers.

EDPSY 449 Laboratory in Educational Psychology (2-6, max. 6) Special studies for counselors, teachers, administrators, and others concerned with student personnel and psychological services in schools and colleges. The course focuses on special topics that have either local or contemporary significance. (Not offered every year; check quarterly *Time Schedule*.)

EDPSY 490 Basic Educational Statistics (3) *Abbott, Klockars, Peckham, Sax* Measures of central tendency and variability, point and interval estimation, linear correlation, hypothesis testing.

EDPSY 499 Undergraduate Research (*) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program. Entry card required.

EDPSY 500 Field Study (*) Individual study of an educational problem in the field under the direction of a faculty member. Prerequisites: approved plan of study and permission of the instructor must be filed in the Office of Educational Psychology in the College of Education. Entry card required.

EDPSY 501 Seminar in Concepts and Problem Solving (3) *McCartin* The psychology of children's thinking. Course emphasizes study of research results in concept development and problem solving with application to classroom learning situations. Entry card required.

EDPSY 502 Seminar in Critical and Creative Thinking (3) The psychology of children's thinking. Course emphasizes study of research results in critical thinking and creative thinking with application to classroom learning situations. Entry card required.

EDPSY 503 Psychology of Reading (3) *Nolen* Reading and perception, word recognition, concept development and meaning in reading, psychology of reading interests and skills. Entry card required.

EDPSY 504 Verbal Instruction (3) *Mizokawa, Nolen* Study of linguistics and the psychological implications of classroom verbal learning. Entry card required.

EDPSY 506 Instructional Theory (3) *Mizokawa* Examination of cognitive theories of learning related to instructional strategies. (Offered alternate years; check quarterly *Time Schedule*.)

EDPSY 507 Reading Disability: Etiology and Diagnosis—Practicum (5) *Nolen, Thalberg* Theory and basic concepts underlying appraisal techniques and causality. Lectures and clinical practicum in administering, scoring, and evaluating each technique, and in interpreting and communicating results. Prerequisite: 425. Entry card required.

EDPSY 508 Clinical Supervision—Practicum (2-6, max. 12) Practicum in supervising, counseling, group counseling, diagnostic activities, and remedial reading therapy. Prerequisites: advanced graduate standing. Entry card required.

EDPSY 510 Seminar in Educational Psychology (1-3, max. 15) Seminar on advanced topics in educational psychology. A critical appraisal of current research. Prerequisites: advanced degree candidacy in educational psychology and permission. (Check quarterly *Time Schedule* for subject listings, which vary from quarter to quarter.)

EDPSY 511 Seminar in Applied Educational Psychology (1, max. 6) Designed for graduate students in educational psychology. Selected contemporary topics relating to the application of theoretical constructs to school psychology and counseling, practice and research. Entry card required.

EDPSY 513 Learning Variables of Minority Children: Instructional Implications (4) ASp *Vasquez* Provides students with data base regarding (1) four variables (language/dialect, cognitive style, locus of control, and motivational systems) that affect learning among minority students, and (2) teaching strategies appropriate for these cultural socioeconomic variables.

EDPSY 514 Seminar in Quantitative Methods (3, max. 15) *Abbott, Klockars, Peckham, Sax* Seminar on such topics as measurement techniques, research design, psychometrics, and statistics. Prerequisite: permission of instructor.

EDPSY 515 Seminar in Development and Socialization (3, max. 15) *Evans, Freehill, Gray, McCartin* Advanced seminar on selected topics concerned with human development and socialization processes. Emphasis placed upon empirical research and its theoretical underpinnings in such areas as cognitive development, moral development and education, self-concept development, and related concerns. Prerequisite: permission of instructor.

EDPSY 516 Seminar in Learning and Thinking (3, max. 15) *Butterfield, Mizokawa, Nolen* Seminar in the psychology of learning language and language learning. Each seminar is offered with predesignated emphasis in one of the following topics: linguistics, phonology, pragmatics, psycholinguistics, semantics. Entry card required.

EDPSY 519 Language in Early Childhood Education (3) *Nolen* Review and critical examination of theories of language acquisition and their psychological implications for developing cognition. Prerequisite: 304 or equivalent; recommended: 523, 532, and PSYCH 414. Entry card required.

EDPSY 520 Human Learning and Educational Practice (3) *Evans, McCartin, Mizokawa* Systematic examination of current research about human learning and instructional psychology, including the study of motivation, human abilities, and learning, the learning process, and performance assessment. Prerequisite: 304 or equivalent.

EDPSY 521 Educational Issues in Human Learning (3) *Butterfield, Freehill, Gray* Study of contemporary problems in learning with emphasis on historical antecedents to modern view, methodological problems in the solution of the issues, relevant studies and phenomenological observation, implications and application of conclusions. Prerequisite: at least 20 credits of previous work in educational psychology and/or psychology.

EDPSY 522 Reading Disability Clinic (3-5) *Nolen, Thalberg* Supervised practicum in diagnosis and remediation of reading disabilities. Prerequisites: 425 and 507. Entry card required.

EDPSY 523 Developmental Foundations of Early Learning (3) *Gray, McCartin* Perceptual-motor, language, and overall cognitive development in children from birth through primary school age. Emphasis on basic learning processes and guidelines for assessment of developmental status and their implications for parents and professionals. Field-based course projects may be required. Prerequisites: background in child development and 520 or equivalent.

EDPSY 531 Socialization of School-Age Children (3) *Evans, McCartin* Study of personal social development and behavior from preschool age through preadolescence. Socialization theory and research are reviewed to include such topics as aggression, achievement, motivation, moral development, social cognition, and applicable socialization influences. Prerequisites: 523 and permission of instructor.

EDPSY 532 Adolescence and Youth (3) *Evans, McCartin* Includes middle school, senior high, and early college years, with implications for helping professions. Developmental processes and patterns examined with major theoretical and current research themes from behavioral sciences. Educational issues, social problems associated with adolescence in Western culture. Prerequisites: 6 credits in psychology, permission of instructor, and 520 or equivalent.

EDPSY 540 Individual Testing (5) *Bashey, Brown, Gray, Meacham, Thalberg* Study of assessment of human intelligence with supervised training in the administration, scoring, and interpretation of individual intelligence tests with emphasis on Stanford-Binet and Wechsler scales. Prerequisite: 490. Entry card required.

EDPSY 541 Group Tests in Counseling (5) *Bashey, Forster, Lawrence* Emphasis on the utilization of objective measures in counseling. Prerequisite: 490 or equivalent. Entry card required.

EDPSY 542 Career Development (3) *Forster, Lavelle, Lawrence* Emphasis on vocational development theory and research. Psychological, social, and economic determinants of vocational development and choice are examined as a basis for vocational counseling. Prerequisite: graduate standing or permission of instructor.

EDPSY 543 Seminar in Vocational Psychology (3) Theory and practice in exploring, clarifying, and articulating individual goals and career plans. Entry card required.

EDPSY 544 Counseling (5) *Bashey, Brammer, Lavelle* Emphasis on the theory and practice of counseling.

EDPSY 545 Practicum in Counseling (3-6, max. 6) *Bashey, Brammer, R. Brown, Fenner, Forster, Lavelle, Lawrence, Thalberg* Supervised practice in counseling. Prerequisite: 544. Entry card required.

EDPSY 547 Organization and Administration of Student Personnel Programs (3) *Brammer* Basic considerations in planning, organizing, and operating school student personnel programs; analysis of issues and problems encountered in formulating policy; supervising and evaluating services. Prerequisite: permission of instructor.

EDPSY 548 Educational Implications of Personality Theory (5) *Bashey, Freehill* Study of personality development and personality theories with continuous attention to the meaning of these in educational practice, testing, and counseling. Prerequisites: 15 credits of psychology and educational psychology.

EDPSY 549 Seminar in Student Personnel Work (3, max. 9) *Brammer* Individual problems and issues of student personnel programs at school and college levels. Entry card required.

EDPSY 550 Family Counseling (3) *R. Brown* Introduction to family counseling theory and practice, emphasizing family dynamics and communication analysis. Prerequisite: 544 or permission of instructor.

EDPSY 553 Student Development Services in Higher Education (3) *Brammer* Survey and critical study of the philosophy and practice of student personnel work in American colleges and universities.

EDPSY 555 Seminar in Counseling Specialty (1-2, max. 6) AWSpS *Bashey, Brammer, Brown, Forster, Lavelle* Oriented toward the role of a counselor as a professional worker in a specific type of setting. The specific setting is designated prior to registration, and topics unique to counseling in such settings are identified, explored, and analyzed. Specialized issues and problems not covered in general courses for all counselors are covered to prepare counselors for specialized duties at predesignated settings. Entry card required.

EDPSY 561 Group Process Laboratory (3) *Bashey, Brammer, R. Brown, Fenner, Forster, Lavelle, Lawrence* Experience in small-group process. Collateral discussions of process and independent study. Entry card required.

EDPSY 564 Practicum in School Psychology (1-6, max. 6) Practicum in appraisal and counseling, emphasizing diagnosis and counseling with behavior and learning disabilities, and focusing on techniques acquired in 540, 545, and 565. Entry card required.

EDPSY 565 Personality Appraisal (5) *Brammer, R. Brown, Freehill, Gray, Meacham* Study of personality evaluation with a supervised laboratory emphasizing work with children and their families. Prerequisites: 540, 548, and permission of instructor.

EDPSY 568 Case Study Seminar (2, max. 4) Integrating theoretical concepts with practice/service issues. Cases selected for discussion represent a wide range of problems and agency settings, including school and child problems. Entry card required.

EDPSY 570 Seminar in School and Community Psychology (2, max. 4) Current issues in professional psychology practice and research. Limited to graduate students in school psychological services. Entry card required.

EDPSY 590 Computer Utilization in Educational Research (3) *Peckham* Computer utilization in solution of research problems, data reduction to forms amenable to computer solution, appropriate framing of problems for solutions by computer. Using an interactive system, editors, and program packages. Prerequisite: 490.

EDPSY 591 Methods of Educational Research (3) *Abbott, Klockars, Mizokawa, Morishima, Peckham, Sax* Introduction to educational research. Primary focus on hypothesis development, experimental design, use of controls, data analysis and interpretation. Prerequisites: 490. Entry card required.

EDPSY 592 Advanced Educational Measurements (3) *Sax* Theory of measurement; an examination of assumptions involved in test theory, errors of measurement, factors affecting reliability and validity, and item analysis. Taught with PSYCH 516. Prerequisite: 490.

EDPSY 593 Experimental Design and Analysis (5) *Klockars, Peckham* Experimental design with emphasis on the analysis of variance. Prerequisites: 490 or equivalent, and 591 or permission of instructor.

EDPSY 594 Advanced Correlational Techniques (5) *Abbott, Klockars* Multivariate analysis, including regression and multiple correlation; matrix algebra; factor analysis. Prerequisite: 490 or equivalent.

EDPSY 595 Measurement and Evaluation Practices in Early Childhood Development and Education (3) SpS *Evans* Review and critical examination of measurement strategies and evaluation procedures in contemporary settings for early childhood development and education. Emphases include a study of early childhood education evaluation research, established and experimental measurement techniques, and the problems of measurement and evaluation unique to young children. Skills in the interpretation of measurements and the design of evaluation studies in early education. Prerequisite: 308 or equivalent; recommended: 490.

EDPSY 598 Program Evaluation (3) *Klockars, Peckham, Sax* Advanced course in evaluation research emphasizing nontraditional designs, especially those that impose severe ecological constraints on the evaluators. Prerequisites: 593, 594, EDC&I 597, or permission of instructor.

EDPSY 597 Test Development (3) *Klockars, Sax* Principles of test construction, including criterion and norm-referenced tests, item writing and sampling, test administration, preparation, scoring, and item evaluation techniques; problems of scaling and norming of cognitive and affective measures. Prerequisites: 592 and 594, or permission of instructor.

EDPSY 599 Independent Studies in Education (*) Independent studies or readings of specialized aspects of education. Entry card required.

EDPSY 600 Independent Study or Research (*) Prerequisite: permission of instructor. Entry card required.

EDPSY 601 Internship (3-9, max. 9) Entry card required.

Policy, Governance, and Administration—Higher Education

EDHED 417 Principles and Practices of Adult and Continuing Education (3) A History and development of adult and continuing education in the United States: component parts of the field; issues, theory, and research; program planning for adults; professionalization of the field.

EDHED 430 Higher Education and the Ethnic Minority (3) A *Morishima* Designed to provide the student with information on special problems in higher education (e.g., access, areas of study, financial ability, etc.) faced by the non-White ethnic minority student. Special emphasis is given to the commonality of experience among the four groups. Additional emphasis placed on major differences.

EDHED 496 Higher Education Programs and Problems (1-6, max. 12) Individual and group study of significant topics such as planning, development, organization, operation, or evaluation of current or emerging programs or problems in higher education. Prerequisite: permission of instructor.

EDHED 499 Undergraduate Research (2-5, max. 15) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program.

EDHED 501 Occupational Programs in Higher Education (3) *Schill* Analysis of occupational preparation programs in institutions of higher education, industry, business, and governmental agencies, with emphasis on methods of determining content, processes for evaluation, and research.

EDHED 502 College Instruction (3) *Reitan* Analysis of various instructional modes, media, and instruments, with emphasis on current research findings and methodology.

EDHED 503 The Community College (3) Study of the history and development, the roles, the objective, and the organizational structure of the community college and of the problems and the issues confronting the two-year college.

EDHED 505 The American College and University (3) *Cope, Williams* Introduction to contemporary United States higher education, with special emphasis on emerging trends, roles of the several kinds of institutions, the composition and character of student bodies and faculty, and the state coordination of colleges and universities.

EDHED 508 History of American Higher Education (3) *Williams* Examination of the historical development of the American higher education enterprise.

EDHED 507 Training Programs in Business and Industry (3) WS *Schill* Investigations of the organization, content, methods, and funding of training programs in business and industry. Emphasis on variables that affect the decisions to establish and continue training programs vs. sending employees elsewhere for training.

EDHED 508 Academic Governance and Collective Bargaining in Higher Education (3) S *Olswang, Schill* Explores the concept and operation of collective bargaining in higher education: its origin; the reasons for its growing popularity as a governance mechanism; the legal framework within which it operates; the rights, powers, and duties subsumed under its operation; and its relationship to the traditional form of faculty governance mechanisms.

EDHED 509 Advancement Programs in Higher Education (3) *Williams* Analysis of the principles, history, and practices of advancement programs in higher education. Alumni relations, fund raising, institutional relations, publications, government relations, and the executive management of these various activities. Needed research in the field is explored.

EDHED 520 Seminar in the Administration of Community Colleges (3) For students preparing for administrative positions in community colleges. Principles and practices in organization and administration of community colleges. Prerequisite: 503 or equivalent.

EDHED 521 Seminar in Occupational Programs in Higher Education (3) *Schill* Analysis of current critical social and educational issues that affect occupational preparation programs in post-high-school institutions. Prerequisite: 501 or permission of instructor.

EDHED 522 Seminar in Teaching and Learning in Higher Education (3-9) *Reitan* Advanced seminar devoted to a consideration of theory and practice in the area of instruction and learning. May be repeated with permission. Open to advanced doctoral students in higher education and to others at the discretion of the instructor.

EDHED 523 Seminar in Institutional Analysis and Planning (3) *Cope* Study of the nature, the functions, and the techniques of analysis as they pertain to institutions of higher education. The application of computer-based information systems, program budgeting, behavioral research techniques, and long-range planning procedures are examined as aids to assessment, planning, and change. Intended for doctoral candidates.

EDHED 524 Seminar in the History and Organization of Higher Education (3) *Williams* Advanced seminar on special problems in the history and the organization of higher education. May be repeated for credit at the discretion of the student and the instructor. Open to advanced doctoral students in higher education and to others at the discretion of the instructor.

EDHED 525 Administering the Urban Community College (3) *Kelly* Examination of the community college in the context of the urban setting. Attention is given to the impact of ecology, critical events, and social action groups upon structure, operations, and development of the community college.

EDHED 526 Higher Education and the Law (3) W *Morishima, Olswang* Legal implications of university operations and an explanation of the legal and constitutional rights of students, faculty, and staff within the university. Special attention given to employment and termination decisions, student protections, and due-process rights and university liabilities.

EDHED 527 Decision Making in Colleges and Universities (3) *Estler* Examination of decision-making processes in modern organizations, such as colleges and universities, characterized by problematic goals, complex decision-making processes, and fluid participation. Consideration given to the impact of information, power, beliefs, resources, organizational structure, and the environment. Alternative models of choice and their implications for leadership and change are reviewed.

EDHED 528 Organizational Change in Colleges and Universities (3) *Estler* Change and innovation in colleges and universities. Theoretical approaches include sociopsychological, rational planning, and political perspectives, as well as those associated with the notion of organized anarchies. Attention also paid to specific topics of interest related to change and innovation (e.g., role of beliefs, symbols and norms, diffusion of innovations, and research issues). Prerequisite: 527 or permission of instructor.

EDHED 529 Resource Allocation in Higher Education (3) *Doi, Estler, Saunders* After attention to the basic tools of economic analysis, focus is on application of those tools to specific topics in higher education (e.g., access, budgeting, finance and policies, and funding alternatives).

EDHED 550 Review of Research in Higher Education (1-3) Open seminar for all students in higher education, devoted to the mutual consideration of research in this field. May be repeated with permission of the adviser.

EDHED 554 Seminar in the Administration of Colleges and Universities (3) *Cope* Study of the internal administration and organization of four-year colleges and universities with emphases on practice and theory. Instruction largely by the case or problem method.

EDHED 559 Seminar in Higher Education (3) Intensive study of selected problems and proposals for research in higher education. May be repeated for credit. Prerequisite: permission of instructor.

EDHED 592 Institutional Research Methods (3) A For students planning to engage in institutional research in higher education. Primary emphasis on survey research and data-gathering forms. Background provided on theory, format, caveats, and the like. Students expected to develop forms for class critique. Prerequisite: EDPSY 591.

EDHED 600 Independent Study or Research (*) Prerequisite: permission of instructor.

EDHED 601 Internship (3-9, max. 9) AWSpS Offered on credit/no credit basis only. Prerequisite: graduate standing and permission received at least one month prior to the beginning of the quarter in which the internship is taken.

Special Education

EDSPE 404 Exceptional Children (3) Atypical children studied from the point of view of the classroom teacher.

EDSPE 414 Integrating Handicapped With Non-Handicapped Preschool Children in the Inner City (3) Upper-division course designed for teachers and aides planning to work in inner-city preschool classrooms where handicapped children are integrated with nonhandicapped children.

EDSPE 418 Vocational Development of Handicapped Children and Youth (3) Curricular aspects of vocational training relevant to each age level in the education of handicapped children. Application of programmed instructional techniques to breaking down of the occupational task. Emphasis on familiarizing school personnel with interdisciplinary services and community resources available to assist them in facilitating the maximal vocational development of handicapped children and youth.

EDSPE 419 Interventions for Families of Handicapped Children (3) *Edgar* Upper-division course for professionals and paraprofessionals working with families of handicapped children enrolled in special education or integrated programs.

EDSPE 435 Principles and Practice of Manual English (3) Nature of manual communication is introduced with an identification of its specific modes: sign language, signed English, simultaneous method, finger spelling, and manual English. Discussions center on the linguistic structure of signs, the psycholinguistic effects of signs on young children, and a review of the pertinent literature. Laboratory sessions emphasize manual English. Entry card required.

EDSPE 436 Manual Communication for the Hearing Impaired (3) Intermediate course in manual conversation stressing fluency in both receptive and expressive manual English. Grammatical system of Ameslan introduced and practiced. Prerequisite: 435 or permission of instructor.

EDSPE 475 Recreation and Leisure Activities for the Handicapped (3) Acquaints the student with the philosophy of specialized recreation and leisure activities for the handicapped: community, state, and national organizations providing leisure activities; adaptive devices and how to organize various activities; and the need to integrate and coordinate recreation, education, and service organizations working with the handicapped. Observation, practical experience, guest speakers, films, and lectures. Experience or at least an interest in working with handicapped students is beneficial.

EDSPE 496 Workshop in Special Education (1-9, max. 15) Demonstration, observation, and/or participation with groups of handicapped children in laboratory or controlled classroom settings. Prerequisite: permission of instructor.

EDSPE 499 Undergraduate Research (2-5, max. 5) Students developing studies under this rubric should be advised that a report or a paper setting forth the results of their investigations should be regarded as a basic part of the program. Prerequisite: permission of instructor.

EDSPE 500 Field Study (3-6, max. 6) Individual study of an educational problem in the field under the direction of a faculty member. Prerequisites: approved plan of study and permission of the instructor must be filed in the Office of Special Education in the College of Education.

EDSPE 505 Educating the Mentally Retarded (3) Basic course for students preparing to teach severely mentally retarded students; organization of programs, curriculum planning, and instructional procedures and materials.

EDSPE 507 Education of Severely Retarded Individuals With Multiple Handicaps (3) Basic course for students preparing to teach the moderately to severely retarded individual and the multiple-handicapped individual. Includes community resources, implementation of instructional techniques, and modification of materials for these students.

EDSPE 508 Administration of Special Education (3) Research and trends in administrative organization, programs, personnel assignments, and instructional groupings for the education of exceptional students as these relate to the total school program, pupil personnel services, community agency services, and state and federal legislation.

EDSPE 509 Seminar in Mental Retardation (3) Interdisciplinary approach to the advanced study of selected research topics in mental retardation. Designed for teachers, psychologists, social workers, and related professional personnel.

EDSPE 510 Behavioral Measurement and Management in the Classroom (3) Response measurement in the classroom; use of data analysis for instructional decisions and behavior management; instructional programming for handicapped children.

EDSPE 511 Applied Behavior Analysis (3) Characteristics of applied behavior analysis are presented: direct, daily measurement, and the systematic investigation of important variables. Representative studies from various applied situations are discussed in terms of dependent and independent variables, research design, reliability, validity, and data analysis. Prerequisite: 510.

EDSPE 513 Clinical Appraisal of Exceptional Children (3) Diagnostic instruments used in the clinical appraisal of exceptional children. Theoretical considerations are used to buttress practical experiences in appraisal related to intervention. Prerequisite: permission of instructor.

EDSPE 514 Fundamentals of Reading for Handicapped Children (3) Preservice course. Emphasis on basic prereading and reading skills, such as phonics and structural analysis, specifically for the handicapped child. Acquisition of comprehension skills by the handicapped. Diagnosis of reading problems; published materials appropriate for handicapped; material modification.

EDSPE 515 Problems and Issues in Special Education (3, max. 9) Intensive examination of the issues pertinent to all of special education, such as legislation, interdisciplinary function, and the role of special education in general education and placement practices. Prerequisite: permission of instructor.

EDSPE 517 Practicum in Research Design and Analysis in Special Education (3) Critical analysis of current research practices in special education serves as background to a student carrying out a small independent research project. Projects are evaluated in seminar discussion. Prerequisites: EDPSY 490 and 591 or equivalent, or permission of instructor.

EDPSE 518 Seminar in Special Education Research (1, max. 3) Designed for doctoral students in special education during their first year of residency. Each candidate selects a dissertation problem and submits a proposal. Topics such as the procurement of subjects, the reporting and communication of research findings, and the evaluation of research are stressed. The seminar leads to the evolution of a viable dissertation proposal.

EDSPE 520 Seminar in Applied Special Education (1-12, max. 12) Designed for graduate students in special education. Focus on contemporary topics relating to the application of the theoretical constructs to special education. Prerequisite: permission of instructor.

EDSPE 521 Classroom Strategies for Developing Communication in Exceptional Children (3) Normal and deviant language/communication development. Assessment of receptive and expressive language and formulation of communication intervention strategies. Various sections focus on children with specific handicapping conditions. Prerequisite: permission of instructor.

EDSPE 522 Seminar on the Education of the Severely/Profoundly Handicapped (3) Advanced graduate seminar arranged to study and discuss the essential components of providing a comprehensive approach to the intervention and education of the severely/profoundly handicapped infant, child, adolescent, or young adult.

EDSPE 525 Educating Autistic and Severely Behavior Disordered Children (3) Consideration of the diagnoses, etiology, education, and prognoses of autistic and severely behavior-disordered children. Prerequisite: permission of instructor.

EDSPE 530 The Hearing Impaired (3) Consideration of problems of deaf individuals from social, economic, and educational point of view; history of education of the hearing-impaired learner.

EDSPE 531 Aural-Oral Communication for the Hearing Impaired: Part I (3) Develops competencies in teaching receptive language skills through children's use of residual hearing, utilization of appropriate amplification, and speech reading. Emphasis on acquisition of related knowledge and demonstration of knowledge with children in individual or group settings. Prerequisite: permission of instructor.

EDSPE 532 Aural-Oral Communication for the Hearing Impaired: Part II (3) Techniques of teaching speech to hearing-impaired children at the phonologic and phonetic levels. Emphasis on speech development using residual hearing. Prerequisite: 531 or permission of instructor.

EDSPE 533 Teaching Language to the Hearing Impaired (3) Methods for instructing hearing-impaired students with language acquisition problems. Analysis of currently available curriculum and instructional materials. Skills in diagnosis, evaluation, and program development. Prerequisite: 521.

EDSPE 534 Teaching the Hearing Impaired (3) Methods for instructing hearing-impaired students in regular school subjects. Skills in educational diagnosis, construction of instructional materials, and program development. Prerequisite: 545.

EDSPE 541 Education of the Emotionally Disturbed (3) Analysis of major theoretical approaches to the education of emotionally disturbed children. Adaptation of various approaches to various educational settings.

EDSPE 542 Mental Retardation (3) Introductory course on mental retardation and the challenges it presents to parents, the mentally retarded individual, the community, the schools, and society.

EDSPE 543 Learning Disabilities (3) Analysis of major theoretical approaches to the study of children with learning disabilities. Adaptation of various approaches to various educational settings.

EDSPE 545 Instructional Modifications for the Education of the Mildly Handicapped (3) In-depth analysis and application of several modifications of instructional techniques necessary for the education of mildly handicapped students.

EDSPE 546 Seminar in Educating the Socially and Emotionally Disturbed (3) Advanced-level seminar that analyzes the classical and contemporary research in the intervention of behavior disorders; reviews intervention procedures, applied in a variety of classroom administrative organizations, and prepares a scholarly manuscript for dissemination.

EDSPE 548 Seminar in the Education of Children With Learning Disabilities (3) In-depth analysis of empirical findings in the specialty of learning disabilities with focus on the synthesis of research findings and their application to educational environment. A paper suitable for publication required. Prerequisite: course in learning theory, introductory course in learning disabilities, or permission of instructor.

EDSPE 585 Seminar: Early Childhood Education for the Handicapped (3) Advanced seminar on early childhood education for the handicapped. Historical and current research from appropriate specialties in special education reviewed; research from related fields is reviewed in terms of its application to the education of young handicapped children.

EDSPE 589 Seminar: Research on Intervention With Handicapped Infants (2, max. 6) Examination and analysis of research on intervention with at-risk, developmentally delayed, and disabled children (birth to thirty-six months). Focuses on design and content of investigations. Prerequisites: permission of instructor or courses in child development and EDPSY 490 or its equivalent. Entry card required.

EDSPE 599 Independent Studies in Education (*) Independent studies or readings of specialized aspects of education.

EDSPE 600 Independent Study or Research (*)

EDSPE 601 Internship (3-9, max. 9) Prerequisites: graduate standing and permission based on prearrangement of internship placement and approval by adviser.

Independent Study, Research, and Field Experiences

(Teaching Practicum)

EDUC 301 Introductory Practicum in Community Service Activity (3) Opportunity is provided for initial tutoring and teaching experiences in a specific community service organization, placement made according to participant interests and needs. Approximately sixty hours of participation on a prearranged schedule plus scheduled seminars are required. Prerequisites: application during quarter prior to participation and permission of instructor.

EDUC 302 Introductory Practicum in Classroom Teaching and Management (3-6, max. 9) Opportunity is provided for initial participation experience in classroom teaching and management. Assignment is for twenty hours per credit in a specific school situation, level as requested. Scheduled seminars required. Prerequisites: application during quarter prior to participation and permission of instructor.

EDUC 401 Practicum in Community Service Activity (3-18) Opportunity is provided for tutoring and teaching experiences in a specific community service organization, placement made according to participant interests and needs. Approximately twenty hours of participation on a predetermined schedule plus scheduled seminars are required for each credit earned. Participants wishing to utilize community service experience to satisfy, in part, certification requirements should make arrangements prior to enrollment with the Director of Certification. Prerequisites: application during quarter prior to participation and permission of instructor.

EDUC 402 Practicum in Classroom Teaching and Management: Early Childhood, Kindergarten, Primary (Through Grade 3) (5-36) Teaching practicum is completed in an assigned school. Approximately twenty hours of participation on a predetermined schedule plus scheduled seminars are required for each credit earned. Placement is approved through the Office of Teacher Education. Prerequisites: permission of instructor.

EDUC 403 Practicum in Classroom Teaching and Management: Intermediate Grades, Middle School (5-36) *Dimmitt* Teaching practicum is completed in an assigned school. Approximately twenty hours of participation on a predetermined schedule plus scheduled seminars are required for each credit earned. Placement is approved through the Office of Teacher Education. Prerequisite: permission of instructor.

EDUC 404 Practicum in Classroom Teaching and Management: Secondary School (Grades 7-12) (5-36) *Dimmitt* Teaching practicum is completed in an assigned school. Approximately twenty hours of participation on a predetermined schedule plus scheduled seminars are required for each credit earned. Placement is approved through the Office of Teacher Education. Prerequisite: permission of instructor.

EDUC 501 Advanced Practicum in Community Service Activity (3-18) Opportunity is provided postbaccalaureate students with selective, in-depth participation and teaching experiences in a specific community service organization. Approximately twenty hours of participation plus scheduled seminars are required for each credit earned. Participants wishing to use advanced community service experience to satisfy, in part, graduate program requirements should make such arrangements prior to enrollment with their adviser and the Director of Certification. Prerequisites: application during quarter prior to participation and permission of instructor.

EDUC 502 Advanced Practicum in Classroom Teaching and Management (3-18) Designed to provide certificated teachers with selective, in-depth classroom participation experiences. Activities include, for example, specialized reading instruction, assessment of learning disabilities, remedial or specialized teaching, experimental approaches to learning, etc. Participants wishing to use the advanced teaching practicum to satisfy, in part, graduate program requirements should make such arrangements prior to enrollment with their adviser and the Director of Certification. Prerequisites: application during quarter prior to participation and permission of instructor.

EDUC 700 Master's Thesis (*) Prerequisite: permission of supervisory committee chairperson or graduate program adviser.

EDUC 800 Doctoral Dissertation (*) Prerequisite: permission of Supervisory Committee chairperson or graduate program adviser.

College of Engineering

Dean

J. Ray Bowen
371 Loew

Associate Deans

Richard C. Corlett
Edwin B. Stear
Thomas G. Stoebe

Engineering is an increasingly critical societal enterprise. More than ever before, the engineer is challenged both to design products whose value is high by social and economic measures and to provide for efficient manufacture of such products within constraints of environmental protection and diminishing raw material resources. Requirements imposed on the transportation system and other elements of society's physical infrastructure pose analogous challenges. At the same time, improvements in computer cost and sophistication are dramatically impacting both the products and processes designed by the engineer and the actual practice of engineering.

An engineer with the baccalaureate degree is adequately prepared for many challenging technical assignments in government and industry. Students who plan to engage in research, college teaching, or creative activities on a professional level, however, should undertake graduate study leading to either a master's or doctoral degree.

At the undergraduate level, the College of Engineering offers a flexible curriculum that accommodates varied student needs, both in established departmental programs and in new interdisciplinary studies. The college also offers active educational and research programs, both departmental and interdisciplinary, at the graduate levels. (See Engineering Interdepartmental Curricular Program for nondepartmental undergraduate and graduate programs.)

The College of Engineering has been a major unit of the University since 1899; the first engineering degrees were authorized in mining engineering and metallurgical engineering in 1898. Degrees were added for civil engineering (1901), electrical engineering (1902), mechanical engineering (1906), chemical engineering (1907), ceramic engineering (1919), aeronautical engineering (1929), and nuclear engineering (1955). In 1983, 1,547 upper-division undergraduate majors and 868 graduate students were enrolled in engineering programs taught by a faculty of about 180 members.

College Facilities

Teaching and research activities of the college are conducted in thirteen major campus buildings (and portions of others), which contain the college's offices, classrooms, and research and teaching laboratories. The engineering library, a branch of the University library, provides outstanding collections of books, periodicals, technical reports, and patents of interest to engineers. Computers and terminals are available in all departments and at the University's Academic Computer Center.

Facilities of particular interest to students include a wind tunnel, nuclear reactor, structural testing laboratory, hydraulics laboratory, laboratory for heat-transfer studies, and interdisciplinary research laboratory.

Student Organizations and Activities

All of the major professional engineering societies have student chapters on campus, and every engineering student is encouraged to join the chapter that represents his or her field of interest. The college also has student chapters of the Society of Woman Engineers, American Indian Science and Engineering Society, National Society of Black Engineers, and the Society of Hispanic Professional Engineers. The Engineering Student Council, comprising student representatives from all departments and professional societies, is the major college-wide student organization and participates actively in college affairs. Honor societies open to engineering students are Tau Beta Pi and Sigma Xi.

Students serve with faculty members on engineering policy committees, which make recommendations concerning teacher evaluation, curriculum revisions, advising, grading systems, and other matters of interest to students and faculty.

Financial Aid

The college offers financial assistance to undergraduates through industrial scholarships and loan funds. Scholarship information is available at the College Advising Center and at the Office of Student Financial Aid, 105 Schmitz. Most scholarships are given after a year in residence by the student.

Undergraduate Program

The College of Engineering provides curricula that offer a variety of educational experiences to its students. The curricula also facilitate transfer from community colleges and from other four-year colleges and universities.

Admission

At present, admission to any of the various engineering departments or curricula is competitive and can occur only after a student has completed certain required courses and has reached at least sophomore standing. In general, the required courses are: one year of calculus, one or two quarters of chemistry and physics, and one or two quarters of engineering science courses (e.g., statics and dynamics). Each department should be consulted for its specific entrance requirements.

Recommended High School Preparation

Substantial high school preparation in mathematics, physical science, and communication is essential for entrance to engineering studies. Required and recommended courses may be determined from the Engineering Advising Center.

Engineering Advising Center

Executive Director: Jack T. Leahy
353 Loew

The Engineering Advising Center assists any student interested in planning the initial portion of an engineering degree program, particularly to the point the student is eligible to apply for admission to one of the seven departments in the college. A student who is interested in engineering is urged to declare a preengineering major in the College of Arts and Sciences and to seek advice in the advising center.

Students are urged to contact faculty members anywhere in the college for program, course, or career information and discussion. A first-year career-planning course (ENGR 110) is available for students who wish more information on career alternatives.

Types of Programs

The college offers three basic programs leading to Bachelor of Science degrees:

Departmental Major. This program leads to a Bachelor of Science degree in a designated field of engineering (e.g., Bachelor of Science in Civil Engineering). It is designed for students who intend to practice as professional engineers in a standard branch of engineering or who plan to undertake graduate study in that field. The curricula for these degrees are accredited by the Accreditation Board for Engineering and Technology, (ABET), the principal engineering accrediting agency in the United States. Accreditation requirements stipulate certain course distribution requirements for the undergraduate degree. A description of how each of the accredited baccalaureate programs meets the ABET requirements is available from the department office and from the Engineering Advising Center. Accredited four-year curricula leading to baccalaureate degrees are offered in aeronautics and astronautics and in ceramic, chemical, civil, electrical, mechanical, and metallurgical engineering. A nonaccredited curriculum leading to a Bachelor of Science in Industrial Engineering degree is offered through the Department of Mechanical Engineering.

Application to a department program at the upper-division level is made at a time that lower-division requirements are satisfied. Currently, enrollment limits imposed by faculty size and laboratory/classroom space available are such that entry into a specific department may be very competitive. In general, a student applicant must demonstrate superior scholastic aptitude, as evidenced by the attainment of grades whose average ranges from 2.5 to 3.4 (depending upon the program) in mathematics, natural science, and engineering science. The student is urged to plan ahead by learning his or her future department's requirements and particularly by noting which requirements must be fulfilled by the time the application is made. Some departmental programs are sufficiently flexible to permit entry in any quarter of the year, while others may permit entry only during Autumn Quarter.

Nondepartmental Professional Program. This program leads to a Bachelor of Science in Engineering degree and is designed for students who have well-defined, special educational objectives that departmental programs do not satisfy. Graduates can practice as professional engineers in newly developing fields, or they may embark on graduate study in these or allied fields (see Engineering Interdepartmental Curricular Program).

Nonprofessional Program. Leading to a Bachelor of Science degree, this program is intended for students who wish to have significant exposure to science and engineering courses, but who do not plan to engage in professional engineering practice (see Engineering Interdepartmental Curricular Program).

General Requirements for Graduation. To graduate, students must meet or exceed the requirements of the University, the college, and their particular program or department. College requirements are listed in this section, and program or departmental requirements are given in the specific section that describes the program or department.

All departments of the college have continuation policies that specify a minimum rate of progress as well as minimum academic performance levels. These policies may be more restrictive than those generally applied by this university and may change in time. Information on current policy is available at the departmental offices.

Selecting courses that fulfill graduation requirements is the responsibility of each individual. Students are urged to check carefully the course and credit requirements of the program in which they are enrolled.

The college requires a minimum number of credits within certain areas of study and some specific courses within certain areas. All programs require:

MATHEMATICS: 23 CREDITS

Specific courses required are MATH 124, 125, 126, and 238. The remaining 5 credits must be taken at the 200 level or higher; MATH 205, ENGR 401, 402, 403, or MATH 327 are recommended.

NATURAL SCIENCE: 23 CREDITS

Chemistry (4 credits) at the level of CHEM 140 or equivalent and PHYS 121 and 122 (8 credits) are required. The 11 additional credits are often completed by further study in chemistry or physics, but students may elect advanced courses in such other fields as astronomy, atmospheric sciences, biology, geological science, geophysics, or oceanography. Elementary survey courses are not acceptable in this category.

FUNCTIONAL TECHNIQUES: 12 CREDITS

ENGR 141, Introductory FORTRAN Programming (4 credits), and a college-level writing course (e.g., ENGR 331 [3 credits]) are required. The remaining credits are to be selected from the following areas of study: visual presentation, written and oral communication, computational technology, design and synthesis, and laboratory techniques. At least three of the five areas must be represented by the courses used to meet the functional techniques requirement.

ENGINEERING SCIENCE: 16 CREDITS

No specific courses are required by the college. Courses may be selected from materials science, mechanics, linear systems, electronics, and thermodynamics. In special cases, and with the major adviser's approval, a student may include in the engineering science category various courses in mathematics, science, and engineering (usually upper-division courses not in the major field).

A major department may specify as many as 16 credits of particular courses, not already specified for all students, from the mathematics, natural science, functional techniques, and engineering science areas (see individual departmental requirements). Such courses are intended to provide the student with a strong background for the chosen major field of study.

Students who have completed 135 credits or more of their degree program may use courses numbered in the 100 and 200 series to satisfy basic requirements of the College of Engineering only with their major adviser's approval. Engineering science and functional techniques requirements are normally satisfied by upper-division students with the substitution of 300- or 400-level courses that are not in the student's major department or professional program.

HUMANITIES AND SOCIAL SCIENCES: 30 CREDITS

A minimum of 10 credits is required in each area. Humanities includes courses in literature, art, music, drama, philosophy, etc., which stress the essential qualities of individual forms of expression. Language courses must be concerned with literature, not skills; similarly, art or music courses must be devoted to music or art forms, not development of students' performing skills. Social sciences include courses in history, economics, psychology, sociology, etc., which stress the social nature of mankind and the development and analysis of societies and/or social institutions.

UPPER-DIVISION ENGINEERING COURSES OF STUDY: 66 CREDITS

Major departments or specific programs may require as many as 78 credits in their curricula.

Special Programs

Cooperative Education and Minority Internship Program
353 Loew
Director: Helene C. Beaver

The Cooperative Education and Minority Internship Program of the College of Engineering provides the opportunity for pre-engineering students and all departmental students to combine practical, full-time, on-the-job engineering experience with alternate periods of full-time academic study. Advantages of participation in this program include assistance for the student in deciding which branch of engi-

neering to follow; additional income to help defray college expenses; relevance and motivation for study, based on real engineering work; and work experience and employment contacts that often result in a higher starting salary after graduation.

Information may be obtained from the Director of Cooperative Education, College of Engineering, FH-10, University of Washington, Seattle, Washington 98195.

Continuing Education Programs

Engineering noncredit short courses, conferences, televised instructional programs, and late-afternoon credit classes are offered to the professional community. These offerings range from refresher courses, which assist engineers who are planning for professional registration, to credit courses leading to a graduate degree. In general, the offering of noncredit and credit continuing education programs is based on need or demand. Courses are announced in *Spectrum*, by special announcements, professional society newsletters, and news media.

Special Facilities

OFFICE OF ENGINEERING RESEARCH

Coordinator: Edwin B. Stear
376 Loew

The Office of Engineering Research attempts to promote, stimulate, and coordinate research in all fields of engineering. Its primary role is to maintain records of grant and contract proposals and awards. It allocates limited resources to various college units to increase the number and quality of research grants and contracts in the College of Engineering. These resources include funds to prepare proposals, to present proposals to possible funding agencies, and to locate potential sources. Support to enhance direct contact with funding sources such as travel supplements is given priority.

AEROSPACE AND ENERGETICS RESEARCH PROGRAM

Director: Abraham Hertzberg
120 Aerospace Research and Engineering Laboratory

The Aerospace and Energetics Research Program is directed toward high-technology engineering research and teaching through research. The program has the task of anticipating, and even trying to outpace, the critical technology needs of our nation. The research and teaching programs of this laboratory, therefore, emphasize those engineering skills that both match the requirements of the present and future and develop in students a broad understanding of the impact of technology on society. Suitable programs are designed to develop in the student through his particular research program the imagination and, more importantly, the willingness to respond to the complex and rapidly changing future of engineering. This ideal directs the faculty's efforts and creates within the principal investigators, research faculty, and students the concept of engineering as an adventure.

The program is marked by a catholic approach to research, with programs covering many fields, usually centered about energy or aerospace. For example, currently active research programs in plasma engineering related to fusion power, space and terrestrial solar energy systems, laser bioengineering experiments, and studies of the basic technology of high-power laser systems, which represent some of the interests of the principal investigators working together in the Aerospace and Energetics Research Program.

BRITTLE MATERIALS DESIGN CENTER

Director: James I. Mueller
301 Roberts

The Brittle Materials Design Center is an interdisciplinary activity of the College of Engineering that involves design methodology studies and research on the utilization of high technology ceramic materials in advanced structures for use in hostile environments.

The design methodology portion includes a unique academic program available to senior students in aeronautics and astronautics, ceramic engineering, civil engineering, mechanical engineering, and metallurgical engineering. Teaching faculty members from four different engineering disciplines are involved in a series of courses that may be utilized to satisfy undergraduate design requirement in several departments. Detailed information on these courses is available in the descriptive material of each of the participating disciplines.

Interdisciplinary research involves faculty and students from the College of Engineering and the College of Arts and Sciences. Support is obtained from several federal agencies and industrial organizations.

OCEAN ENGINEERING LABORATORY

Director: Bruce H. Adee
326 Mechanical Engineering

The diverse ocean engineering research program is housed in various areas around the campus. At the Applied Physics Laboratory, the emphasis is on underwater acoustics and instrumentation research, while wave channels and hydraulic modeling are the main facilities in use at the Harris Hydraulics Laboratory. The Mechanical Engineering Building houses computer facilities, including a computer-controlled data-acquisition system and a small laboratory used to support field experiments. A large portion of the laboratory activities involve field experiments. Where wave measurement is required, a mobile semisubmersible wave-measuring platform is available and has been used extensively in conjunction with radio-controlled ship model tests.

Research activities undertaken by the faculty include marine acoustics, marine hydrodynamics, coastal structures, floating breakwaters, marine materials, marine propulsion, marine transportation safety, shipbuilding productivity, and computer-aided design and engineering.

WASHINGTON MINING AND MINERAL RESOURCES RESEARCH INSTITUTE

Director: Osgood J. Whittemore
304 Roberts

This state institute was established in January, 1960, at the University. Its responsibilities include the conduct of research, investigations, demonstrations, and experiments of a basic and/or practical nature in relation to mining and mineral resources and the provision for the training of mineral engineers and scientists. The institute is under the direction of the Department of Materials Science and Engineering.

Course Descriptions

Courses for Undergraduates

Functional Techniques

ENGR 123 Introduction to Engineering Graphics (2) AWSpS Freehand sketching, lettering, scales, use of instruments, layout drawings, orthogonal projection, descriptive geometry, pictorials, and basic dimensioning. Communicating technical information in engineering design and research. Brief introduction to computer-aided design.

ENGR 124 Engineering Graphics With an Introduction to Design (3) AWSpS Engineering graphics for developing design and research ideas; freehand sketching, layout, detail and assembly drawings, applied descriptive geometry. Design projects assigned to illustrate design processes and application of engineering graphics in design and research. Includes graphical mathematics, report preparation, computer-aided design, and patent drawings. Prerequisite: 123 or equivalent.

ENGR 130 Introduction to Technical Writing (3) Principles of organizing, developing, and expressing technical information. Report forms and rhetorical patterns common to scientific and technical disciplines (description, process, research and laboratory reports). Technical writing conventions such as illustration and heading use, style, and tone. Kinds of writing required of students during their academic careers.

ENGR 140 Measurement and Experimentation (4) AWSp Collection and analysis of data on practical subsystems in the context of engineering situations. Common laboratory instrumentation is explained and utilized. Results are synthesized into engineering report form as both group and individual experiences. Prerequisites: MATH 124, PHYS 121.

ENGR 141 Introductory FORTRAN Programming (4) AWSpS Computer programming using FORTRAN language. Includes use of one-, two-, and three-dimensional arrays and subroutines. Emphasizes problem-solving techniques using structured or modular programming concepts. Prerequisite: MATH 105 or permission of adviser.

ENGR 199 Special Projects (1-3, max. 3) AWSpS Students propose problems to solve to an engineering faculty member. The problems may be selected from the student's own experiences and interests, from the interest of the faculty member, or from other sources such as faculty or graduate students doing research projects, or from personnel in the physical medicine area, occupational therapy, hospital, industry, government, etc. Corroboration by an engineering faculty member is required. Project suggestions are available.

ENGR 202 Special Projects (1-3) AWSpS Projects on topics of current interest in engineering. Prerequisite: permission of instructor.

ENGR 331 Advanced Scientific and Technical Writing (3) Principles of presenting technical material logically, concisely, and effectively to meet the requirements of various situations and audiences. For majors in engineering and similar professional programs, and for those in the natural, social, and health sciences. Kind of writing required of professionals in these technical fields. Prerequisite: junior standing or permission of instructor.

ENGR 332 Technical Briefings and Presentations (3) Technical information for different audiences and different purposes. Includes analyzing the professional situation, preparing the presentation, and the role and use of visuals. For students in engineering and similar professions and for those in the natural, social, and health sciences. Concentrates on professional papers, management briefings, and public presentations. Prerequisite: junior standing or permission of instructor.

Engineering Sciences

ENGR 170 Fundamentals of Materials Science (4) AWSpS Elementary principles underlying the structure and properties of materials utilized in the practice of engineering. The properties of inorganic and organic materials are related to atomic, molecular, and crystalline structure. Metals, ceramics, multiphase systems, and natural and synthetic polymeric materials are included. Mechanical stress, electromagnetic fields, irradiation, and thermal and chemical changes are considered with respect to their influences on mechanical, electrical, and chemical properties. For advanced freshmen and sophomores. Prerequisite: CHEM 150 or permission of adviser.

ENGR 171 Materials Science Laboratory (1) AWSpS Experiments in materials science designed to illustrate fundamentals related to the structure and the properties of engineering materials; optical microscopy, x-ray diffraction, mechanical properties, electrical conductivity, crystal growth, solid-state reactions. Prerequisite: 170, which may be taken concurrently.

ENGR 180 Introduction to Logical System Design (4) AWSpS Introduction to concepts of logical design of specific classes of systems primarily observed in digital logics. Representation, conversion, and arithmetics of number systems related to logical systems. Boolean algebra fundamentals and operations. Topological representation of logical combinational functions, complexity reduction, optimization criteria. Time-dependent sequential logics using memory, representations, minimization, and implementation. Register transfer concepts. Four hours lecture weekly. Prerequisite: MATH 105.

ENGR 198 Educational Projects in Materials Science (1-5) AWSpS In-depth study of special topics in materials science with special seminars and lectures, participation in materials science research projects or curriculum development projects involving science or industrial arts classes. May be repeated for credit. Prerequisite: permission of instructor.

ENGR 210 Engineering Statics (4) AWSpS Principles of statics, basic concepts, parallelogram law, Newton's law, resultants, force-couple relationships, equilibrium diagrams, equilibrium analysis, three-dimensional structures, two-dimensional frames, trusses, beams, and friction. Vector algebra used throughout the course. Prerequisites: MATH 126, PHYS 121. Recommended: graphics background.

ENGR 220 Introduction to Mechanics of Materials (4) AWSpS Introduction to the concepts of stress, deformation, and strain in solid materials. Development of basic relationships between loads on structural and machine elements such as rods, shafts, and beams, and the stresses, deflections, and load-carrying capacity of these elements under tension, compression, torsion, bending, and shear forces, or combinations thereof. Prerequisite: 210.

ENGR 230 Kinematics and Dynamics (4) AWSpS Kinematics of particles, systems of particles, and rigid bodies; moving reference frames; kinetics of particles, systems of particles, and rigid bodies; equilibrium, energy, linear momentum, angular momentum, Euler equations, and special problems (e.g., central force motion, vibration). Prerequisite: 220.

ENGR 260 Thermodynamics (4) AWSpS *Depew* Introduction to the basic principles of thermodynamics, from a predominantly macroscopic point of view. Development of the basic laws of thermodynamics, together with this illustration by application to energy transformations and state changes in engineering problems. Prerequisites: MATH 126, 100-level physics and chemistry courses.

Electives

ENGR 110 Career Planning I (1) AW Presentations by various faculty members, staff, students, and recent graduates offer an introduction to the College of Engineering, curricular options, fields of engineering, interdisciplinary programs, and information of general interest. Offered on credit/no credit basis only.

ENGR 305 Environmental Radioactivity (3-4) Sp Nature of various sources of radioactivity encountered today and to be expected in the future. Topics include: natural radioactivity; radiation

from nuclear weapons, from nuclear power plants and fuel reprocessing plants, and from medical diagnosis; radiation effects on plants and animals; radiation therapy and other useful applications and methods of detection.

ENGR 310 Social Constraints on Engineering Design (3) WS Examines cases of engineering designs and identifies ways in which social goals affect engineering design decisions. As part of this examination, social values and public policy issues that generate design criteria are explored. Appropriate course for students from any discipline. Offered on credit/no credit basis only. Prerequisite: junior standing or permission of instructor.

ENGR 341 Computer Applications of Numerical Methods (3) AWSpS Development and application of numerical methods and algorithms to solve problems in engineering. Simultaneous equations, curve fitting, root-finding algorithms, Taylor series analysis, numerical integration, ordinary differential equations. Offered jointly with AMATH 341. Prerequisites: 141 or equivalent and MATH 238, which may be taken concurrently.

ENGR 345 Advanced Topics in Digital Computing (3) AWSpS The concept of the higher-level language. Advanced FORTRAN techniques used to construct an interpreter, including the full set of FORTRAN 77 statements, the machine-dependent features of the CDC/CYBER 170-750, real and integer binary number conversion, object-time formatting, and introduction to use of control cards. Several programs in addition to the interpreter are written and executed. Prerequisite: 141 or equivalent.

ENGR 346 Assembly Language Programming (3) AWSpS The central processor assembler language, COMPASS, of the CDC/CYBER 170-750 computer, including program structure and organization, COMPASS language instructions, pseudoinstruction, and macroprogramming techniques. Integer and floating-point conversion, character manipulation, simple and nested loops, array accessing, COMPASS-FORTRAN subroutine linkage, and instruction timing. Programs are coded and executed on the computer. Prerequisite: 141 or equivalent.

ENGR 351 Inventions and Patents (1) Sp *Seed* Law and procedures for patenting inventions, employer-employee relationship, and trademarks. Primarily for engineering students. Prerequisite: junior standing.

ENGR 360 Introductory Acoustics (3) Sp Introduction to propagation of acoustical waves; emphasis on propagation of sound waves in air, but material is applicable to propagation of sound waves in liquids, including underwater acoustics, and to propagation of stress waves in solids. Includes a historical development of acoustics, terminology, and units employed.

ENGR 401 Methods in Applied Mathematics I (4) ASp Acquisition of technique and experience in application of areas of mathematics encountered in science and engineering; illustrated by case studies from many fields. Applications of vector differential calculus; line and surface integrals, integral theorems; complex variables; Taylor and Laurent series, contour integration. Offered jointly with AMATH 401. Prerequisites: MATH 205, MATH 327 or A A 370, and AMATH 351 or MATH 238 or permission of instructor.

ENGR 402 Methods in Applied Mathematics II (4) WS See 401. Applications of ordinary differential equations, phase plane, stability; systems of differential equations; power series solutions, Laplace and Fourier transforms; Fourier series. Offered jointly with AMATH 402. Prerequisite: AMATH 401 or permission of instructor.

ENGR 403 Methods in Applied Mathematics III (4) SpS See 401. Application of partial differential equations, special functions, probability and statistics. Offered jointly with AMATH 403. Prerequisite: AMATH 402 or permission of instructor.

ENGR 498 Special Topics in Engineering (1-5, max. 6) AWSpS

ENGR 499 Special Projects in Engineering (1-3, max. 6) AWSpS

Cooperative Education

ENGR 321- Engineering Cooperative Education (2-, max. 16) AWSpS Engineering practicum; the integration of classroom theory with on-the-job training. Periods of work alternate with periods of study. Open only to students who have been admitted to the Engineering Cooperative Education Program. Offered on credit/no credit basis only.

ENGR -322 Engineering Cooperative Education Postwork Seminar (-1, max. 4) AWSpS Reporting and evaluation of co-op work experience, and discussion of current topics in engineering. To be taken during the first quarter in school following each work session. Offered on credit/no credit basis only.

ENGR 323- Engineering Internship (2-, max. 10) AWSpS Engineering practicum; integration of classroom theory with on-the-job training. Open only to students who meet the requirements of the Engineering Cooperative Education Program. Offered on credit/no credit basis only.

ENGR -324 Engineering Internship Postwork Seminar (-1, max. 4) AWSpS Reporting and evaluation of internship work experience and discussion of current topics in engineering. To be taken during the first quarter in school following the work session. Offered on credit/no credit basis only.

Engineering Interdepartmental Curricular Program

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The College of Engineering directly administers nondepartmental undergraduate and graduate degree programs, all of the college's lower-level courses, and upper-level courses not encompassed by regular departmental offerings. Most of these courses are designated ENGR; in general, ENGR courses are supervised and taught by regular departmental faculty members. The college also is continuing to offer a few courses previously offered by two units terminated in 1983: Department of Humanistic-Social Studies (HSS) and Program in Social Management of Technology (SMT).

Undergraduate Programs

353 Loew
Coordinator: Amy Maki

The interdisciplinary engineering studies program offers an opportunity to construct individual curricula designed to fill particular educational goals. Two types of curricula are available for this purpose: the professional program, leading to the degree of Bachelor of Science in Engineering, and the nonprofessional program, culminating in the degree of Bachelor of Science.

A student in these programs does not join an engineering department. Instead, the Office of Academic Affairs provides a base for his or her records and initial advising. The student must develop a personal program of study approved by a faculty adviser with similar interests. This program must be reviewed and approved by the faculty member who oversees all interdisciplinary study programs. Students are urged to contact the Office of Academic Affairs for information on established procedures and guidelines for entry into the nondepartmental B.S.E. and B.S. programs. Entrance requirements and the continuation policy for participation in these programs are consistent with those of other departments in the college.

Bachelor of Science in Engineering Degree

Typical B.S.E. programs include energy systems, environmental, nuclear, ocean, structural, and surveying engineering as well as mineral resources. Others may evolve in keeping with student or faculty interests. Admission into this program (usually after completion of 90 credits) is competitive with a grade-point average of at least 2.80 in technical courses required for entry. A minimum of 75 credits must be completed after entering the program before a B.S.E. degree is awarded.

Bachelor of Science Degree

The nonprofessional Bachelor of Science degree provides greater flexibility than does the Bachelor of Science in Engineering degree. It can be an excellent base of subsequent professional studies in law, medicine, or business. It may also be the primary educational objective in such fields as technical writing, engineering sales, or environmental studies. Detailed requirements are available from the coordinator in the Office of Academic Affairs.

Graduate Programs

The college also offers graduate programs leading to the Master of Science in Engineering, Master of Engineering, and Master of Science degrees, without designation of a specific major. Approved programs lead to the M.S.E. degree in civil, mechanical, electrical, or interengineering; an approved program leads to the M.Eng. degree in aeronautics and astronautics; and approved programs lead to the M.S. degree in civil, metallurgical, and ceramic engineering. Admission requires a B.S. degree in engineering, mathematics, or physical science and substantial evidence of aptitude for graduate study. Submission of scores on the Graduate Record Examination is required. Admission to the interengineering option requires a statement describing the applicant's objectives. Application for admission should be made to the Graduate School. Graduate and entrance requirements, which differ for the various programs, may be obtained from the office of the Dean, College of Engineering.

Faculty

Chairperson

Richard C. Corlett

Professors

Leahy, Jack T., M.A., 1956, Washington; literature of the Third World, the literature of travel, developing countries.

Skeels, Dell R., Ph.D. 1949, Washington; folklore, myth, and folktale

Souther, James W., M.A., 1948, Washington; communication process and communication in organizations, document design.

Trimble, Louis P. (Emeritus), Ed.M., 1953, Eastern Washington; humanistic-social studies.

White, Myron L. (Emeritus), Ph.D., 1958, Washington; technical editing and management.

Associate Professors

Bereano, Philip L.,* J.D., 1965, Columbia; technology assessment, technology and social values, women and technology, public policies regarding technologies, work, genetic engineering, alternative technologies and the environment.

Botting, David C. (Emeritus), Ph.D., 1950, Chicago; history and social ecology of technology.

Coney, Mary B., Ph.D., 1973, Washington; writing and theories of technical discourse.

Douthwaite, Geoffrey K., M.S.E.E., 1963, Washington; computer applications of engineering mathematics, technology and its impact on society, technology and environmental law, technology and its economic impact.

Higbee, Jay A. (Emeritus), D.S.S., 1955, Syracuse; human rights, impact of technology on society, contemporary affairs and the media.

Hyman, Barry I.,* (Mechanical Engineering) Ph.D., 1965, Virginia Polytechnic Institute; energy technology and public policy, solar energy, energy conservation, the engineering profession and public policy.

Assistant Professors

Farkas, David K., Ph.D., 1976, Minnesota; the composing process, technical writing, editing, document design.

Ramey, Judith A., Ph.D., 1983, Texas; computer documentation, computers and information management.

Lecturers

Spyridakis, Jan, M.A.T., 1972, Washington; technical writing and editing.

Williams, Thomas R., M.C., 1981, Washington; production editing and publications management.

Course Descriptions

Humanistic-Social Studies

Courses for Undergraduates

HSS 350 The Literature of Travel (3) *Leahy* Readings of major contemporary travel writers, with emphasis on the ability of travel literature to present a unique global perspective.

HSS 421 Socioeconomic Consequences of Technology (3) Sp *Douthwaite* Overview of the role of technology in forming public policies and in determining personal alternatives.

HSS 451 The Living Theater (3) *Leahy* Introduction to the art of theatrical performance by reading, attending, and discussing plays offered currently in theatres on campus and in the community. Offered on credit/no credit basis only.

HSS 480 Science Fiction and Fantasy: Prophecy and Symbol (3) AWSp *Skeels, White* Science fiction is compared with forecasts of the future by authorities in science and technology. The fiction is analyzed in terms of depth of meaning and of the particular stylistic qualities and abilities of the authors.

Social Management of Technology

Courses for Undergraduates

SMT 301 Creating the Future (5) W *Douthwaite* Examines the concept of alternative individual and societal futures and the opportunities for creating them. A number of scenarios for the future are explored, and several methods of forecasting investigated.

SMT 401 Introduction to Technology as a Social and Political Phenomenon (3) A *Bereano* Introductory survey presenting some of the issues pertaining to technology and social change, technology and values, etc. Emphasis on the social, political, and economic aspects of current problems that have important technological components. Extensive reading. Prior technical background not required. Prerequisite: junior standing or permission of instructor.

SMT 454 Alternative Technology *Bereano* Exploration of the evolution of technological forms that are small-scaled, decentralized, etc., emphasizing the public policy aspects of these developments. Topics include the relationship between alternative technologies and worker-controlled enterprises, community planning, the politics of technological change, the Third World, and decentralized development. Open to students who have done some previous work in the social implications of technology; background in engineering or technical design is not required.

SMT 499 Special Research Projects: Technology, Society, and Public Policy (2-5; max. 10) AWSp Independent individual or team undergraduate research projects dealing with technology, society, and public policy. Prerequisites: 3.00 grade-point average and permission of instructor.

Courses for Graduates Only

SMT 530 Technology Assessment Methods and Analysis I (3 or 5) W *Bereano* In-depth analysis of the concept, practice, and methods of technology assessment (policy analysis that concentrates on social consequences of technological development): social, political, economic, and environmental impacts of new technologies; options for channeling these developments; and relevant decision-making institutions and processes. Designed to sequence with 531. Offered jointly with URB P 515.

SMT 568 Women and Technology (3) Sp *Bereano* Comparison of technological rationality with feminist modes of thought. Focuses on values that are or could be applied in assessing technologies in order to evaluate their effects. Offered jointly with SOC 568. Prerequisite: permission of instructor.

SMT 582 Energy Conservation (3) Sp *Hyman* Integrated approach to technological, political, social, and environmental aspects of energy use, opportunities for more efficient techniques of utilization. Use of price and other forms of regulation to induce conservation. Legislation and public policy issues at federal and local levels.

SMT 583 Promise of Solar Energy (3) A *Bodola, Hyman* Interdisciplinary approach to the potential and implications of widespread use of solar energy. Direct and indirect applications of solar energy for heating and generation of electricity. Examination of governmental research programs, institutional consultants, and financial incentives.

SMT 599 Current Topics in the Social Management of Technology (1-5, max. 9) AWSp Advanced independent study. Prerequisite: permission of instructor.

Aeronautics and Astronautics

206 Guggenheim

Aeronautics and Astronautics deals with atmospheric and space flight and a broad spectrum of related engineering science. Established in 1930, the department offers a full complement of degree programs and is unique in the Pacific Northwest.

Undergraduate Program

The department offers the Bachelor of Science in Aeronautics and Astronautics degree, based on a program of study of engineering science with emphasis on the design and development of vehicles operating within the atmosphere or space. The program is accredited by the Accreditation Board for Engineering and Technology, and all graduates must meet certain specific distribution requirements.

Admission

Entrance into the department requires the equivalent of at least 45 credits with a 2.0 grade-point average and attainment of 2.0 in specified courses. These are minimum requirements; admission is competitive. Details of the entrance requirements, application deadlines, application forms, and advising literature may be obtained from the department office.

Technical Preparation

The department has the following recommendations and requirements for technical preparation beyond those courses required of all engineering students. In mathematics, A A 370 is required and MATH 205 is recommended. In natural science, CHEM 150 and PHYS 123, 224, and 225 are recommended. In engineering science, ENGR 210, 230, and 260 are required; ENGR 210 must be taken before Autumn Quarter of the junior year and ENGR 230 and 260 before Winter Quarter of the junior year. In practice, both of these courses should be taken before Autumn Quarter to avoid an overload. In addition, ENGR 170 and E E 306 (4 credits) are recommended in the first two years.

Professional Courses

The department program normally begins in the Autumn Quarter of the junior year. Exceptions are possible, but must be coordinated with the undergraduate adviser. Required junior courses: A A 300, 301, 302, 311, 312, 320, 321, 322, 330, 331, 332. Required senior courses: A A 410 or 420, 460, 498 and 24 credits of senior technical electives, with at least 21 chosen from department offerings.

Additional free electives may be needed to meet the 182 credits required for graduation. Appropriate technical electives include electronics, automatic control, mathematics, applied mathematics, computer science, physics, and astronomy. Senior programs should be planned with the assistance of the faculty adviser.

Graduate Program

Keith A. Holsapple, Graduate Program Coordinator

The Department of Aeronautics and Astronautics offers programs that provide a foundation in the engineering sciences and study in various engineering applications. These lead to the degrees of Master of Science in Aeronautics and Astronautics or Doctor of Philosophy. The department also provides an authorized college option leading to the Master of Engineering degree.

Master of Science in Aeronautics and Astronautics Degree

Each program of study is tailored to the needs and interests of the student. All must be approved by the department graduate committee and must provide breadth through a variety of subjects, depth through extensive study of a specialized field, and analytical strength. Minimum programs consist of either 39 credits of course work, or 30 credits of course work and a 9-credit thesis.

Master of Engineering Degree

The Master of Engineering program is intended to provide course work and research beyond that for the degree of Master of Science in Aeronautics and Astronautics. The student must complete an approved program of study and research, which usually consists of a prior Master of Science degree, followed by a minimum 30 credits of course work and a 9-credit thesis.

Doctor of Philosophy Degree

The doctoral program consists of lectures, seminars, discussions, and independent study, enabling the student to master a particular field and to make original contributions therein. The formal steps toward obtaining the degree are listed in the general requirements section of this catalog. In addition to those requirements, the student is expected to be in continuous full-time residence for one academic year after advancement to Candidate standing.

Research Activities

Research facilities include the Kirsten 8x12-foot low-speed wind tunnel, a high-pressure air supply and several smaller tunnels, shock and Ludwieg tubes, material and structural test machines, a dynamic fracture laboratory, a twin-engine aircraft, a six-meter solar concentrator, and various engineering physics laboratories. A close relationship is maintained with the Aerospace and Energetics Research Laboratory, where interdisciplinary research is conducted. Several minicomputers are available.

Problems currently being studied by faculty members and students include characterization of brittle materials, control of flexible spacecraft, turbulent mixing in clouds, biomedical application of lasers, space power systems, solar-pumped lasers, fluid mechanical optics, electrical discharge lasers, computational fluid mechanics, engine/airframe flow interaction, thrust-reversing nozzles, high-strain-rate fracture, solar energy conversion, failure of composite materials, structural response to rapid energy deposition, tunnel design for high-lift testing, impact fusion, wave propagation, mixing of swirling flows, wet flows at high Mach number, aerodynamics of vortex generators, and optimal control and estimation theory.

Admission

Students who have earned a baccalaureate degree in an accredited program of aeronautics and astronautics or closely related field are eligible for the Master of Science program. Backgrounds in related fields require review on a case-by-case basis, and preparatory courses may be required, depending on the student's previous studies and educational objectives. Admission is competitive, with the equivalent of a 3.00 grade-point average in previous technical study a minimum standard.

Admission to the Graduate School does not imply admission to the Ph.D. program. This decision requires evidence of superior academic ability.

Additional Information

Students who intend to work toward advanced degrees must apply for admission to the Graduate School. Most students are financially supported by their employers or by the department as teaching or research assistants. For further information on this or other aspects of department programs, contact: Graduate Program Coordinator, 206 Guggenheim, FS-10.

Faculty

Chairperson

David A. Russell

Professors

Bollard, R. John H.,* Ph.D., 1954, Purdue; mechanics of materials, structural mechanics, aeroelasticity, design and crash-worthiness of aircraft.

Christiansen, Walter H.,* Ph.D., 1961, California Institute of Technology; gas dynamics and gas physics, high-power gas lasers and their application, energy conversion.

Eastman, Fred H. (Emeritus), M.S., 1929, Massachusetts Institute of Technology; aeronautics and astronautics.

Fyfe, Ian M.,* Ph.D., 1958, Stanford; dynamics, wave propagation in solids and fluids.

Ganzer, Victor M. (Emeritus), B.S.A.E., 1941, Washington; aeronautics and astronautics.

Hertzberg, Abraham,* M.S., 1949, Cornell; high-power lasers, fusion research, solar energy, space systems, energy systems, heat transfer.

Holsapple, Keith A.,* Ph.D., 1966, Washington; solid mechanics, continuum mechanics, structures, waves, finite elements.

Joppa, Robert G.,* Ph.D., 1972, Princeton; aircraft flight mechanics, stability and control, V/STOL testing, airplane design.

Kevorkian, Jirair,* (Applied Mathematics),† Ph.D., 1961, California Institute of Technology; mathematical fluid mechanics, nonlinear wave propagation, resonance phenomena, perturbation methods, applied mathematics.

MacCormack, Robert W.,* M.S., 1967, Stanford; computational fluid dynamics, numerical analysis.

Oates, Gordon C.,* Ph.D., 1959, California Institute of Technology; propulsion, fluid mechanics, energy conversion, biofluid mechanics.

Parmerter, R. Reid,* Ph.D., 1964, California Institute of Technology; structures, solid mechanics, fracture mechanics.

Pearson, Carl E.,* (Applied Mathematics),† Ph.D., 1949, Brown; wave propagation, fluid mechanics, numerical analysis.

Russell, David A.,* Ph.D., 1961, California Institute of Technology; fluid mechanics and gas physics, aerodynamics shock, processes, and laser fluid dynamics.

Street, Robert E. (Emeritus), Ph.D., 1939, Harvard; aeronautics and astronautics.

Vagners, Juris,* (Applied Mathematics),† Ph.D., 1967, Stanford; optimal control and estimation theory, applications to aircraft systems.

Associate Professors

Bruckner, Adam P.* (Research), (Bioengineering), Ph.D., 1972, Princeton; light scattering, biomedical applications of lasers, holography, ultrashort-pulse optical phenomena, space power systems, solar energy.

Decher, Reiner,* Ph.D., 1967, Massachusetts Institute of Technology; aircraft propulsion, fluid mechanics, energy conversion.

Lin, K. Y., Ph.D., 1977, Massachusetts Institute of Technology; composite materials, structural materials, structural mechanisms, finite element methods.

Mattick, A. Thomas (Research), Ph.D., 1975, Massachusetts Institute of Technology; energy conversion, gas lasers, gas physics.

Rae, William H., Jr.,* M.S., 1959, Washington; experimental low-speed aerodynamics.

Assistant Professors

Bossi, Joseph A.,* Ph.D., 1980, Stanford; control and estimation, theory and application, dynamics.

Breidenthal, Robert E., Jr., Ph.D., 1978, California Institute of Technology; turbulence, mixing, combustion, vorticity.

Course Descriptions

Courses for Undergraduates

A A 300 Aerodynamics I (4) A *Breidenthal, Decher, Rae* Aerodynamics as applied to the problems of performance of flight vehicles in the atmosphere. Prerequisite: junior standing or permission of instructor. Entry card required.

A A 301, 302 Aerodynamics II, III (4,4) W,Sp *Breidenthal, Decher, Rae* Kinematics and dynamics of flow fields; incompressible flow about bodies. Thin airfoil theory; finite wing theory. Compressible fluids; one-dimensional compressible flow; two-dimensional supersonic flow. Viscous flows; boundary layers. Prerequisites: MATH 238 and ENGR 260 for 301; 301 for 302. Entry card required.

A A 311 Orbital and Atmospheric Flight Mechanics (3) W *Bossi, Fyfe, Vagners* Review of kinematics and particle dynamics. Dynamics of systems of particles. Gravitational field of the earth. Keplerian motion. Application to orbital transfer problems. Rigid-body dynamics. Prerequisite: ENGR 230. Entry card required.

A A 312 Dynamics of Flight Vehicles (3) Sp *Bollard, Fyfe* Vibration theory. Characteristics of single and multiple degree of freedom linear systems with forced inputs. Approximate methods for determining principal frequencies and mode shapes. Application to simple aeroelastic problems. Prerequisite: 311. Entry card required.

A A 320, 321, 322 Junior Laboratory I, II, III (2,2,2) A,W,Sp *Breidenthal, Bruckner* Theory, calibration, and use of instruments. Measurement techniques, analysis of data, report writing. Laboratory experiments on subsonic aerodynamics, supersonic flow, material properties, structures, vibrations. Recommended: PHYS 131, 132, 133. Entry card required.

A A 330, 331, 332 Structural Analysis I, II, III (4,4,4) A,W,Sp *Bollard, Holsapple, Parmerter* Development of the equations of elasticity, viscoelasticity, and plasticity. Plane stress, plane strain; torsion, bending, and stability of rods and beams; virtual work, potential energy, Castigliano's theorem; statically indeterminate structures. Prerequisite: 331 for 332. Entry card required.

A A 370 Introduction to Applied Analysis (3) *Holsapple, Pearson* Advanced calculus, from applications point of view. Review of ordinary differential equations. Fourier series and integrals. Laplace transformation. Bessel functions, Legendre polynominals. Review of vector analysis. Line, surface, and volume integrals. Prerequisite: MATH 238. Entry card required.

A A 400 Gas Dynamics (3) A *Christiansen, Russell* Introduction to kinetic theory; velocity distribution function, transport properties. Free molecule flow. Thermodynamics of real gases. One-dimensional gas dynamics: ideal and real gas flows, nonsteady waves, idealized nozzle flow, diffusers, oblique shocks. Prerequisites: 302 and ENGR 260 or permission of instructor.

A A 401 Fluid Mechanics (3) Sp *Christiansen, Oates, Russell* Equations of motion of viscous, heat conducting, compressible fluid. Potential flow: panel methods, method of characteristics, linear solutions. Laminar and turbulent boundary layers: similarity, finite difference methods, approximate solutions via integral techniques. Prerequisites: 302 and ENGR 260 or permission of instructor.

A A 410 Aircraft Design (4) W *Joppa* Preliminary design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance. Satisfaction of stability, control, and handling qualities requirements. Recommended: 440.

A A 411 Aerospace Structural Design (3) Sp *Bollard, Joppa* Experience in design of aerospace structural systems using modern materials by development of a preliminary design for a chosen vehicle or vehicle component with attention to the design process, reliability, efficiency, and safety. Prerequisite: 410 or 420.

A A 420 Spacecraft and Space Systems Design I (4) W *Hertzberg* Expanding role of space has created a new technology with unique components and systems. The methodology will be developed for treating the special power, transportation, attitude control, etc., systems required for current and anticipated spacecraft. Applications extend from communications to solar power from space. Prerequisite: senior standing.

A A 430 Finite Element Structural Analysis (3) A *Holsapple, Lin* Introduction to the finite element method. Applications to trusses, beams, frames, box beams, plane stress, and heat transfer. Prerequisite: 332.

A A 431 Plates and Shells (3) W *Bollard, Lin, Parmerter* Introduction to the theory of plates and shells. Membrane theory of shells of revolution, cylindrical, and conical shells. Axisymmetric bending of shells of revolution. Stability of structures. Prerequisite: 332.

A A 440, 441 Flight Mechanics I, II (3,3) A,Sp *Joppa, Rae* Calculation of aerodynamic coefficients and stability derivatives. Prediction of performance, stability, and control characteristics of a specified aircraft. Vehicle equations of motion near a flat earth; the performance problem within the atmosphere; an introduction into the dynamic stability of vehicles subject to aerodynamic forces. Comparison of wind tunnel and derived aerodynamic characteristics. Determination in flight of performance, stability, and control characteristics; and comparison with predicted and wind tunnel results. Prerequisites: 302 for 440; 440 for 441.

A A 450, 451 Control in Aerospace Systems I, II (3,3) A,Sp *Bossi, Vagners* Review of linear, ordinary differential equations. Linearization of mathematical models for aircraft and spacecraft, state space models. Laplace transformation, stability criteria, frequency domain and time domain analysis techniques. Feedback control and compensation methods. Digital control methods. Applications to aerospace vehicle control problems. Prerequisite: MATH 238; recommended: 311, 312.

A A 460, 461 Propulsion I, II (3,3) A,W *Decher, Oates* Study of the aero/thermodynamics of rocket engines. Rocket vehicle performance. Introduction to space propulsion. Air-breathing engines as propulsion systems. Turbojets, turbofans, turboprops, ramjets, hybrid engines. Aerodynamics of gas-turbine engine components. Prerequisites: 302 and ENGR 260.

A A 470 Analytical Problems in Aeronautics (3) W Numerical methods for algebraic and differential equations. Transforms. Introduction to perturbations, eigenvalues, nonlinearities. Probability and statistics. Variational idea. Prerequisites: MATH 238 and ENGR 141.

A A 476 Introduction to Design With Brittle Materials (3) W *Bollard* Properties and behavior of ceramic and other brittle materials are related to their use in advanced technology structures. Analytical and numerical methods required for probabilistic design and current case studies utilized. Offered jointly with CER E 476, CESM 476, M E 476, and MET E 476.

A A 480 Systems Dynamics (3) W *Bollard, Fyfe* Equations of motion and solutions for selected problems; natural frequencies and mode shapes; of continuous systems; response of simple systems to applied loads, including random excitation. Prerequisite: senior standing.

A A 481 Elementary Aeroelasticity (3) Sp *Bollard* Discussion of aeroelastic problems in aircraft design; elementary development of static and dynamic aeroelastic problems, divergence, control effectiveness, flutter. Prerequisite: 480 or permission.

A A 498 Special Topics in Aeronautics and Astronautics (0-1, max. 2) AWSp Lectures and discussions on topics of current interest in aviation and space engineering. Two quarters required for credit.

A A 499 Special Projects (2-5, max. 10) AWSp Investigation on a special project by the student under the supervision of a faculty member. A maximum of 6 credits may be applied toward senior technical electives. Prerequisite: senior standing.

Courses for Graduates Only

A A 501 Physical "Gasdynamics" I (3) A *Christiansen, Hertzberg* Equilibrium kinetic theory; chemical thermodynamics; thermodynamic properties derived from quantum statistical mechanics; reacting gas mixtures; applications to real gas flows and gas dynamics. (Offered odd-numbered years.)

A A 502 Physical "Gasdynamics" II (3) W *Christiansen, Hertzberg* Introduction to vibrational relaxation and nonequilibrium chemistry. Nonequilibrium physics applied to flow. Brief introduction to nonequilibrium kinetic theory. Application to a variety of research and development areas such as high-temperature energy systems and gas lasers. Prerequisite: 501 or permission of instructor. (Offered even-numbered years.)

A A 504 Fluid Mechanics (3) A *Christiansen, Decher, MacCormack, Oates, Russell* Review of thermodynamics; vectors and dyads. Derivation of the Navier-Stokes equations, stream functions and potential functions; integrals of the equations of motion. Boundary conditions and discontinuity surfaces in fluids. Exact solutions. Dimensional analysis. Highly viscous flows.

A A 505 Fluid Mechanics of Inviscid Flow I (3) W *Christiansen, Decher, Oates, Russell* Ideal incompressible flow; potential and stream functions. Airfoil theory and lifting line theory. Introduction to nonsteady flow; sound waves and surface waves; special topics. (Offered even-numbered years.)

A A 506 Fluid Mechanics of Inviscid Flow II (3) Sp *Christiansen, Decher, Oates, Russell* Ideal compressible flow; supersonic airfoils; shock waves; slender-body theory; lifting surface theory; approximate methods. Transonic flow; similarity; special topics. Prerequisite: 505. (Offered even-numbered years.)

A A 507 Aerodynamics of Viscous Fluids I (3) W *Oates, Russell* Introduction to viscous flow; exact solutions of the laminar equations of motion; approximate equations. Exact solutions for laminar boundary-layer equations. Approximate methods for compressible laminar boundary layers. (Offered odd-numbered years.)

A A 508 Aerodynamics of Viscous Fluids II (3) Sp *Breidenthal, Oates, Russell* The phenomena of turbulence; transition prediction; Reynolds stresses; turbulent boundary-layer equations. Approximate methods for turbulent boundary layers. Prerequisite: 507 or permission of instructor. (Offered odd-numbered years.)

A A 509 Computational Fluid Dynamics I (3) W *MacCormack* Numerical approximation of the inviscid compressible equations of fluid dynamics. Analysis of numerical accuracy, stability, and efficiency. Use of explicit, implicit, and flux split methods. Discussion of splitting, approximate factorization, discrete point, and finite volume approaches. Applications to the solution of simple hyperbolic systems of equations and the Euler equations.

A A 510 Computational Fluid Dynamics II (3) Sp *MacCormack* Numerical approximation of equations of compressible viscous flow. Mesh requirements for resolving viscous effects in high Reynolds number flows. Analysis of numerical accuracy, stability, and efficiency. Use of explicit and implicit methods, boundary condition procedures. Applications to solution of the Navier-Stokes equations. Prerequisite: 509 or permission of instructor. (Offered odd-numbered years.)

A A 513 Gas Laser Theory and Practice (3) Sp *Christiansen, Hertzberg, Russell* Physics and fluid mechanics of high-power lasers, emphasis on performance of modern gas dynamic lasers, flowing chemical lasers, and gaseous electric lasers. Techniques of obtaining population inversions, power extraction, basic thermodynamics, and the interaction of optical radiation with matter. Applications of high-power lasers also are emphasized. (Offered even-numbered years).

A A 516 Stability and Control of Flight Vehicles I (3) A *Joppa* Static and dynamic stability and control of flight vehicles in the atmosphere. Aerodynamics for stability derivatives. Response to control inputs and external disturbances. Effect of stability derivatives on flight characteristics. Handling qualities. Introduction to automatic control.

A A 517 Stability and Control of Flight Vehicles II (3) W *Bossi, Joppa, Vagners* Specification of flight vehicle performance objectives. Control system components, sensor characteristics, choice of system models. Compensator design, frequency domain design of stability augmentation systems, single/multiple loop autopilot design and evaluation. Use of computer-aided control design packages. Prerequisite: 516.

A A 518 Stability and Control of Flight Vehicles III (3) Sp *Bossi, Vagners* Introduction to Linear-Quadratic-Gaussian (LQG) optimal control theory. Synthesis of stability augmentation systems and autopilot control laws using LQG methodology. Relationship of LQG results to frequency domain criteria. Reduced-order controller synthesis, digital design and implementation. Use of computer-aided control design packages. Prerequisite: 517.

A A 523 Special Topics in Fluid Physics (3) AWSp

A A 524 Aerothermodynamics of Aircraft Gas Turbine Engines I (3) W *Decher, Oates* Aircraft gas turbine engine cycle analysis. Component performance measures. Preliminary design of engines, including component losses. Off-design performance. Variable geometry engines. (Offered even-numbered years.)

A A 525 Aerothermodynamics of Aircraft Gas Turbine Engines II (3) Sp *Decher, Oates* Estimation of component performances. Inlets, description of flow distortion. Aerodynamics of turbines and compressors. Radial equilibrium theory, through-flow theory, the cascade transformation. Behavior of mixers. Prerequisite: 524. (Offered even-numbered years.)

A A 526 Aerothermodynamics of Aircraft Gas Turbine Engines III (3) A *Decher, Oates* Aircraft engine noise. Description and measurement of noise, correlation functions, power spectra. Elementary duct acoustics, rotor-stator interaction, effect of design blade loading. Turbine noise, core noise, acoustic linings. Jet noise, Lighthill theory, scaling laws. (Offered odd-numbered years.)

A A 527 Energy Conversion I (3) A *Decher, Hertzberg, Oates* Energy sources: resource magnitude estimates. Heat generation by advanced reactors, combustion, solar collection. Analysis of power systems for space and advanced commercial power generation. High-temperature cycles. (Offered even-numbered years.)

A A 528 Energy Conversion II (3) W *Decher, Hertzberg, Oates* Heat exchangers, energy storage, heat rejection. Direct conversion of heat to electricity. Electrochemical processes. Recommended: 527. (Offered odd-numbered years.)

A A 529 Space Propulsion (3) Sp *Decher, Oates* Nucleonics, and heat transfer of nuclear heated rockets. Electrothermal, electromagnetic, and electrostatic thrusters. Prerequisite: permission. (Offered odd-numbered years.)

A A 530 Mechanics of Solids I (3) A *Bollard, Holsapple, Lin, Parmerter* General concepts and theory of solid mechanics. Behavior of elastic, viscoelastic, and plastic solids. Linear theory of elasticity and thermoelasticity. Wave propagation in solids.

A A 531 Mechanics of Solids II (3) W *Fyfe, Holsapple, Parmerter* Theory of plasticity; yield surfaces, hardening rules; flow rules; path dependence; anisotrophy. Limit theorems, slip line theory. Concepts of failure and fatigue. Prerequisite: 530 or equivalent or permission of instructor. (Offered odd-numbered years.)

A A 532 Mechanics of Composite Materials (3) Sp *Holsapple, Lin, Parmerter* Analyses and design of composite materials for aerospace structures. Anisotropic elasticity. Laminated plate theory. Viscoelastic behavior and wave propagation in composites. Prerequisite: 530 or permission of instructor. (Offered odd-numbered years.)

A A 535 Analysis of Shells (3) Sp *Parmerter* Nonlinear equations of shallow shells. Solution of the linearized equations for shells of revolution and other shapes. Composite shells; buckling. Postbuckling deformation of shells. (Offered even-numbered years.)

A A 540 Finite Element Analysis I (3) W *Fyfe, Holsapple, Lin* Formulation of the finite element method through the use of variational principles. Element types and interpolation functions. Application to elasticity problems in plane stress and plane strain, thermal conduction and potential flow.

A A 541 Finite Element Analysis II (3) Sp *Fyfe, Holsapple, Lin* Advanced concepts of the finite element method. Hybrid and boundary element methods. Nonlinear and eigenvalue problems. Techniques for large problems. Prerequisite: 540 or permission of instructor.

A A 547 Engineering Aspects of the Fluid Mechanics of the Human Body (3) W *Oates* Engineering background to the many flow regimes existing in the human body. Specific examples of flow problems such as cardiovascular, bronchial, microcapillary, urethral, etc. Offered jointly with BIOEN 547. Offered on credit/no credit basis only. Prerequisite: permission of instructor. (Offered odd-numbered years.)

A A 548 Applied Optimal Control and Estimation I (3) W Review of calculus of variations, definition of the dynamic optimization problem, constraints and Lagrange multipliers, the Pontryagin minimum principle, necessary conditions for optimality, the Hamilton-Jacobi equation, singular arc problems, linear quadratic (LQ) control problem. Offered jointly with E E 548. Prerequisite: E E 584 or equivalent.

A A 549 Applied Optimal Control and Estimation II (3) Sp Review of continuous random processes, definition of the LQ optimal control/estimation problem for continuous systems in the presence of noise, the certainty-equivalence principle, duality of regulator/follower-filter/smoother problems, necessary conditions for optimality synthesis of steady-state regulators and filters using eigenvector decomposition techniques. Ricatti equation factorization. Luenberger observers. Offered jointly with E E 549. Prerequisites: 548 or E E 548, E E 505, or equivalent.

A A 550 Applied Optimal Control and Estimation III (3) A Review of discrete random processes, definition of the discrete LQ optimal control/estimation problem, factorization methods for discrete filters, Luenberger observers, reduced order filters, suboptimal filters. Offered jointly with E E 550. Prerequisite: 549 or E E 549 or permission of department Chairperson.

A A 553 Vibrations of Aerospace Systems (3) Sp *Bollard, Fyfe* Natural frequencies and modal analysis; forced vibrations and motion-dependent forces. Structural damping; composites and periodic structures. Measurements for structural dynamic testing. Prerequisite: 571 or equivalent. (Offered odd-numbered years.)

A A 555 Special Topics in Aerospace Systems (3) AWSp

A A 567 Analysis in Engineering and Science I (3) A Complex variable and associated topics. Branch cuts, series and product expansions. Contour integration, numerical implications. Harmonic functions. Complex potential (and singularities) in physical problems. Conformal mapping; applications and examples. Grid generation. Fourier and Laplace transforms, inversions, and asymptotics. Spectral decomposition, FFT method. Complex matrices. Offered jointly with AMATH 567.

A A 568 Analysis in Engineering and Science II (3) W Survey of properties and practical solution techniques for ordinary differential equations. Series expansions. Eigenvalue problems. Transforms and applications. Variational methods. Asymptotic expansions. Perturbations, regular and singular. Difference equations. Numerical procedures. Offered jointly with AMATH 568. Recommended: ENGR 401 or equivalent.

A A 569 Partial Differential Equations (3) Sp *Kevorkian, Pearson, Vagners* Properties of diffusion, wave, and Laplace-type equations. Initial and boundary-value problems. Series expansions, transform methods. Singularities, Green's functions. Classification of second-order equations; theory and applications of method of characteristics. Offered jointly with MATH 569 and AMATH 569. Prerequisite: 568 or MATH 428 or ENGR 403 or permission of instructor.

A A 571 Principles of Dynamics I (3) A *Bossi, Fyfe, Vagners* Review of rigid-body dynamics; calculus of variations. Lagrangian mechanics. The canonical equations of Hamilton; canonical transformations. Hamilton-Jacobi theorem; Hamiltonian perturbation theory. Periodic and quasiperiodic motion. Stability of dynamical systems; resonance in dynamical systems.

A A 575 Thermo- and Electro-dynamics of Continua (3) W *Holsapple* General formulation of the fundamental concepts of motion, stress, energy, and electromagnetism for a continuum. General equations of conservation of mass, balance of momentum, balance of energy. Phenomenological theory of thermodynamics. Maxwell's electromagnetic field theory. Elastic and viscous materials. (Offered even-numbered years.)

A A 583 Special Topics in Solid Mechanics (3) AWSp

A A 584 Applied Linear Algebra and Introductory Numerical Methods (3) A *Vagners* Applied linear algebra: matrix operations, linear systems, matrix factorization, eigenvalues, numerical methods, applications to optimization, circuits, differential equations. Surveys of numerical methods: nonlinear systems, curve fitting, ordinary differential equations, quadrature, basic ideas in partial differential equations. Offered jointly with AMATH 584.

A A 585, 586 Approximate Numerical Analysis II, III (3,3) W,Sp Advanced topics in numerical analysis. More detailed consideration of topics in 584. Emphasis on methods for partial differential equations, integral equations, finite elements, stability and accuracy, mesh generation, adaptive meshes, sparse matrices, variational methods. Post-master's sequence. Offered jointly with AMATH 585, 586. Prerequisites: 567, 584, and 568, 569, or equivalent. (Offered even-numbered years.)

A A 590 Special Topics in Applied Analysis (3) AWSp

A A 599 Special Projects (1-5, max. 15) AWSp Investigation on a special project by the student under the supervision of a faculty member.

A A 600 Independent Study or Research (*) AWSp

A A 700 Master's Thesis (*) AWSp

A A 800 Doctoral Dissertation (*)

Bioengineering

309 Harris Hydraulics Laboratory

The Center for Bioengineering provides a comprehensive, multidisciplinary program of research and education. The concepts and techniques of the physical sciences and engineering are applied to problems in the health sciences. Major areas of current bioengineering research include biomaterials, biomathematics, biomechanics, controlled drug-release systems, fertility studies, health-care-delivery systems, hearing, laser applications, microanalysis of subcellular structures, microcirculatory exchanges and blood flow, muscle, and ultrasonic instrumentation. For a description of this program, its faculty, and its courses, see the Interschool or Intercollege Programs section of this catalog.

Chemical Engineering

105 Benson

Chemical engineering is concerned with processes for transforming raw materials into energy or into such consumer goods as petroleum products, synthetic fuels, pulp and paper, fertilizers, rubber, plastics, detergents, pharmaceuticals, and industrial chemicals. Most chemical engineers work on research and development of these processes as well as on the design and operation of chemical plants and equipment in which production is carried out. This must be done with efficiency, economy, and concern for society and the environment. Some chemical engineers also work in bioengineering, manufacturing industries, and government agencies.

The foundations of chemical engineering are mathematics, physics, and chemistry. The chemical engineer uses this base to develop competence in the use of fundamental tools for engineering analysis and design: thermodynamics, chemical kinetics and reactor design, fluid mechanics, heat and mass transfer, computer programming, and economics. At the University, the student studies intensively in these fields to provide knowledge and skills applicable in a variety of specialized fields and industries. The program also provides a solid basis for further professional study in graduate school.

Undergraduate Program

Bachelor of Science in Chemical Engineering Degree

The Bachelor of Science in Chemical Engineering degree offered by the department is an accredited, professional program generally completed in four years. Its completion should enable the graduate either to find employment in industry or to continue on to graduate school.

The degree requirements are available in detail from the department. In brief, the required 180 credits are to be distributed in accordance with the following minimum credits: mathematics, 23; physics, 12; chemistry, 37; communication skills, 12; ENGR 170 and 260 plus 7½ in other engineer science electives; humanities and social sciences, 30; chemical engineering, 40; technical electives, 3½; and unspecified electives, 7. A minimum grade-point average of 2.00 in chemical engineering courses based on the first time each course is taken is required for graduation.

The department participates in the Cooperative Education Program of the college. However, most courses are usually given only once per year, which makes participation in the program difficult. The student should consult an adviser about the current situation.

Advising in the Department

Any student who is considering chemical engineering as a major may, and is encouraged to, be advised in the department.

Admission Requirements

Admission to the department is limited, and application requirements are subject to change. Students should consult an adviser about current requirements. Applications from women and minorities are encouraged. The applicant must have completed, or be enrolled in, the following: MATH 124, 125, 126, 238 (18 credits); CHEM 140, 150, 151, 160 (14); PHYS 121, 122 (8), ENGR 141, 260 (8). The applicant must have at least a 2.80 grade-point average for these specified courses as well as an overall grade-point average of at least 2.80 for all courses applicable to the B.S.Ch.E. degree. These averages may change without notice as necessary to control enrollment. In addition, it is strongly recommended that students complete CHEM 231, 235, 241, and PHYS 123.

Application Procedure and Timing

Application is made by filling out an application form available in the department office. All students who meet the minimum are admitted.

Any student may apply for admission as soon as he or she meets the admission requirements. In anticipation of admission, students may preregister for departmental courses, but if denied admission they must withdraw from these courses during the change of registration period (first week of Winter Quarter). Admission decisions will be made immediately after Autumn Quarter grades are available to the department, normally December 30-31. Students who are admitted Winter Quarter must have had CH E 310, CHEM 455, ENGR 260, and MATH 238 by the end of the Autumn Quarter.

Admission for the Disadvantaged

While the sole purpose of the admission requirement is to limit enrollment to a number we can teach well with the resources we have available, the department recognizes that this may eliminate some applicants whose potential is high but who, through extenuating circumstances of their background, have had limited access to early education that provides adequate experience in abstract reasoning. These students are encouraged to apply for admission and to attach to their application a letter to the admissions committee that provides information on the applicant that he or she believes is relevant to the admission decision.

Entrance to Chemical Engineering Courses

Entrance into most chemical engineering courses is ordinarily limited to majors in chemical engineering, pulp and paper technology, and the B.S.E. program. Other students who wish to take departmental courses must meet the admission requirements of the department, have the course prerequisites, and fill out a Chemical Engineering course request form.

Entry to a departmental course is ordinarily limited to students who have not previously passed the course.

Continuation Policy

The department policy on continuation is consistent with the continuation policy of the college. Details may be obtained from the department.

Graduate Program

The department offers degrees of Master of Science in Chemical Engineering and Doctor of Philosophy.

In the master's program, primary emphasis is placed on course work, and the degree generally requires about fifteen months of study. Thesis and nonthesis options are available, the former requiring both course work and research. The Ph.D. program builds upon course work, but is centered upon the doctoral dissertation. It is primarily a research degree and is generally completed in 4-4½ years beyond receipt of the B.S.Ch.E. degree.

The study program normally includes basic subjects of importance to all chemical engineers, such as thermodynamics, transport phenomena, kinetics, and applied mathematics. In addition, students are invited to take more specialized courses in chemical engineering or in other departments. During the first year, students usually take three or four courses each quarter, and research is started. Subsequently, less time is spent on course work and more on research.

The department has fifty to sixty full-time graduate students, roughly half of whom are working toward the M.S. degree and the other half toward the Ph.D. degree. They study and collaborate with the faculty in an environment that is both more informal and more intellectually vigorous than is usual in undergraduate programs.

Research Facilities

The department is fortunate in having outstanding facilities. The chemical engineering building, Benson Hall, is supplied with much new research equipment. The building contains classrooms, offices, stockrooms, a well-staffed machine shop, laboratories, and a variety of specialized research equipment, including a VAX 11/750 computer that can be used for on-line data acquisition and analysis. Each graduate student is provided desk space in a small laboratory as well as access to larger laboratories in the building. Students also may use the services of the Academic Computer Center and the glass-blowing shop, and the Chemistry-Chemical Engineering Library in neighboring Bagley Hall.

Admission Requirements

A student is accepted for admission to the Graduate School as a chemical engineering major by joint action of the Graduate School and the department after consideration of a formal application. Most students applying for admission as graduate students have a Bachelor of Science degree in chemical engineering. If a student has had an undergraduate degree in chemistry, physics, mathematics, or another branch of engineering, he or she may obtain a graduate degree in chemical engineering by meeting certain additional requirements.

Financial Aid

The department has various sources of support for qualified graduate students. Prospective students interested in applying for support should request assistantship application forms from the department. The completed forms and reference letters should be received in the department office by March 1, if possible. Assistantship and fellowship offers are usually made during March. Students who receive financial support must be registered for 9 or more credits.

Correspondence and Information

A brochure describing the graduate program is available.

Graduate Program Coordinator
Department of Chemical Engineering, BF-10

Faculty

Chairperson

Charles A. Sleicher

Professors

Allan, G. Graham,* (Forest Resources),† Ph.D., 1956, Glasgow; lignin and forest products chemistry.

Babb, Albert L.,* (Nuclear Engineering),† Ph.D., 1951, Illinois; nuclear engineering, solvent extraction molecular diffusion, biomedical engineering.

Berg, John C.,* Ph.D., 1964, California (Berkeley); interfacial phenomena, surface and colloid science.

Bowen, J. Ray,* Ph.D., 1963, California (Berkeley); combustion.

David, Morton M. (Emeritus), D.Eng., 1950, Yale; chemical engineering.

Davis, E. James,* Ph.D., 1960, Washington; fluid mechanics of porous media, single aerosol particle physics and chemistry, and surface and colloid science.

Finlayson, Bruce A.,* (Applied Mathematics),† Ph.D., 1965, Minnesota; modeling of chemical reactors, polymer flow, and flow through porous media.

Gartid, Kermit L.,* (Nuclear Engineering),† Ph.D., 1961, Minnesota; nuclear engineering, process dynamics.

Heideger, William J.,* Ph.D., 1959, Princeton; mass transfer, interfacial phenomena.

Hoffman, Allan S.,* (Bioengineering),† Sc.D., 1957, Massachusetts Institute of Technology; polymer materials science.

Johanson, Lennart N. (Emeritus), Ph.D., 1948, Wisconsin; kinetics, thermodynamics, design, pulp and paper technology.

McCarthy, Joseph L.,* (Forest Resources),† Ph.D., 1938, McGill; thermodynamics, lignin and cellulose, chemistry, pulp and paper technology, biochemical engineering.

McKean, William T.,* (Forest Resources),† Ph.D., 1968, Washington; pulp and paper technology.

Moulton, R. Wells (Emeritus), Ph.D., 1938, Washington; chemical engineering.

Pilat, Michael J.,* (Civil Engineering),† Ph.D., 1967, Washington; air resources engineering (design of air-pollution-control equipment).

Sarkanen, Kyosti V.,* (Forest Resources),† Ph.D., 1956, State University College of Forestry (New York); chemistry of lignin and cellulose.

Sleicher, Charles A.,* Ph.D., 1955, Michigan; fluid mechanics, heat transfer.

Associate Professors

Horbett, Thomas A.* (Research), (Bioengineering),† Ph.D., 1970, Washington; interfacial proteins.

Krieger, Barbara B.,* Ph.D., 1975, Wayne State; chemical kinetics of energy systems, atmospheric and environmental chemistry.

Ratner, Buddy D.* (Research), (Bioengineering),† Ph.D., 1972, Polytechnic Institute of Brooklyn; interaction of synthetic polymer materials with biological systems.

Ricker, N. Lawrence,* Ph.D., 1978, California (Berkeley); chemical process design, simulation, and control.

Seferis, James C.,* Ph.D., 1977, Delaware; polymer science and engineering, polymer and composite materials.

Assistant Professors

Hager, Harold E.,* Ph.D., 1979, Princeton; electrochemistry, photochemistry, solar technology, semiconductor processing.

Kaler, Eric W.,* Ph.D., 1982, Minnesota; microemulsions, small-angle x-ray scattering.

Course Descriptions

Courses for Undergraduates

CH E 200 Introduction to Chemical Engineering (3) The engineering design process: conception, analysis, process and equipment design, operation; familiarization with the techniques of design. Prerequisites: CHEM 150, calculus, and sophomore standing or permission of instructor.

CH E 309 Creativity and Innovation (2) *Allan* Understanding creativity and creative thinking; its challenges and dynamics through knowledge, judgment, planning, and observation. Techniques of creative thinking: Design and development of creative games. Computer-aided creative thinking. Creation, protection, and exploitation of a useful idea, including bargaining and negotiations. Offered jointly with FOR P 309. Prerequisite: junior standing or permission of instructor.

CH E 310 Material and Energy Balances (4) A Chemical and physical process calculations; steady- and unsteady-state material and energy balances with specific examples in vapor-liquid contact operations and multiphase extraction, and introductory thermochemistry. Prerequisite: ENGR 260, which may be taken concurrently, although inadvisably.

CH E 326 Chemical Engineering Thermodynamics (4) W Phase equilibria and chemical equilibria in multicomponent systems; theories of solution; chemical reaction analysis. Prerequisites: 310; CHEM 456 or ENGR 260.

CH E 330 Transport Processes I (4) W Diffusive transport of momentum, heat and mass; general aspects of fluid flow; the Navier-Stokes equations; one-dimensional flow with engineering applications. Prerequisites: 310 and MATH 238, which may be taken concurrently.

CH E 340 Transport Processes II (4) Sp Heat transfer, basic principles, and applications. Conduction, convection, and radiation. Prerequisite: 330.

CH E 410 Computer Analysis of Chemical Processes (3) A *Finlayson* Application of the computer to the design process: mass and energy balances for chemical processes, evaluation of alternative designs, process optimization, energy conservation in processes. Emphasis is placed on the creative aspects of design, and the computer is used as a calculation tool. Prerequisites: 310 and ENGR 141.

CH E 435 Transport Processes III (4) A Mass transfer, basic principles, and applications to equipment design. Physical separation processes. Prerequisites: 310, 326, 330, and 340.

CH E 436 Chemical Engineering Laboratory I (3) ASp Lectures on statistical analysis of data, instrumentation, and report writing; laboratory experiments on transport phenomena. Emphasis on experimental methods and report writing. Prerequisites: 326 and 330.

CH E 437 Chemical Engineering Laboratory II (3) W Continuation of 436. Laboratory investigation of chemical engineering principles applied to equipment design with emphasis on heat transfer and mass transfer operations. Prerequisites: 340, 435, and 436.

CH E 455 Surface and Colloid Science Laboratory (3) Sp *Berg* Laboratory techniques, equipment, and underlying fundamentals in surface and colloid science. Experiments in the measurement of surface tension, adsorption, wetting and spreading, colloid properties, emulsion preparation and stability, electrophoresis, and interfacial hydrodynamics. Prerequisites: 326, 330; CHEM 461.

CH E 461 Electrochemistry (3) *Hager* Fundamentals of electrochemistry with applications to batteries and industrial processes. Emphasis is on obtaining a basic working knowledge in the field. Offered jointly with E E 461. Prerequisite: senior standing in engineering or chemistry.

CH E 465 Reactor Design (3) W Application of principles of chemical kinetics to the design of commercial-scale chemical reactors; characterization of batch and flow reactors in homogeneous and heterogeneous systems. Prerequisites: 310, 326, 330, and 340.

CH E 468 Air-Pollution Control Equipment Design (3) Designs to control air pollutants from stationary sources. Procedures for calculating design and operating parameters. Fundamental mechanisms and processes of gaseous and particulate control equipment for absorptionand adsorption of gaseous pollutants; electrostatic precipitation and filtration of particular pollutants. Actual case studies. Offered jointly with CEWA 468 and M E 468. Prerequisite: senior standing or permission of instructor.

CH E 470 Chemistry of Wood (3) A Chemical and physical properties of cellulose, lignin, hemicellulose, and extractives; wood as a raw material for the chemical industry. Prerequisite: CHEM 102 or 232 or permission.

CH E 471 Pulping and Bleaching Processes (3) W *Sarkanen* Conversion of wood to mechanical and chemical pulps. Kraft, sulfite, and semichemical pulping processes. Chemical recovery systems. Bleaching of mechanical and chemical pulps. Offered jointly with FOR P 476.

CH E 472 Papermaking Processes (3) Sp Fiber sources and properties. Secondary fibers. Stock preparation, sheet forming, water removal, finishing. Coating, lamination, and printing. Paper products. Offered jointly with FOR P 477.

CH E 473 Pulp and Paper Laboratory (2) *Sarkanen* Laboratory experiments in chemical and semichemical pulping of wood. Bleaching of chemical and high-yield pulps. Physical and chemical characteristics of pulp fibers. Offered jointly with FOR P 478. Prerequisite: FOR P 476.

CH E 480 Process Dynamics and Control (3) A Analysis of the dynamics of simple chemical process units and systems; applications to stability, control, and instrumentation of such processes. Prerequisites: 310, 326, 330, and 340.

CH E 481 Process Optimization (3) Sp Concepts and techniques of optimizing chemical engineering processes and systems, including classical and direct methods of search, linear and nonlinear programming, dynamic programming, statistical experimental design, and evolutionary operation. Prerequisites: 435 and 485.

CH E 485 Process Design I (3) W Applied economics in chemical engineering design and operations; market survey and plant location; introduction to plant and process design. Prerequisite: 435.

CH E 486 Process Design II (5) Sp Comprehensive design of a specific process, including economic feasibility studies, utilization of market survey and plant location studies, process equipment design and optimization, and overall plant integration and layout. Prerequisites: 435, 465, and 485.

CH E 487 Industrial Waste Management (3) Application of chemical engineering concepts to industrial-waste management and to the analysis of constraints and criteria encountered in such application. Includes design of biological and physical control systems, as well as nontreatment alternatives. Prerequisite: permission of instructor.

CH E 490 Engineering Materials for Biomedical Applications (3) W *Hoffman* Combined application of the principles of physical chemistry, biochemistry, materials engineering, mass transfer, and fluid mechanics to biomedical problems. Case studies include considerations of the selection of materials, the design and the operation of instruments, components of, or entire, artificial organs (heart, kidney, lung) and artificial structural elements (bone, teeth, skin), all for use in contact with body fluids. Offered jointly with BIOEN 490. Prerequisite: organic chemistry or permission of instructor. (Offered even-numbered years.)

CH E 491 Controlled Release Systems—Principles and Applications (3) W *Hoffman* Mechanisms for controlled release of active agents and the development of useful systems for this purpose. Release mechanisms include diffusive, convective, or erosive driving forces. Applications to the biomedical, agricultural, forestry, and oceanography fields. Some special case studies covered in detail. Offered jointly with BIOEN 491. Prerequisite: permission of instructor. (Offered odd-numbered years.)

CH E 498 Special Topics in Chemical Engineering (1-4, max. 12) Topics of current interest in the field. Subject matter changes from year to year. Prerequisite: permission of instructor.

CH E 499- Undergraduate Research (1-6-, max. 12) AWSp Independent research projects in chemical engineering. Prerequisite: permission of instructor.

Courses for Graduates Only

CH E 523 Seminar in Chemical Engineering (1, max. 20) AWSp Topics of current interest in chemical engineering. Offered on credit/no credit basis only.

CH E 526 Chemical Engineering Thermodynamics (4) A Review of principles of thermodynamics. Applications to problems in multiphase and multicomponent systems; theories of solutions. Prerequisite: undergraduate thermodynamics.

CH E 526 Topics in Thermodynamics (3) Classical and molecular thermodynamics of phase equilibria, solution theory, thermodynamic stability, and critical phenomena. Prerequisite: 525 or permission of instructor.

CH E 530 Momentum, Heat, and Mass Transfer I (4) A Derivation of the differential equations for mass, energy, and momentum transport. Principles of fluid mechanics; creeping flow, turbulence, boundary layer theory.

CH E 531 Momentum, Heat, and Mass Transfer II (4) Continuation of 530. Flows of fluid-particle systems; convective heat transfer, natural convection. Prerequisite: 530.

CH E 532 Separation Processes (3) Design of industrial processes for separation and purification of materials. Covers classification and selection of separation techniques, efficiency of separators, energy conservation concepts, and methods for design calculations.

CH E 533 Mass Transfer (3) Molecular mass transport; single-phase mixing; age distributions and residence time analysis; transfer across interfaces; coupled heat and mass transfer; effects of chemical reaction; design considerations.

CH E 543, 544 Fluid Turbulence (3,3) A,W *Gessner, Sleicher* Statistical and phenomenological theories of turbulence. Introductory concepts, velocity correlations, the energy spectrum, the decay of turbulence, scalar fields, turbulent transport, shear turbulence, wall turbulence, phenomenological theories of energy transport, turbulent modeling instrumentation, recent literature. Offered jointly with M E 543, 544. Prerequisite: 6 credits in graduate fluid mechanics. (Offered Autumn Quarter in odd-numbered years, Winter Quarter in even-numbered years.)

CH E 555 Interfacial Phenomena (4) Sp *Berg* Surface tension, capillary statics, wetting and spreading phenomena; thermodynamics of capillary systems, adsorption, surfactant monolayers and micellar solutions; capillary hydrodynamics, interfacial turbulence and applications in distillation, absorption, and extraction. Prerequisites: 525, 530, or permission of instructor. (Offered even-numbered years.)

CH E 556 Principles and Applications of Colloidal Materials (3 or 4) Sp *Berg, Hoffman* Preparation, stabilization, properties and destruction of important colloidal materials. The theory and structure of the electrical double layer, electrokinetics. Includes selected case studies pertinent to air and water pollution, biological fluids, industrial processes. (Offered odd-numbered years.)

CH E 564 Applications of Chemical Kinetics (3) Fast reactions and highly energetic reactions with applications to combustion, explosions, and lasers. Coupling of transport processes and reaction rates, photochemical kinetics, intermolecular energy transfer, free radical, and chain reaction kinetics. Rate plasmas, flames, and biological systems.

CH E 565 Kinetics and Catalysis (3) *Finlayson, Hager, Krieger, Stuve* Homogeneous and heterogeneous systems with emphasis on chemical engineering principles applied to industrial reactor design. Prerequisite: 525.

CH E 566 Control of Gaseous Air Pollutants (3) Sp *Pilat* Physical and chemical processes used to control gaseous air pollutants. Absorption into liquids. Aqueous spray dryer scrubbers. Adsorption beds. Control of sulfur oxide and nitrogen oxide. Case studies of control systems. Offered jointly with CEWA 566. Prerequisite: 435 or 468 or permission of instructor. (Offered even-numbered years.)

CH E 567 Control of Particulate Air Pollutants (3) Sp *Pilat* Processes used to control emissions of particulate air pollutants. Use of settling chambers, cyclones, fabric filters, wet scrubbers, and electrostatic precipitators to control aerosol particles. Case studies of particulate air-pollutant control systems. Offered jointly with CEWA 567. Prerequisite: 468 or permission of instructor. (Offered odd-numbered years.)

CH E 570 Chemistry of High Polymers (3, max. 6) *Allan* Fundamentals of high polymer chemistry, including kinetics of addition and condensation polymerization, the determination of average molecular weights and chain length distributions, solution properties and the relationship between molecular structure and plastic film and fiber properties of various polymers. Prerequisite: an undergraduate sequence in organic chemistry.

CH E 571 Polymer Physics and Engineering (3) Sp *Seferis* Description and analysis of methods for processing polymeric materials. Introduction to solid polymer physics with emphasis on the coupling of structure morphology and properties. Development of structure-property models for quantitative description and control of properties in synthetic and natural polymers and composite materials.

CH E 572 Advanced Polymeric Composites (3) *Seferis* Design, manufacture, and properties of organic and inorganic particle and fiber-reinforced polymers. Advanced techniques for characterization of processing and properties, including anisotropic elasticity/viscoelasticity theory, polymerization and network formation of matrices, theory of reinforcement, environmental and chemical effects. Prerequisite: 571 or MSE 423 or permission of instructor.

CH E 574 Cellulose and Lignin (3) W *Sarkanen* Chemistry and technology of cellulose, lignin, and related substances. Preview of the chemistry of conversion of wood to pulp, paper, and by-products. Prerequisite: 470.

CH E 575 Nonlinear Analysis in Chemical Engineering (3) Sp *Finlayson* Comparison of numerical techniques: similarity, perturbation, finite difference, Galerkin, orthogonal collocation methods as applied to nonlinear chemical engineering problems. (Offered odd-numbered years.)

CH E 580 Topics in Chemical Engineering Design (3, max. 9) Lectures and seminars on current design methods in chemical engineering, including technical and economic feasibility of processes, design and optimization of process equipment, and environmental and social constraints. Prerequisite: undergraduate chemical engineering design, admission to chemical engineering nonthesis master's program, or permission of instructor.

CH E 599 Current Topics in Chemical Engineering (1-3, max. 12) Readings or lectures and discussions of topics of current interest in the field of chemical engineering. Subject matter changes from year to year. Prerequisite: permission of instructor.

CH E 600 Independent Study or Research (*) AWSpS

CH E 700 Master's Thesis (*) AWSpS

CH E 800 Doctoral Dissertation (*) AWSpS

Civil Engineering

Neil H. Hawkins, Chairperson
201 More

Civil engineering is a very broad field that interfaces closely with the public in the planning, design, construction, and management of facilities serving the needs of society. These activities include all transportation modes: highways, aerospace, rivers, and harbors; water resources and ocean engineering; structures, mechanics, and geotechnical engineering; surveying, mapping, and photogrammetry; engineering hydraulics; urban planning and development; water supply, wastewater treatment, water-quality management; and the chemistry, quality control, and management of the air resource.

A civil engineer may specialize in one or several of these activities and may further specialize in a particular function, such as design or management. The civil engineer's work frequently provides close associations with the legal profession, urban and regional planners, economists, public officials, biologists, chemists, financial consultants, architects, and system analysts. An essential ingredient in education and practice is a consideration not only of the technological-science aspects of a particular problem but also of its relationship to social, economic, political, and environmental constraints.

To better accommodate these wide areas of interest, the department is organized into three academic programs: Structural and Geotechnical Engineering and Mechanics; Transportation, Surveying, and Construction Engineering; Environmental Engineering and Science.

Undergraduate Program

J. E. Colcord, Undergraduate Program Adviser

Admission to the department is usually at the junior level after satisfactory completion of the required mathematics, science, and engineering college courses in the freshman and sophomore years. Student enrollment in the department is limited; students desiring entrance must formally apply to, and be accepted by, the departmental admissions committee. The degree granted by this department is the Bachelor of Science in Civil Engineering.

Prospective students should obtain a copy of the departmental Undergraduate Advising Guide and the departmental application form. These are available in 201 More.

Graduate Program

R. E. Nece, Graduate Program Coordinator

The Department of Civil Engineering offers courses leading to the degrees of Master of Science in Civil Engineering and Doctor of Philosophy. The department also provides authorized options leading to the college-wide Master of Science and Master of Science in Engineering degrees.

The three master's programs are intended to accommodate the needs of three categories of students: the M.S.C.E. for those who have completed an undergraduate degree in civil engineering and plan to continue with their professional training; the college-wide M.S.E. for other engineering graduates who wish to do graduate work in civil engineering; and the college-wide M.S. for those whose Bachelor of Science degrees are not in engineering, but who desire to apply their training in science to the solution of problems in some specific sector related to civil engineering. The nonengineer may take additional course work to obtain an M.S.E. degree.

Graduate work is offered in most fields of civil engineering through the following three programs: Structural and Geotechnical Engineering and Mechanics; Transportation, Surveying, and Construction Engineering; and Environmental Engineering and Science.

The requirement for the master's degree is a minimum of 39 credits, of which 30 must be in formal course work and 9 in thesis. A nonthesis program is available, requiring a minimum of 45 credits, of which at least 3 credits will be individual study with the advisory committee chairperson. For all master's degrees, at least 3 credits must be from outside the major field of study.

Students working for the Ph.D. degree must complete an approved program of studies and research normally requiring an additional two or three years beyond the master's degree.

Financial Aid

Most students receiving assistance are research assistants or trainees. The number of positions available depends on the volume of our research program and, in the case of traineeships, on grants for this purpose. Some fellowships and teaching assistantships are also available.

Research Facilities

More Hall and Wilcox Hall have structural, concrete, and bituminous materials, soil mechanics, surveying and photogrammetry, computer, water-quality, solid-wastes, and air-quality laboratories as well as an air-monitoring station and equipment for fieldwork in the construction, water, air, and solid-waste programs. Modern facilities for experimental studies in hydraulics and fluid mechanics are available in the department.

Correspondence and Information

Graduate Program Coordinator
163 Wilcox, FX-10

John F. Ferguson, Program Director
Environmental Engineering and Science

Alan H. Mattock, Program Director
Structural and Geotechnical Engineering and Mechanics

Sandor A. Veress, Program Director
Transportation, Surveying, and Construction Engineering

Faculty

Chairperson

Neil M. Hawkins

Professors

Bogan, Richard H.,* Sc.D., 1954, Massachusetts Institute of Technology; water and air resources.

Brown, Colin B.,* Ph.D., 1962, Minnesota; structural engineering and systems.

Burges, Stephen J.,* Ph.D., 1970, Stanford; hydrology, systems analysis, water resources planning.

Carlson, Dale A. (Emeritus), Ph.D., 1960, Wisconsin; water resources and solid-waste management.

Charlson, Robert J.,* (Geophysics, Institute for Environmental Studies),† Ph.D., 1964, Washington: atmospheric chemistry.

Clanton, Jack R. (Emeritus), M.S.C.E., 1939, Pittsburgh; structural engineering.

Colcord, Josiah E.,* M.S.C.E., 1949, Minnesota; surveying engineering.

Dunn, Walter L. (Emeritus), M.P.H., 1953, California (Berkeley); transportation planning.

Elias, Ziad M.,* Sc.D., 1963, Massachusetts Institute of Technology; engineering mechanics.

Evans, Roger J.,* Ph.D., 1965, California (Berkeley); engineering mechanics.

Ferguson, John F.,* Ph.D., 1970, Stanford; chemical and biological processes in water and waste treatment and in natural water systems.

Hammer, Vernon B. (Emeritus), M.S., 1941, Harvard; solid-waste management.

Hartz, Billy J. (Emeritus), Ph.D., 1955; California; engineering mechanics.

Hawkins, Neil M.,* Ph.D., 1961, Illinois; structures and materials.

Hennes, Robert G. (Emeritus), M.S., 1928, Massachusetts Institute of Technology; transportation engineering.

Horwood, Edgar M. (Emeritus), (Urban Planning), Ph.D., 1959, Pennsylvania; urban transportation and information systems.

Mar, Brian W.,* (Environmental Studies, Fisheries), Ph.D., 1958, Washington; water resources management, environmental systems analysis, interdisciplinary research management.

Mattock, Alan H.,* Ph.D., 1955, London; structural behavior and design.

Nece, Ronald E.,* Sc.D., 1958, Massachusetts Institute of Technology; hydraulic engineering.

Pilat, Michael J.,* (Chemical Engineering),† Ph.D., 1967, Washington; air resources engineering (design of air-pollution-control equipment).

Rhodes, Fred H., Jr. (Emeritus), B.S.C.E., 1935, Washington; structural engineering.

Richey, Eugene P. (Emeritus), Ph.D., 1955, Stanford; hydraulic engineering.

Rossano, August T., Jr. (Emeritus), Sc.D., 1954, Harvard; air resources.

Sawhill, Roy B. (Emeritus), M.E., 1952, California; transportation engineering, traffic engineering and traffic safety.

Schneider, Jerry B.,* (Environmental Studies, Urban Planning), Ph.D., 1966, Pennsylvania; planning and programming, major public utilities.

Seabloom, Robert W. (Emeritus), M.S.C.E., 1956, Washington; water-quality and solid-waste management.

Sergev, Sergius I. (Emeritus), M.E., 1931, Washington; structural engineering.

Sherif, Mehmet A.,* Ph.D., 1964, Princeton; soil mechanics, materials and geotechnical earthquake engineering.

Sylvester, Robert O. (Emeritus), S.M., 1941, Harvard; water resources.

Terrel, Ronald L.,* Ph.D., 1967, California (Berkeley); pavement design and construction materials.

Vasarhelyi, Desi D. (Emeritus), Dr.Ingr., 1944, Technical University (Budapest); structural engineering.

Veress, Sandor A.,* Ph.D., 1968, University de Laval (Quebec); photogrammetry.

Welch, Eugene B.,* Ph.D., 1967, Washington; water resources and aquatic biology.

Wenk, Edward, Jr. (Emeritus), Dr.Eng., 1950, Johns Hopkins; structural mechanics, marine technology affairs, decision analysis, futures and science policy.

Wessman, Harold E. (Emeritus), Ph.D., 1936, Illinois; structural engineering.

Zerbe, Richard O.,*‡ (Economics, Public Affairs), Ph.D., 1969, Duke; economics, economics of regulation and pollution-control strategies.

Associate Professors

Benjamin, Mark M.,* Ph.D., 1979, Stanford; chemistry of natural waters, chemical and biological treatment of water and wastewater.

Chenoweth, Harry H. (Emeritus), M.S.C.E., 1957, Washington; engineering mechanics and hydraulic engineering.

De Walle, Foppe,*‡ (Research), (Environmental Health), Ph.D., 1973, Washington; wastewater treatment systems, toxic trace pollutants in environment, groundwater pollution, advanced waste-treatment processes, fixed film anaerobic biological processes.

Harrison, Halstead,*‡ (Atmospheric Sciences), Ph.D., 1960, Stanford; atmospheric chemistry.

Hinze, James W., Ph.D., 1976, Stanford; construction engineering and management.

Hoag, Albert L. (Emeritus), M.S., 1973, Stanford; construction management.

Kent, Joseph C.,* Ph.D., 1952, California; hydraulic engineering.

Konicheck, Dorland H. (Emeritus), B.S.C.E., 1930, North Dakota State; general engineering.

Lettenmaier, Dennis P.* (Research), Ph.D., 1975, Washington; systems analysis and water resources planning.

Mahoney, Joe P.,* Ph.D., 1978, Texas A&M; construction materials, pavement systems.

Meese, Richard H. (Emeritus), S.M., 1941, Harvard; soil mechanics and foundations.

Miller, William M. (Emeritus), M.S.C.E., 1952, Washington; materials.

Mittet, Holger P. (Emeritus), M.S.C.E., 1938, Massachusetts Institute of Technology; structural engineering.

Nihan, Nancy L.,* Ph.D., 1970, Northwestern; transportation planning and systems analysis.

Roeder, Charles W.,* Ph.D., 1977, California (Berkeley); structures and materials.

Rutherford, G. Scott,* Ph.D., 1974; Northwestern; transportation planning and engineering.

Spyridakis, Dimitris E.,* Ph.D., 1965, Wisconsin; water chemistry.

Stanton, John F.,* Ph.D., 1978, California (Berkeley); earthquake engineering, nonlinear materials analysis, restoration and rehabilitation, mechanics of rubber, structural design and engineering and behavior of structures.

Stensel, H. David, Ph.D., 1971, Cornell; water pollution, sanitary engineering.

Strausser, Howard S. (Emeritus), M.S.E., 1950, Johns Hopkins; hydraulic engineering.

Waggoner, Alan P.* (Research), Ph.D., 1971, Washington; atmospheric optics and aerosol effects.

Assistant Professors

Banerjee, Sunirmal,* Ph.D., 1978, California (Berkeley); foundation and geotechnical engineering, soil mechanics.

Chu, Wen-Sen,* Ph.D., 1979, California (Los Angeles); computational hydraulics, fluid mechanics and hydraulic transients.

Covert, David S.*‡ (Research), (Environmental Health), Ph.D., 1973, Washington; environmental health aspects of aerosols and ambient monitoring.

Horner, Richard R.* (Research), Ph.D., 1978, Washington; environmental impact assessment and studies, control of eutrophication, nonpoint source water pollution, periphyton in energy budgets of lakes and streams and productivity in natural waters and wastewater effects.

Larson, Timonthy V.,* Ph.D., 1976, Washington; airborne particles, air quality modeling, and instrument development.

Miller, Gregory R., Ph.D., 1983, Northwestern; structural engineering, materials, and mechanics.

Palmer, Richard N.,* Ph.D., 1979, Johns Hopkins; civil engineering systems, computer methods, optimization, water resources planning and management, water supply and waste-management systems.

Reed, Dorothy A., Ph.D., 1980, Princeton; probability, statistics, and wind engineering.

Ritchie, Stephen G., Ph.D., 1983, Cornell; transportation systems planning and engineering.

Shawcroft, Robert G. (Research), Ph.D., 1979, Washington; urban information systems in transportation planning.

Yeh, Harry H., Ph.D., 1983, California (Berkeley); hydraulics and wave mechanics.

Course Descriptions

Courses for Undergraduates

Core Courses

CIVE 213 Plane Surveying (3) AWSp *Veress, Staff* Plane surveying methods involving levels, transits/theodolites, and distance measurement. Computation of local coordinates, areas, and volumes. Mapping by stadia and other techniques. Introduction to public land system. Plan and profile preparation. Prerequisite: MATH 124 or Q SCI 291.

CIVE 306 Construction Engineering I (3) WSp *Hinze, Mahoney* Introduction to construction engineering, planning, scheduling, methods, contracts, and specifications. Production estimates; equipment selection; ownership and operating costs; role of the engineer in construction. Prerequisite: civil engineering students only or by departmental permission.

CIVE 316 Geometronics (4) ASp *Colcord, Staff* Introduction to geodetic and photogrammetric concepts and their applications to engineering surveys. Errors. Measurement of position with modern techniques, including use of tacheometric, optical, and electronic instruments. Reduction to plane coordinates. Analysis and adjustment of measurements by computer. Prerequisites: ENGR 141 or permission and 18 credits in mathematics, and civil engineering students only or by departmental permission.

CIVE 320 Transportation Engineering I (3) AW *Mahoney, Staff* Introduction to the historical development of transportation with important legislation. Review of operating characteristics of transportation modes, review of methods used to predict travel demand and capacity supply; study of basic geometric fundamentals and their relationship to design with emphasis on highways, concepts of administration, and management of transportation systems. Prerequisite: 316, which may be taken concurrently.

CIVE 342 Fluid Mechanics (4) ASp *Nece, Staff* Elementary mechanics of incompressible fluids. Hydrostatics. Continuity, energy, and momentum equations. Introduction to potential flow. Resistance phenomena for laminar and turbulent flows. Dynamic similitude. Prerequisites: ENGR 210, 230 and civil engineering students only or by departmental permission.

CIVE 345 Hydraulic Engineering (4) AW *Nece, Staff* Extension and application of fluid mechanics principles to hydraulic engineering problems. Open channel flow, pipeline systems, turbomachinary, unsteady flow in pipes, diffusion and mixing processes, surface water hydrology. Prerequisites: 342 and civil engineering students only or by departmental permission.

CIVE 350 Environmental Engineering—Water and Air Quality (4) AW *Ferguson* Description of water and air resources and parameters that characterize their quality. How their use alters their properties, emphasis on effects of civil engineering projects; significance to engineer/scientist and society. Laboratory sessions stress water-quality analysis techniques and significance. Prerequisite: civil engineering students only or by departmental permission.

CIVE 351 Water Supply and Waste Management (3) WSp *Bogan, Staff* Fundamentals of water supply: surface- and groundwater sources, demand, and system design. Municipal sewerage systems: wastewater quantity and quality, and fundamentals of engineering design for collection, treatment, and disposal. Solid wastes: characteristics and quantities, collection, treatment, and disposal. Prerequisites: 345, which may be taken concurrently, 350, and civil engineering students only or by departmental permission.

CIVE 363 Constructional Materials (4) ASp *Mahoney, Miller* General treatment of physical and mechanical properties and engineering behavior of metallic and nonmetallic materials. Steel, aluminum, concrete, wood. Laboratory testing, instrumentation, and investigation into macrobehavior. Correlation with microstructure and various aspects of materials science. Prerequisites: ENGR 220 and civil engineering students only or by departmental permission.

CIVE 366 Basic Soil Mechanics (4) WSp *Banerjee, Sherif* Introduction to basic soil properties, soil classification, volumetric relationships, compaction, consolidation, soil rheology, shear strength, bearing capacity, and lateral stresses against retaining structures. Prerequisites: ENGR 220 and civil engineering students only or by departmental permission.

CIVE 379 Mechanics of Structural Elements (3) ASp *Elias, Stanton* Review of engineering theory of beams, combined stresses, beam deflections and influence lines, indeterminate beams; principle of virtual work, application to beams; unsymmetrical bending, shear center, torsion of open and closed thin-walled sections; composite beams; inelastic bending of beams; elastic stability, beam-columns, column design formulas. Prerequisites: ENGR 220 and civil engineering students only or by departmental permission.

CIVE 380 Structural Analysis I (3) AW *Elias, Evans, Stanton* Types of structures, loadings, object, and role of structural analysis. Force method applied to statically determinate and statically indeterminate structures. Behavior of determinate and indeterminate structures under service loads and beyond the elastic limit. Stiffness analysis through moment distribution. Prerequisites: 379 and civil engineering students only or by departmental permission.

CIVE 381 Concepts of Structural Design (3) WSp *Brown, Hawkins, Mattock, Roeder, Stanton* Planning, design, and constructional aspects of structures. Criteria for structural adequacy and efficiency. Examination of the design process. Introduction to design of components. Prerequisites: 380 and civil engineering students only or by departmental permission.

CIVE 390 Civil Engineering Systems (3) AWSp *Mar, Nihan, Palmer, Reed* Introduction to civil engineering system processes. Decision methods, economic considerations, linear graphs,

optimization and systems simulation. Examples illustrating quantitative and subjective aspects of civil engineering practice. Prerequisite: civil engineering students only or by departmental permission.

CIVE 423 Heritage of Civil Engineering (3 or 4) Sp *Colcord* Contribution of civil engineering to civilization based on the lives and projects of prominent engineers and cultures. Incidents and individuals from prehistory to the nineteenth century give the student an awareness of the profession and its influence on society. Industrial archaeology and historic sites are considered. An additional 1 credit may be earned by participating in a special project. Emphasis on the control of elements and the methodology, planning, objectives, and reasons for the project. May be used as social science distribution. Prerequisite: junior standing.

CIVE 491 Deterministic Systems (3) A *Mar, Palmer* Development of quantitative methods for mathematical problem solving with emphasis on computer applications. Linear programming, mathematics of the simplex algorithm, sensitivity analysis, dynamic programming, systems simulation, and goal programming. Class project required. Prerequisite: 390 or equivalent or permission of instructor.

CIVE 492 Stochastic Systems (3) W *Burges, Nihan, Palmer* Introduction to probability distributions and statistics useful in systems analysis, conditional distributions, queuing theory and applications, Monte Carlo simulation, chance constrained mathematical programming, and stochastic dynamic programming. Emphasis on application of the techniques to civil engineering systems problems, including transportation, water resources, structural and information systems. Prerequisite: 491 or permission of instructor.

Transportation, Surveying, and Construction Engineering

CETS 400 Computer-Aided Design (3) A Review and evaluation of C.A.D. hardware, software, and applications in civil engineering. Use of interactive graphic software to solve complex, multiobjective design problems. Prerequisite: senior standing in civil engineering or permission of instructor.

CETS 405 Critical Path Methods of Project Scheduling (3) AWSp *Hinze, Staff* Precedence analysis of project activities; critical path methods (CPM); computer applications. CPM project; PERT and PRECEDENCE techniques. No auditors.

CETS 406 Construction Engineering II (3) A *Hinze, Terrel* Construction engineering, with emphasis on heavy construction. Includes selection of equipment, work analysis, methods, schedules, and labor cost. Prerequisite: CIVE 306 or permission of instructor.

CETS 407 Contracts and Specifications (3) AW *Hinze, Staff* Specification writing and the elements of contract law relating to heavy construction and engineering services. Prerequisite: senior standing.

CETS 410 Traffic Engineering Fundamentals and Surveys (3) A *Ritchie, Sawhill* General review of the fundamentals of traffic engineering, including their relationship to urban planning, municipal engineering, and highway safety, with special emphasis on traffic engineering field surveys and data analysis. Prerequisite: senior or graduate standing in engineering or permission of instructor.

CETS 411 Highway and Traffic Engineering—Geometric Design (3-5) Sp *Rutherford, Sawhill* Factors and elements in geometric design of arterials, intersections, freeways, interchanges, parking facilities, including problem solution. 1 additional credit available for design project and report and another for theory and design of traffic signals, including design project and report. Prerequisites: CIVE 320 and senior or graduate standing in civil engineering.

CETS 412 Traffic Flow Theory (3) Introduction to traffic flow theory, characteristics. Measurement, statistical representation of traffic characteristics. Speed-flow-concentration models and relationship to level of service, highway capacity. Human element. Car-following and shock-wave analysis. Application of queueing theory to traffic events; introduction to traffic flow simulation. Prerequisites: CIVE 320 and senior standing in civil engineering.

CETS 415 Photogrammetry (3) A *Veress* Geometrical characteristics of photographs. Planning and control considerations for mapping. Theory of stereoscopy, parallax measurement, interior and exterior orientation. Photogrammetric instrumentation (production of maps, orthophotos, and cross-sections). Evaluation of accuracies and error sources. Prerequisite: CIVE 316 or permission of instructor.

CETS 417 Cadastral Surveys (3) W *Colcord* System of public lands; boundaries; adverse and riparian rights. Legal cases, testimony, and professional ethics. Multipurpose cadastre concepts. Subdivision design and site planning. Prerequisite: CIVE 316 or permission of instructor.

CETS 418 Urban Surveying and Mapping (3) Sp *Colcord, Staff* Survey specifications. Urban projection systems and design of horizontal and vertical control for engineering, utility and city maps, and photogrammetric projects. Azimuth determination. Surveying and mapping data banks. Ground and hydrographic map design project. Prerequisite: CIVE 316 or permission of instructor.

CETS 424 Pavement Design (3) W *Mahoney, Terrel* Current and developing procedures for the structural thickness design of pavements. Bituminous and concrete pavements for highways, airports, and special heavy loading. Elastic layered systems, slab theory. Performance evaluation for maintenance and overlay design. Prerequisite: senior or graduate standing in civil engineering.

CETS 440 Transportation Technologies and Systems (3) W *Rutherford* Review and evaluation of conventional and innovative vehicle systems, fuel types, command and control systems, and information systems. Technology forecasting and assessment techniques. Alternative futures for the role of transportation system in society. Prerequisite: CIVE 320 or permission of instructor.

CETS 484 Construction Materials II (4-6) A *Hawkins, Terrel* Types, sources, uses, and performance behavior from a construction point of view of aggregates, asphalt products and mixtures, portland cement and concrete, and selected other materials. Emphasis is on those materials for which the civil engineer has responsibility for selection and manufacture on the job site. All students take the lecture (3 credits) with optional independent (1 credit each) asphalt laboratory, concrete laboratory, or special topics in testing materials using standard recommended practice in the industry. Prerequisites: CIVE 363 or equivalent and senior standing in engineering or architecture.

CETS 485 Cold Regions Engineering (3) W *Mahoney* Introduction to the unique conditions associated with engineering applications in cold regions. Includes treatment of heat transfer mechanisms, ground thermal analysis, frost action in soils, design of insulation in buildings, and construction, earthwork, pavement design, and foundation design for cold regions. Prerequisites: CIVE 363, 366.

CETS 470 Urban Transportation Planning and Design (3) A *Rutherford* Brief review of major issues in urban transportation planning. Planning process discussed and transportation models introduced. Uses a systems framework, including goals and objectives, evaluation, implementation, and monitoring. A design term project, individual or small groups, utilizes material presented on a contemporary problem. Prerequisites: senior standing and CIVE 320 or graduate standing and permission of instructor.

CETS 471 Urban Transportation Demand Forecasting (3) Sp *Nihan* The urban transportation planning process and its traditional travel demand modeling components, including trip generation, trip distribution, model choice, and route assignment techniques. Quick response method, sketch planning, and other alternatives to the conventional modeling process. Prerequisites: senior standing and CIVE 390.

CETS 472 Computer-Aided Planning of Urban Systems (3) W *Schneider, Staff* Survey of on-line planning applications; use of various on-line systems to solve urban systems design problems; investigations of hardware/software tradeoffs; human factors in man-computer systems design theory as it relates to problem-solving activity. Offered jointly with URB P 429. Prerequisite: CIVE 390 or permission of instructor.

CETS 498 Special Topics: Transportation, Construction, and Geometronics (1-5, max. 12) AWSp Special topics in civil engineering offered as course with lecture and/or laboratory. May be repeated for credit. A maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

CETS 499 Special Projects: Transportation, Construction, and Geometronics (1-5, max. 12) AWSpS Individual undergraduate research projects. May be repeated for credit. A maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

Structural and Geotechnical Engineering and Mechanics

CESM 431 Seismology and Earthquake Engineering (3) A *Evans, Smith* Presents an overview of earthquake processes and details of the characteristics of destructive ground motion; illustrates the effects of such motion on engineering structures; reviews current practice in estimating earthquake hazards for important structures such as nuclear power plants. Offered jointly with GPHYS 431. Prerequisite: MATH 238 or permission of instructor.

CESM 466 Foundation Design (3) ASp *Banerjee, Sherif* Design considerations for foundations and retaining structures. Subsurface investigations and determination of soil properties for design. Design of shallow and deep foundations and retaining structures. Foundations and soil considerations for waterfront structures. Prerequisite: CIVE 366.

CESM 467 Soil Mechanics (3) W *Banerjee* Elementary seepage theory. Seepage through earth embankments and toward well points. Soil strength review. Mechanics of landslides. Selection of parameters and methods of analysis for slope stability. Control and correction of slope failures. Prerequisite: CIVE 351 and 366.

CESM 470 Advanced Mechanics of Materials (3) AW *Brown, Miller, Reed* General theory of torsion and bending of straight and curved beams; beams on elastic foundations and beam-columns. Prerequisite: CIVE 379 or permission of instructor.

CESM 471 Structural Analysis II (3) AW *Elias, Evans* Governing equations of linear structural analysis in matrix form. Principles of virtual displacements and virtual forces. The stiffness and flexibility methods of analysis with emphasis on the stiffness method and programming applications. Prerequisite: CIVE 380.

CESM 472 Applied Elasticity (3) Sp *Brown, Elias, Evans* Governing equations of linear elasticity with applications to two-dimensional problems. Airy's stress function. Kirchoff's theory of plate bending. Solutions for rectangular and circular plates. St. Venant's torsion problem. Virtual work and energy theorems with applications. Prerequisite: CIVE 379.

CESM 477 Structural Design Through Model Studies (3) W *Albrecht, Mattock* Theory of models, dimensional analysis, direct model analysis; studies employing specific materials, techniques of testing and measurement. Offered jointly with ARCH 521. Prerequisite: permission of instructor.

CESM 480 Design of Metal Structures (3) WSp *Brown, Roeder, Stanton* Introduction to the design and behavior of metal structures by working stress and plastic design methods. Includes plastic design and analysis; upper- and lower-bound plasticity theorems; buckling of beams and columns; application of design methods and codes. Design of a simple frame is required. Prerequisites: 471, CIVE 381.

CESM 481 Design of Reinforced Concrete Structures (3) ASp *Hawkins, Mattock, Stanton* Fundamentals of design of buildings in reinforced concrete in accordance with current codes and practices. Prerequisite: CIVE 381.

CESM 482 Prestressed Concrete Design (3) AW *Hawkins, Mattock, Stanton* Analysis, design, and construction of reinforced and prestressed concrete structures. Prerequisite: 481 or graduate standing.

CESM 486 Design of Timber Structures (3) Sp *Evans, Miller* The design and construction of timber structures, using elements made of sawn wood, glued-laminated wood, and plywood. Prerequisite: CIVE 381.

CESM 487 Structural Unit Masonry (3) Sp *Lebert, Mattock* Structural behavior and design of reinforced brick, tile, and unit concrete masonry structures. Offered jointly with ARCH 426. Prerequisite: CIVE 381 or permission of instructor.

CESM 489 Design Project (3) Sp *Mattock, Staff* Design projects that synthesize the material of the prerequisite courses. Emphasizes the complete design operation, including preliminary decisions, computations, presentation of work by drawings, specifications, maintenance, and supervision. Prerequisites: 466, 470, 471, 480, 481.

CESM 498 Special Topics: Structures and Mechanics (1-5, max. 12) AWSpS Special topics in civil engineering offered as course with lecture and/or laboratory. Maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

CESM 499 Special Projects: Structures and Mechanics (1-5, max. 12) AWSpS Individual undergraduate research projects. Maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

Environmental Engineering and Science

CEWA 430 Biological Problems in Water Pollution (3) *Taub* Ecological aspects of water-pollution problems arising from such processes as electrical power production, oil utilization, pest-control practices, and land management. Not available to undergraduates as a continuing education technical elective. Offered jointly with FISH 430. Prerequisite: senior standing in fisheries, civil engineering, or other science major, or permission of instructor.

CEWA 431 Laboratory for Biological Problems in Water Pollution (2) Laboratory experiments and field visits relating to biological problems in water pollution. Laboratory fee may be required. Not available to undergraduates as a continuing education technical elective. Offered jointly with FISH 431. Prerequisite: concurrent registration in 430.

CEWA 434 Ecological Effects of Waste Water (3 or 5) ASp *Welch* Principles of aquatic ecology that relate to causes and effects of water quality problems in lakes and streams. Includes popu-

lation growth kinetics, nutrient cycling, eutrophication, acidification, oxygen/temperature requirements, and effects of various wastes on aquatic animals. Offered jointly with FISH 434. Prerequisite: senior or graduate standing in engineering or science.

CEWA 435 Physiological Effects of Water Pollutants (3) Sp *Brown* Physiological effects of water pollutants on economically important or endangered fishes, especially with respect to wastewater. Types of industrial, urban, and agricultural entities that contribute wastes to natural waters. Monitoring procedures and assessment of changes in fisheries as a consequence of waste effluents. Offered jointly with FISH 435. Prerequisites: upper-division or graduate standing, organic chemistry, and some background in any of the following: general physiology, cell biology, biochemistry, chemical biology, sanitary engineering.

CEWA 442 Introduction to Hydraulics in Water Resources (3) A *Nece* Physics of water movements in natural freshwater bodies and inshore marine waters. Brief review of some essential fluid mechanics. Flow in rivers and streams; motions in lakes, reservoirs, and estuaries. Some aspects of diffusion. Not open to students with undergraduate civil engineering backgrounds. Prerequisites: senior or graduate standing and permission of instructor. (Offered even-numbered years.)

CEWA 444 Coastal Engineering I (3) W *Yeh* Linear theory of water waves, wave transformations due to boundary conditions, sediment motion, elementary tidal theory; applications illustrated by laboratory experiments and selected case histories. Offered jointly with O ENG 444. Prerequisite: CIVE 342.

CEWA 445 Computational Hydraulics (3) A *Chu* Introduction to unsteady hydraulic problems in open channels and pressure conduits; their solutions by numerical techniques. Existing models used to analyze problems in hydraulic flood routing, tidal river hydraulics, transient flows in pipes, unsteady transport phenomena. Practical applications emphasized. Prerequisites: CIVE 345, MATH 238, and senior standing in civil engineering.

CEWA 446 Analysis Techniques for Groundwater Flow (3) W *Burges* Development of appropriate equations to describe saturated groundwater flow, and application of numerical methods for solving groundwater flow problems. Participants required to solve specific problems using numerical techniques developed during the course. Prerequisite: CIVE 342 or equivalent.

CEWA 447 Physical Hydrology (3) A *Burges* Global water picture, data sources and data homogeneity, precipitation, evapotranspiration, flow to wells, hydrographs. Hydrologic data frequency analysis. Hydrologic design: flood mitigation, drainage. Introduction to deterministic and stochastic models. Prerequisite: senior standing or permission of instructor.

CEWA 448 Open-Channel Engineering (3) Sp *Nece* Water flow in natural and constructed channels. Analysis and design of canals, transitions, energy dissipators, and similar structures. Analysis of surface profiles and effect of nonlinear alignment on flow. Introduction to river mechanics. Design-oriented problems. Prerequisite: CIVE 345.

CEWA 449 Water Resources and Hydraulic Engineering Design (3) ASp *Burges, Nece* Opportunity to effect design solutions for projects or major project components in areas of water resources engineering or hydraulic and coastal engineering. Problems include irrigation, multiple- or single-purpose reservoirs (e.g., flood, water supply, hydroelectric), hydraulic structures, and coastal facilities. Prerequisites: senior standing in civil engineering and permission of instructor.

CEWA 450 Environmental Pollution: Assessing Problems and Solutions (5) A *Welch, Staff* Environmental problems caused by increasing demands on resources: definition and prospects for control from an engineering viewpoint. Includes ecological cycles, quantity and quality of wastes, biological effects of pollutants, energy, legislation, policy. Primarily for nonengineering students. Prerequisites: junior standing; course in biology, chemistry, physics or oceanography from "A" list.

CEWA 451 Environmental Engineering Design (3) AW *Bogan* Introduction to the theory and the practice of planning and design of urban water supply, sewerage, solid wastes, and drainage collection systems. Evaluation of service areas and service requirements and their relationships to urban and regional planning activities. Engineering methods and computer programs for designing basic system elements. Prerequisite: CIVE 351.

CEWA 453 Water and Wastewater Treatment (3) W *Bogan, Carlson, Stensel* Objectives of water and wastewater treatment; associated physical, chemical, and biological phenomena; design of common treatment systems. Prerequisite: CIVE 351 or permission of instructor.

CEWA 454 Environmental Engineering Design Studies (3) Sp *Bogan* Individual and group design studies involving local communities. Preparation of comprehensive plans and preliminary design studies for water supply, sewage and drainage, and solid-waste management systems. Preparation of engineering reports dealing with selected design problems. Prerequisite: 451 or permission of instructor.

CEWA 455 On-Site Wastewater Disposal (3) Sp *Seabloom, Spyridakis* Latest information on design, construction, operation, maintenance of individual and small community wastewater disposal systems. Conventional water carriage septic tank soil absorption systems considered with new alternatives, such as mounds, evapotranspiration systems, anaerobic filters, pressure drainfields, sand filters. Nonwater carriage methods studied. Pressure and vacuum sewers introduced. Prerequisite: senior standing.

CEWA 456 Aquatic Chemistry (3) ASp *Benjamin, Ferguson, Spyridakis* Principles of chemical equilibrium relevant to natural water systems; the nature and effect of chemical interactions of domestic and industrial waste effluents on natural water systems; chemical principles involved in the treatment of water and wastewaters. Prerequisite: one year of general chemistry or equivalent.

CEWA 457 Water-Quality Analysis (3) W *Spyridakis* Laboratory evaluation of chemical quality of natural and wastewaters. Theory and application of instrumentation used in water-quality measurement.

CEWA 458 Introduction to Air Chemistry (4) A *Charlson* The atmosphere as a chemical system; the analytical and physical chemistry of trace atmospheric constituents, both natural and manmade. Offered jointly with ATM S 458. Prerequisites: CHEM 140, senior standing.

CEWA 461 Air-Pollution Control (3) A *Pilat* Fundamental concepts of air pollution. Emission sources, atmospheric dispersion, ambient concentrations, adverse effects, governmental regulations, emission standards, air-quality standards, processes and equipment for controlling emissions. Prerequisite: senior standing.

CEWA 467 Air-Pollution Source Testing and Equipment Evaluation (3) Sp *Pilat* Engineering evaluation of air pollutant sources and air-pollution control equipment. Air pollutant source testing and stack sampling. Analysis of equipment performance and source emissions in the field and in the laboratory. Prerequisites: senior standing and permission of instructor.

CEWA 468 Air-Pollution Control Equipment Design (3) W Designs to control air pollutants from stationary sources. Procedures for calculating design and operating parameters. Fundamental mechanisms and processes of gaseous and particulate control equipment for absorption and adsorption of gaseous pollutants; electrostatic precipitation and filtration of particulate pollutants. Actual case studies. Offered jointly with CH E 468 and M E 468. Prerequisite: senior standing or permission of instructor.

CEWA 470 Solid-Waste Disposal (3) A *Bogan* Elective for undergraduate and graduate engineers and urban planners covering the sources and the handling of industrial, municipal, and agricultural solid wastes; with examination of processing, by-product recovery, and disposal methods. The roles of urban and industrial planning and of collection and transportation aspects in solid-waste production and disposal are discussed, especially as related to community location and planning and to methods of hauling and controlling wastes concentration and utilization.

CEWA 485 Sampling Techniques for Water Quality (3) Sp *Welch* Collection and analysis of water for selected abiotic and biotic characteristics in lakes, rivers, and estuaries. Emphasis is placed on the natural variability of water-quality characteristics as determined by application of appropriate field sampling techniques and data analysis with the objective of designing adequate sampling programs. Prerequisite: 457 or permission of instructor.

CEWA 498 Special Topics—Water and Air Resources (1-5, max. 12) AWSpS Special topics in civil engineering offered as course with lecture and/or laboratory. Maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

CEWA 499 Special Projects—Water and Air Resources (1-5, max. 12) AWSpS Individual undergraduate research projects. Maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

Courses for Graduates Only

Core Courses

CIVE 504 Public Works—Finance, Policy, and Programming (3) W *Rutherford, Staff* Research seminar in the study of public works planning and evaluation systems, particularly emphasizing programming and review processes and social, political, and environmental concerns. Students select topics in their areas of public works interest.

CIVE 505 Economic Analysis of Public Works (3) Sp *Rutherford, Staff* The use of benefit-cost ratio, rate of return, and maximization of benefits as criteria in project justification, cost allocation, and selection among engineering alternatives in the design and construction of public works. Topics vary from year to year.

CIVE 506 Theory of Design (3) Sp *Brown* Decision processes in design. Resolution of dichotomy between owner and society. Study of input data, analytical procedures, and subsequent response. Safety, reliability, and durability measures. Paradigms in design. Prerequisite: graduate standing.

CIVE 540, 541, 542 Social Management of Technology I, II, III (3,3,3) A,W,Sp *Wenk* Interaction of technology and society through general principles and case studies of contemporary issues. Systems analysis of technological enterprise, its scientific base, roles of capital, specialized manpower, organizational structure and management; decision making and institutional behavior; goal generation; strategies, risk assessment and policy planning. 540: policy process; 541: policy analysis; 542: policy design. Offered jointly with PB AF 540, 541, 542. Prerequisites: permission of instructor for 540; 540 for 541; 541 for 542.

CIVE 543 Marine Technology Affairs I (3) W *Wenk* Case studies in marine legislation, fishery conventions, coastal pollution, oil and gas extraction, environmental observations, planning for international exploration of the sea, federal organizations, etc., to identify components in the marine technology enterprise, dynamics of interrelationships, externalities, policy planning and institutional conflicts in setting goals, priorities, and program strategies. Offered jointly with O ENG 503 and IMS 543. Prerequisite: permission of instructor.

CIVE 700 Master's Thesis (*) AWSpS

CIVE 800 Doctoral Dissertation (*) AWSpS

Transportation, Surveying, and Construction Engineering

CETS 507 Heavy Construction Estimating (3) W *Hinze, Staff* Principles and procedures for estimating and bidding heavy construction projects. Project reconnaissance, site investigation, methods analysis, breakdown of project into common construction operations, programming, cost analysis, cost distribution; cost summarization, and bid preparation. Prerequisites: 406 and graduate standing, or permission of instructor.

CETS 508 Construction Administration (3) Sp *Hinze, Staff* Administration and management of construction operations from the viewpoint of the contractor. Forms of ownership; organization; staffing, planning, and control; bidding; contracts; bonding; insurance; project cost accounting; labor law; labor relations; project safety. Prerequisite: graduate standing or permission of instructor.

CETS 511 Traffic Systems Operations (3) Sp Operational planning, management of arterial and freeway traffic systems. Review of transportation system management strategies to achieve more efficient use of existing infrastructure, including improved and innovative traffic control systems and demand management policies, measures of effectiveness, impact assessment, traveler response. Introduction to use of relevant computer models and packages.

CETS 515 Stereo-Photogrammetry (3) W *Veress* Theory of orientation; mathematical concept of relative and absolute orientation for vertical and convergent photography. Error propagation and corrections. Accuracy element of orientation. Critical surfaces. Standard residual Y-parallaxes: Prerequisites: 415, 530.

CETS 516 Analytical Photogrammetry (3) W *Veress* Basic principle of analytical photogrammetry. Stereo comparators and the analytical plotter. Reduction of plate coordinates. Perspectivity. Colinearity, coplanarity, space coordinate systems, transformations. Space intersection and resection and their adjustments. Solutions using high-speed electronic computers. Prerequisites: 415, 530.

CETS 518 Aerial Triangulation (3) Sp *Veress* Radial aerotriangulation; instrumental aerial triangulation by independent pairs, aeropolygon, aeroleveling and independent geodetic control methods. Semianalytical aerotriangulation. Mathematical strip and block adjustment. Analytical aerotriangulation methods. Prerequisites: 515, 516.

CETS 520 Seminar (1, max. 6) AWSp Prerequisite: permission of thesis supervisor.

CETS 529 Urban Region Geocoding and Land-Based Information Systems (3) *Horwood* Multipurpose street network and land-based information systems. The United States Census geocoding system, automated map overlay systems, and cadastral file information use. Applications to land surveying, urban and transportation planning, and geographic analysis. Offered jointly with GEOG 529 and URB P 529.

CETS 530 Adjustment Computations (4) A *Veress* Two- and multi-dimensional distributions and concept of errors, variances, covariances, weight and error propagation. Least square adjustment by variation of parameters and other methods. Adjustments of hybrid systems using matrix notation inversion by high-speed computers. Prerequisite: permission of instructor.

CETS 531 Geodesy (4) A *Colcord* Concepts of geometric, gravimetric, and astrogeodesy. Computation of geodetic position; gravity observation and reduction and positional astronomy. Introduction to satellite and inertial survey systems. Prerequisite: permission of instructor.

CETS 537 Electronic Surveying (4) W *Veress* Modern EDM instrumentation theory and applications; hydrographic and navigation systems; chart and map designs, application of lasers in surveying; long line reduction and trilateration adjustment. Prerequisite: 530.

CETS 541 Transit Systems Planning (3) W Planning, operational methods for urban public transportation. Review of technological, operating characteristics of vehicles and systems; financing, management, institutional aspects. Paratransit. Short-range planning, operational strategies, revenue-fare structures. Service monitoring. Mode choice, transit demand relating to service. Computer-aided methods for planning, design of transit systems. Prerequisite: graduate standing or permission of instructor.

CETS 542 Freight Transportation (3) Characteristics of urban and intercity freight movements, transport modes and commodities. Nature of freight transportation problems and issues. Government regulation. Terminal facilities. Freight demand analysis. Role of freight in urban transportation planning process. Emphasis on the systems approach to freight transportation problems. Prerequisite: graduate standing or permission of instructor.

CETS 543 Airport Engineering (3) Sp *Mahoney* Definitions and terminology relating to airport engineering. Characteristics of aircraft, air traffic control; and resulting impact upon design process. Airport capacity, configuration, and planning associated with terminal design. Emphasis on geometric and structural design of pavements and airside. Design projects relating to airport engineering required. Prerequisite: permission of instructor.

CETS 564 Soil and Site Improvement (3) Sp *Mahoney, Terrel* Development, improvement, and utilization of marginal natural earth materials through compaction and stabilization using chemicals, portland cement, lime, asphalt, salt, and others. Includes discussion, design, and evaluation of foundation soil treatment, as well as surface materials for pavement subgrades, slope protection, dust palliation, and general site improvement. Prerequisites: 424, 464.

CETS 565 Remote Sensing of Environment (3) W *Colcord* Satellite and aerial image acquisition. Analysis of multispectral, multisensor imagery for object identification and for baseline engineering and environmental studies. Factors and aberrations in system components and in target signatures and evaluation models.

CETS 570 Land Use/Transportation Models (3) A *Schneider* Review of theoretical basis of several existing models used to forecast urban growth patterns and their associated land use, transportation, and energy requirements. Model validation studies in relation to empirical studies of urban growth and change. Environmental implications of alternative urban growth patterns. Offered jointly with URB P 530.

CETS 571 Analytical Methods in Transportation (3) Application of analytical and statistical methods to transportation planning problems. Analysis of probability distributions that describe variables. Development of statistical models for predicting transportation phenomena. Elementary sampling theory applied to transportation data. Mathematical programming applications in transportation. Network analysis. Prerequisite: graduate standing or permission of instructor.

CETS 572 Transportation Data Collection and Analysis (3) Sp *Mahoney, Ritchie* Data collection methods, survey sampling, experimental design in transportation planning and engineering. Preliminary planning, sampling methods, sources of errors, sample size, survey instruments, survey administration, data processing. Analysis of variance, experimental design. Illustrative examples drawn from various branches of transportation planning and engineering. Prerequisite: graduate standing or permission of instructor.

CETS 573 Transportation Systems Evaluation (3) Principles and concepts of alternatives analysis and evaluation in relation to decision-making processes of large-scale transportation projects. Estimation of capital, operating/direct user costs, benefit/cost concepts, impact identification, forecasting/assessment, equity/financing considerations, methods for improving decision-making process. Prerequisite: graduate standing or permission of instructor.

CETS 574 Advanced Travel Demand Theory and Applications (3) Sp New methods for estimating and forecasting travel demand. Individual as economic, psychological decision-making unit. Theoretical background to models, model structures, model specification, attitudinal measurement, empirical estimation, market segmentation, aggregation issues, model transferability, parameter updating. Practical applications, directions of present and future research. Prerequisite: graduate standing or permission of instructor.

CETS 599 Special Topics: Transportation, Construction, and Geomatronics (2-5, max. 15) AWSpS Prerequisites: permission of instructor and department Chairperson.

CETS 600 Independent Study or Research (*) AWSpS

Structural and Geotechnical Engineering and Mechanics

CESM 520 Seminar (1, max. 6) AWSp Required for doctoral students. Prerequisite: permission of thesis supervisor.

CESM 561 Engineering Properties of Clay (3) A *Sherif* Shear strength, consolidation characteristics, structural concepts, rheological behavior, and related properties of clay. Prerequisite: CIVE 366.

CESM 562 Stresses in Earth Masses (3) W *Sherif* Stress function. Stress-strain analysis within elastic range with emphasis on soil/water systems. Stress distribution under various loadings. Prerequisite: 467 or permission of instructor.

CESM 563 Seepage and Slope Stability (3) W *Banerjee* Analysis of groundwater flow, using relaxation, matrix and finite-element methods, slope stability analysis, considering seepage forces and pore-water pressures. Prerequisite: 467.

CESM 564 Applied Soil Mechanics (3) Sp *Banerjee* Passive pressure and bearing capacity theories. Foundation soils engineering project to develop design recommendations and performance estimates for deep and shallow foundation schemes. Prerequisite: 467 or permission of instructor.

CESM 565 Case Studies in Geotechnical Engineering I (2) A Includes stability of reservoir slopes and performance of dams, dynamic soil properties under dynamic and static loading, instrumentation. Prerequisite: graduate standing or permission of instructor.

CESM 566 Case Studies in Geotechnical Engineering II (2) W Includes siting and design of nuclear reactor foundations, case studies, instrumentation and performance evaluation. Prerequisite: graduate standing or permission of instructor.

CESM 567 Case Studies in Geotechnical Engineering III (2) Sp Includes static and dynamic foundation design in cold regions, case studies, instrumentation and performance evaluation. Prerequisite: graduate standing or permission of instructor.

CESM 571 Plates: Theory and Applications (3) W *Elias, Miller* Bending of plates. Analytical methods. Design methods for plates and reinforced concrete slabs. Prerequisite: 470 or permission of instructor. (Alternates every other year with 576.)

CESM 572 Stability of Structures (3) AW *Brown, Stanton* Theory of elastic stability of columns, frames, and arches. Introduction to inelastic stability. Buckling of frameworks. Lateral and torsional buckling of beams. Stability of plates and shells. Prerequisite: 470 or permission of instructor.

CESM 573 Matrix Structural Analysis (3) AS *Elias, Evans, Reed* Matrix methods in structural mechanics. Review of basic structural theory. Principle of virtual work. Development of basic matrix force (flexibility) and displacement (stiffness) methods of structural analysis. Prerequisite: graduate standing or permission of instructor.

CESM 574 Structural Dynamics (3) W *Elias, Evans, Reed* Dynamic response of structures using mode superposition and matrix methods. Lumped and distributed parameter systems. Application to earthquake, moving and blast loads. Approximate and numerical methods. Prerequisite: 573 or permission of instructor.

CESM 575 Variational Methods in Structural Mechanics (3) A *Brown, Elias* Variational and energy methods in structural and solid mechanics. Application of calculus of variations and minimal principles of mechanics to nonlinear structural analysis, elastic stability, theory of elasticity, plates and shells, and vibrations. Prerequisite: 574 or permission of instructor. (Offered alternate years.)

CESM 576 Shells: Theory and Applications (3) W *Elias* General theory of thin shells. Membrane and bending behaviors. Application to the design of dome, cylindrical, and translational roof shells. Prerequisite: 470 or permission of instructor. (Alternates every other year with 571.)

CESM 577 Finite Element Methods in Structural Mechanics (3) Sp *Elias* Extension of the matrix methods of structural analysis to the solution of elasticity, plate, and shell problems by use of finite element approximations. Discussion of convergence and bounding and extension to investigation of stability and finite deformations. Prerequisite: 573 or permission of instructor.

CESM 580 Strain Measurements and Instrumentation (3) W *Hartz* Experimental determination of strain under static and dynamic loads; strain gauges; transducers for displacement velocity and acceleration; photoelasticity, brittle coating and other methods; problems of instrumentation, data collection, and analysis of data; use of modern IC electronic components and computers or microprocessors for data collection and analysis. Offered jointly with O ENG 580. Prerequisite: graduate standing or permission of instructor.

CESM 582 Advanced Structures II (3) W *Evans* Analysis of trussed structures. Deflections and secondary stresses. Influence lines. Strain energy theorems, flexibility matrix, specialized or computer programs. Prerequisite: 573 or permission of instructor.

CESM 584 Plastic Design of Steel Structures (3) A *Roeder* Plastic (inelastic) behavior of structural steels. Applications to the design of structural members and systems. Upper- and lower-bound theorems, minimum weight design. Limitations and economy of the procedure. Prerequisite: graduate standing or permission of instructor.

CESM 585 Advanced Design of Concrete Structures (3) Sp *Hawkins, Mattock, Stanton* Advanced topics in the design of reinforced and prestressed concrete structures. Design of cast-in-place and precast statically indeterminate prestressed concrete structures. Design of prestressed concrete flat plate structures. Unusual design problems in reinforced concrete structures (e.g., combined torsion, bending, and shear, etc.). Prerequisites: 481, 482, or similar basic courses in design of prestressed and reinforced concrete.

CESM 586 Structural Materials and Design (3) W *Brown, Miller* Critical review and discussion of the mechanical properties of structural steel, structural aluminum alloy, and reinforced concrete that affect structural design. Fatigue and impact in metal structures. Failure of structures and structural members. Prerequisite: graduate standing in civil engineering.

CESM 587 Advanced Design of Steel Structures (3) Sp *Roeder* Broad review of the factors influencing the function of a structure, such as material properties and fabrication methods. Welded, riveted, and bolted connections. Particular problems of welded structures. Design projects. Prerequisite: 586 or permission of instructor.

CESM 588 Behavior of Concrete Members (3) A *Mattock* Behavior of structural concrete members subject to long- or short-term loading by axial force, bending, shear, and torsion. Prerequisite: 481 or permission of instructor.

CESM 589 Behavior of Concrete Structures (3) W *Mattock* Behavior under load of concrete structures, continuous beams, frames, and slabs. Effect of creep and shrinkage on the behavior of structures. Prerequisite: 588 or permission of instructor.

CESM 590 Wind, Wave, and Earthquake Response of Structures (3) Sp *Reed* Fundamental principles governing the static or dynamic response of suspended structures, transmission lines, tall stacks, and other flexible structures subject to deflection, overturning, or oscillation as a result of wind, wave, and earthquake action. Offered jointly with O ENG 590. Prerequisite: graduate standing in engineering.

CESM 591 Theory of Elasticity I (3) Sp *Brown, Evans, Miller* Elementary formulation of linear elasticity using indicial notation. Use of Airy stress function for solution of plane elasticity problems in rectangular and polar coordinates. Saint Venant's theory of torsion. Elementary treatment of thermal stress problems. Energy methods. Prerequisite: graduate standing in engineering. (Offered alternate years.)

CESM 592 Theory of Elasticity II (3) A *Brown, Evans, Miller* Rigorous formulations of classical theory making use of Cartesian tensor analysis. Stress functions. Use of potential theory to obtain solutions in terms of Papkovitch functions. Prerequisite: 591, A A 530 or M E 551, or permission of instructor. (Offered alternate years.)

CESM 594 Waves in Geophysics and Engineering (3) Sp *Evans, Fyfe* Examination of the fundamental concepts and mathematical descriptions of wave propagation; group and phase velocity, dispersion, effects of boundaries, normal mode and progressive wave descriptions; waves in elastic solids, acoustic waves, electromagnetic waves; sources of waves; waves in inhomogeneous media; applications to acoustics, seismology, and earthquake engineering. Offered jointly with GPHYS 594.

CESM 599 Special Topics: Structures and Mechanics (2-5, max. 15) AWSpS Prerequisites: permission of instructor and department Chairperson.

CESM 600 Independent Study or Research: Structures and Mechanics (*) AWSpS

Special Program in the Design of Brittle Ceramic Materials

CESM 476 Introduction to Design With Brittle Materials (3) W Properties and behavior of ceramic materials are related to their use in advanced technology structures. Analytical and numerical methods required for probabilistic design and current case studies utilized. Offered jointly with A A 476, CER E 476, M E 476, and MET E 476. Prerequisites: ENGR 220 or equivalent; senior or graduate standing.

CESM 496 Brittle Material Design Project (3) Sp *Bollard, Emery, Kobayashi, Love, Mueller, Scott, Taggart, Whittemore* Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CER E 496, M E 496 and MET E 496. Prerequisites: CER E 476.

CESM 536 Brittle Material Design Problem (3, max. 9) AWS *Bollard,, Emery, Kobayashi, Love, Mueller, Scott, Taggart, Whittemore* Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CER E 536 and MET E 536. Prerequisite: CER E 496.

Environmental Engineering and Science

CEWA 520 Seminar (1, max. 6) AWSp Required of all graduate students in the Water and Air Resources Division each quarter.

CEWA 525 Seminar in Atmospheric Problems Associated With Air Pollution (2) W *Charlson, Harrison* For both engineers and atmospheric scientists in the atmospheric problems related to air pollution. Offered jointly with ATM S 525. Offered on credit/no credit basis only. Prerequisite: ATM S 301 or permission of instructor.

CEWA 540 Hydrodynamics (4) A *Nece* Applications of the equations of motion to the flow of ideal and real fluids. Fundamentals of fluid potential motion. Viscous flows; Navier-Stokes equations and some exact solutions. Boundary-layer theory. Introduction to turbulence. Two- and three-dimensional examples, including free surface flows. Applications of field equations to problems of engineering significance. Prerequisite: CIVE 342 or equivalent.

CEWA 541 Hydrodynamics in Water Quality (3) W *Nece* Theoretical, field study, and laboratory model approaches to diffusion in problems of concern to water resources engineers. Offered jointly with O ENG 541. Prerequisite: CIVE 342 or permission of instructor.

CEWA 544 Coastal Hydraulics (3) Sp *Yeh* Theory of water waves. Classical water wave problem and approximate solution techniques. Evolution equations for wave systems, and their solutions. Stability analysis. Random waves analyzed by time series techniques. Offered jointly with O ENG 544. Prerequisite: familiarity with linear wave theory and FORTRAN.

CEWA 545 Advanced Computational Hydraulics (4) Sp *Chu* Review of hydrodynamic and transport equations for hydraulic engineering application; numerical solution methods; implementation and practice with existing two- and three-dimensional numerical models; numerical model calibration and verification techniques; case studies. Theoretical and civil engineering decision makers aspects. Prerequisites: 445, 540, 541 or permission of instructor.

CEWA 547 Advanced Hydrology (3) W *Burges* Detailed treatment of statistical methods used in hydrologic analysis. Stochastic hydrology, detailed examination and use of a deterministic watershed model (e.g., Stanford Watershed Model). Economic aspects of hydrologic design. Prerequisite: graduate standing in civil engineering or permission of instructor.

CEWA 550 Biological Waste Treatment (3) A *Ferguson, Stensel* Biological treatment processes and systems used in water-quality control. Biological and engineering considerations of wastewater treatment, including theory, purpose, evaluation, and design of secondary and tertiary processes. Prerequisite: CIVE 350 or equivalent or permission of instructor.

CEWA 551 Sanitary Engineering Unit Operations (3) W *Benjamin, Bogan, Ferguson* Major unit operations employed in water and waste treatment, including solids separations, filtration, chemical coagulation, ion exchange, and gas transfer and adsorption. Theory and basic principles. Development of mathematical models and evaluation of current design criteria and methods. Prerequisite: 456 or permission of instructor.

CEWA 552 Design of Water- and Waste-Treatment Processes (3) Sp *Bogan, Stensel* Selection and functional design of water- and waste-treatment processes to satisfy specific requirements. Comprehensive design of a specific process selected by the student, including process equipment selection, plant layout, site development, and cost studies. Introduction to the use of mathematical models, computer simulation techniques and systems analysis methods in the design of treatment processes. Prerequisite: 551.

CEWA 553 Topics in Ecological Effects of Wastewater (3) W *Welch* Application of ecological concepts for analysis and interpretation of bioenvironmental problems and data from inland and coastal waters. Students participate in presentation and discussion of current research on selected topics. Prerequisites: 434, 456, or permission of instructor.

CEWA 554 Advanced Topics in Environmental Engineering, Chemistry, and Biology (3) W *Benjamin, Ferguson, Spyridakis* Special topics of current importance in environmental engineering. Application of fundamental chemical and biological principles to the study of such phenomena as the behavior of aqueous colloids, corrosion processes, bacterial metabolism in chemically complex solutions, and acid precipitation. May be taken more than once for credit. Prerequisites: 550, 551.

CEWA 556 Industrial Waste Treatment (3) Sp *Benjamin, Ferguson, Stensel* Survey of laws and regulations governing industrial waste discharge. Sources, amounts, and characteristics of wastes from various industries. Specialized treatment processes, case studies, and site visits. Prerequisite: 550 or 551 or permission of instructor.

CEWA 557 Water Resources Management (3) W *Mar* Engineering, social, and economic factors involved in water resource development and management; water policies, programs, and administration; use relationships and conflicts; considerations for regional water resource systems.

CEWA 558 Water-Quality Management (3) Sp *Mar, Palmer* Engineering, social, and economic factors involved in water resource development and management; water policies, programs, and administration; conflict resolution; regional water resources system consideration. Recommended: 434, 447, 456, and CIVE 491.

CEWA 559 Water Resources System Management (3) A *Burges, Mar, Palmer* Application of advanced quantitative methods, including linear and dynamic programming, to the analysis and management of water resources. Quantitative analysis of water quantity and quality issues in specific settings. Prerequisites: 447, 557, CIVE 491; recommended: 558.

CEWA 560 Topics in Environmental Health (3) A *Larson* Introduction to human biology, including physiology, epidemiology, and toxicology. Study of contemporary environmental health problems and practices as they relate to radiological health, solid-waste disposal, food- and water-borne diseases, occupational health, biometeorology, and bioengineering.

CEWA 562 Industrial Sources of Air Pollution (3) W *Pilat* Study in depth of the major sources of air pollution, including analysis of flow diagrams, raw materials, off-streams, pollution-control facilities, and environmental impact. Field trips to representative plants; trip reports and term paper. Prerequisite: 461 or permission of instructor.

CEWA 563 Air Resources Management (3) Sp *Larson, Pilat* Technical, administrative, and legal aspects of air conservation. Current case studies involving engineering analysis, air quality modeling, and regulatory aspects at local, state, and federal governmental levels. Prerequisite: 458 or 461 or permission of instructor.

CEWA 564 Aerosol Science and Technology I (3) W *Charlson* Topics related to suspended particulate matter in a gaseous medium. Statistics, mechanics, and physical chemistry of aerosols. Particular reference to particulate matter in air, to experimental methods, Brownian movement, diffusion, coagulation, and light scattering. Prerequisite: permission of instructor.

CEWA 565 Aerosol Science and Technology II (3) Sp *Charlson* Sequel to 564; focusing on current research with regard to atmospheric aerosols. Prerequisite: permission of instructor.

CEWA 566 Control of Gaseous Air Pollutants (3) Sp *Larson, Pilat* Physical and chemical processes used to control gaseous air pollutants. Absorption into liquids. Aqueous spray dryer scrubbers. Adsorption beds. Control of sulfur oxide and nitrogen oxide. Case studies of control systems. Offered jointly with CH E 566. Prerequisite: 468 or CH E 435 or permission of instructor. (Offered even-numbered years.)

CEWA 567 Control of Particulate Air Pollutants (3) Sp *Pilat* Processes used to control emissions of particulate air pollutants. Use of settling chambers, cyclones, fabric filters, wet scrubbers, and electrostatic precipitators to control aerosol particles. Case studies of particulate air pollutant control systems. Offered jointly with CH E 567. Prerequisite: 468 or permission of instructor. (Offered odd-numbered years.)

CEWA 577 Risk Assessment for Environmental Health Hazards (3) A *Omenn* Context, methodologies, types of data, uncertainties and institutional arrangements for risk assessment. Both qualitative and quantitative approaches to the identification, characterization, and control of environmental hazards to health emphasized through didactic and case studies. Offered jointly with ENV S 577, ENVH 577, and PB AF 577. Prerequisites: ENV S 515, BIOST 511, EPI 511, or permission of instructor.

CEWA 599 Special Topics: Water and Air Resources (2-5, max. 15) AWSpS Prerequisites: permission of instructor and department Chairperson.

CEWA 600 Independent Study or Research (*) AWSpS

Electrical Engineering

211 Electrical Engineering

Electrical engineering is concerned with the utilization of electricity and the electric and magnetic properties of matter to provide society with useful, efficient, and economic products and services. The scope of activity ranges from the planning, design, implementation, and maintenance of large-scale processes, such as worldwide communication networks and regional power generation and distribution systems, to applied research in the development of microelectronic devices for signal processing in all branches of the physical and life sciences and engineering.

In the field of electrical engineering, where rapid technological innovation is the rule rather than the exception, preparation for a professional career requires a solid foundation in fundamental mathematical and physical principles, plus practice in the application of these principles to real problems. In addition, the important role of technology in contemporary society calls for significant emphasis on studies in the humanities and social sciences.

The department's undergraduate program provides the intellectual tools, analytical and laboratory skills, and humanistic-social studies for professional work. In addition, the program forms a basis for further professional development in graduate school through continuing education programs or through independent study. The core curriculum, which consists of required courses in the college and department, focuses on mathematical and physical principles and on techniques that have applications to real problems. Electives then offer the opportunity to obtain breadth and depth in such areas as electronic devices and circuits, power systems and energy conversion, electrophysics, computer engineering, communication systems, automatic control, and signal processing.

Undergraduate Program

Bachelor of Science in Electrical Engineering Degree

Due to the large demand for professional training in electrical engineering in the presence of limited space and resources, the Department of Electrical Engineering is unable to accept all qualified applicants for its undergraduate program. As a result, it requires a separate application for admission to the undergraduate program in electrical engineering. Deadlines for submitting such applications are the same as the closing dates that are given in the Academic Calendar at the front of this catalog for all new and former student applications. To be eligible for consideration for admission, a student must satisfy the following conditions: (1) have applied and be admissible to the University or already be a student in good standing; (2) have completed a minimum of 45 credits (i.e., sophomore standing) with a cumulative grade-point average of 2.50 or higher; (3) have successfully completed a year of college calculus (MATH 124, 125, and 126); a quarter of differential equations (MATH 238); two quarters of physics using calculus (PHYS 121, 122); a quarter of college chemistry (CHEM 140); and a quarter of logical system design (ENGR 190); and a quarter of computer programming (ENGR 141); with a cumulative grade-point average of 2.50 or higher.

In addition to the overall post-high school grade-point average and the minimum grade requirement in the courses mentioned above, the selection process considers the grade-point average in other technical courses taken. The above requirements are minimum, and meeting all of them does not guarantee admission to the program.

Copies of the Bachelor's Degree Planbook, which contains detailed curriculum requirements and suggestions for the design of an effective sequence of elective courses, are available in 213 Electrical Engineering or in the Engineering Advising Center.

In addition to the College of Engineering requirements, the department requires the following courses: a core of specified electrical engineering courses: E E 231, 310, 312, 333, 335, 344, 355, 356, 371, 372 and/or 374, 381, and 383 (44); electrical engineering electives (19), and approved electives—non-electrical engineering (8). To graduate, a student must earn a total of 186 credits with a minimum cumulative grade-point average of 2.00 in all electrical engineering courses taken with no grade below 1.0 in any of these courses. In addition, it is required that each student's program of study conform with the Accreditation Board for Engineering and Technology requirement of at least 46 credits in engineering science and 23 credits in engineering design.

The department policy on continuation is consistent with the continuation policy of the college. Details may be obtained from the department.

Many scholarships specifically for electrical engineering majors, based on merit and financial need, are awarded each year. Students interested in applying for these and other College of Engineering scholarships may obtain information from the Department of Electrical Engineering Scholarship Awards Committee chairperson.

Graduate Program

The Department of Electrical Engineering offers graduate programs leading to the degrees of Master of Science in Electrical Engineering or Doctor of Philosophy. For the M.S.E.E. degree, a minimum of 39 credits is required, of which 9 are for a research or engineering thesis project prepared under the supervision of a faculty member. The remaining 30 credits are course work, carefully chosen and approved by a faculty committee.

A student may wish to pursue an interdisciplinary program under the supervision of an electrical engineering adviser. If more flexibility is desired than the M.S.E.E. requirements allow, a student should consider the interdisciplinary degree of Master of Science in Engineering, which is described in the College of Engineering section.

For the Ph.D. degree, the student must pass the departmental qualifying examination, pass an advanced General Examination, pursue an original research problem, and report the results of that research in a dissertation that must be a contribution to knowledge. At least one year of course work beyond the M.S.E.E. degree is usually necessary. Foreign-language proficiency is not required.

Graduate courses and research programs are offered in control systems, electromagnetics, solid-state sensors, microelectronics, power electronics, telecommunications, computer engineering, computer architecture, software engineering, operating systems, energy systems, circuits and network theory, signal processing, optics, acoustics, radioscience, and biosystems. Opportunities also exist for research participation on medical instrumentation in the Bioengineering Program, and in marine acoustics and instrumentation systems at the Applied Physics Laboratory.

Research Facilities

Facilities in the Electrical Engineering Building include laboratories for solid-state materials, integrated circuits, microtechnology, optics, acoustics, microwave bioeffects, radioscience, computer technology, computer systems, digital electronics, electric machinery, bioelectronics, control systems, statistical data analysis, and several general-purpose research rooms.

Admission Qualifications

In addition to meeting the general Graduate School requirements, applicants for admission must take the Graduate Record Examination, both the aptitude test and the advanced test in engineering. Although most applicants have baccalaureate degrees in electrical engineering, applicants with degrees in other branches of engineering, the physical sciences, computer science, or mathematics often are able to pursue graduate study in electrical engineering after some additional preparation.

Financial Aid

Research assistantships, teaching assistantships, scholarships, and fellowships are available to qualified graduate students in all areas of electrical engineering. Nine graduate teaching scholarships and fellowship-loans are awarded to United States citizens intending to pursue a Doctor of Philosophy degree to be followed by a career in engineering education. The annual stipends for these awards with a teaching or research assistantship range from $15,000 to $18,000.

Correspondence and Information

Graduate Program Coordinator
Department of Electrical Engineering, FT-10

Faculty

Chairperson

James S. Meditch

Professors

Albrecht, Robert W.,* (Nuclear Engineering),† Ph.D., 1961, Michigan; stochastic and dynamic analysis of physical systems.

Andersen, Jonny,* Ph.D., 1965, Massachusetts Institute of Technology; circuits, systems, CAD-CAM.

Auth, David C.,* (Bioengineering), Ph.D., 1969, Georgetown; lasers and electro-optical system design electrophysics, medical instrumentation.

Baer, Jean-Loup,*‡ (Computer Science), Ph.D., 1968, California (Los Angeles); computer science.

Bergseth, F. Robert (Emeritus), S.M., 1938, Massachusetts Institute of Technology; electric power systems.

Bjorkstam, John L. (Emeritus), Ph.D., 1958, Washington; materials science, nondestructive radiation, magnetic resonance spectroscopy.

Cheung, Peter W., Ph.D., 1973, Washington; microelectronics; semiconductor materials and devices; microprocessor and microcomputer medical instrumentation systems; microcircuit design, processing, and fabrication; intelligent sensing systems; microsensors for clinical applications.

Clark, Robert N.,* Ph.D., 1969, Stanford; automatic control systems.

Dow, Daniel G.,* Ph.D., 1958, Stanford; microwaves, physical electronics, semiconductor devices.

Ehrenberg, John E.* (Research), Ph.D., 1973, Washington; communications, signal processing, marine acoustics.

Golde, Hellmut,* (Computer Science), Ph.D., 1959, Stanford; computer science, compilers and languages.

Guilford, Edward C. (Emeritus), Ph.D., 1959, California; electronics, computers.

Guy, Arthur W.,* (Bioengineering, Rehabilitation Medicine), Ph.D., 1966, Washington; biological effects and medical applications of electromagnetic fields.

Hill, W. Ryland (Emeritus), M.S.E.E., 1941, California (Berkeley); electrical engineering.

Hoard, George L. (Emeritus), M.S.E.E., 1926, Washington; electrical engineering.

Holden, Alistair D. C.,* (Computer Science), Ph.D., 1964, Washington; computer engineering, speech recognition, computer-aided design, artificial intelligence.

Hsu, Chih-Chi,* Ph.D., 1951, Ohio State; control systems and cybernetics.

Ishimaru, Akira,* (Applied Mathematics), Ph.D., 1958, Washington; electromagnetics, optics, acoustics, applied mathematics, scattering theory.

Johnson, David L.,* Ph.D., 1955, Purdue; digital design, artificial intelligence (models of learning systems).

Lauritzen, Peter O.,* Ph.D., 1961, Stanford; power electronics, electronic devices, instrumentation.

Lewis, Laurel, J. (Emeritus), Ph.D., 1947, Stanford; electrical engineering.

Lytle, Dean W.,* Ph.D., 1957, Stanford; communication and stochastic systems analysis, marine acoustics.

Meditch, James S.,* Ph.D., 1961, Purdue; computer networks, distributed processing, optimization theory.

Moritz, William E.,* (Computer Science), Ph.D., 1969, Stanford; computer engineering, microcomputer applications, biomedical instrumentation.

Noe, Jerre D.,*‡ (Computer Science), Ph.D., 1948, Stanford; operating systems, computer measurement and evaluation, distributed computer networks.

Noges, Endrik,* Ph.D., 1959, Northwestern; automatic control systems, nonlinear and discontinuous control.

Peden, Irene C.,* Ph.D., 1962, Stanford; applied electromagnetics, radio science.

Reynolds, Donald K. (Emeritus), Ph.D., 1948, Harvard; electronic system design, antenna engineering.

Rogers, Walter E. (Emeritus), M.S.E.E., 1948, Washington; electrical engineering.

Sigelmann, Rubens A.,* Ph.D., 1963, Washington; bioengineering, ultrasonics, propagation, acoustics.

Smith, George S. (Emeritus), E.E., 1924, Washington; electrical engineering.

Stear, Edwin B.,* Ph.D., 1961, California (Los Angeles); control, communications, and systems theory, manual control systems, biocybernetics, operations research.

Swarm, H. Myron (Emeritus), Ph.D., 1960, Stanford; electromagnetics, digital electronics.

Venkata, Subrahmanyam S.,* Ph.D., 1971, South Carolina; power energy systems, reliability, industry applications.

Yee, Sinclair S.,* Ph.D., 1965, California (Berkeley); physical electronics, semiconductor devices, biomedical instrumentation.

Zick, Gregory L.,* Ph.D., 1974, Michigan; computer engineering, biomedical instrumentation, real-time computers.

Associate Professors

Acker, William C. (Research), M.S.E.E., 1963, Washington; electronics, underwater acoustics, ocean instrumentation.

Afromowitz, Martin A., (Bioengineering), Ph.D., 1969, Columbia; bioengineering, integrated-circuit fabrication and microtechnology, solid-state sensors.

Alexandro, Frank J.,* Eng.Sc.D., 1964, New York; control systems, numerical methods.

Damborg, Mark J.,* Ph.D., 1969, Michigan; control systems theory, signal analysis, power system dynamics, power system computer applications.

Daniels, Patricia D.,* Ph.D., 1974, California (Berkeley); systems simulation, computer-aided design, biological systems analysis.

Helms, Ward J.,* Ph.D., 1968, Washington; analog and digital circuit design, integrated circuits, acoustics and audio, radio science.

Jackson, Darrell R.* (Research), Ph.D., 1966, Washington; Ph.D., 1977, California Institute of Technology; underwater acoustics.

Katz, Philip L. (Research), Ph.D., 1970; Michigan; underwater acoustics, modeling and control of dynamic systems, applications of optimization theory, information gathering for model components.

Marks, Robert J. II,* Ph.D., 1977, Texas Tech; optical information processing, image processing, statistical communication theory.

Pinter, Robert B.,* (Zoology), Ph.D., 1964, Northwestern; cybernetics, control systems.

Redeker, Charles C., M.S.M.E., 1964, Washington; computer programming languages.

Robbins, Floyd (Emeritus), E.E., 1949, Washington; electrical engineering.

Tanimoto, Steven L.,*‡ (Computer Science), Ph.D., 1975, Princeton; image analysis, artificial intelligence, computer graphics.

Tsang, Leung, Ph.D., 1976, Massachusetts Institute of Technology; electrophysics, electromagnetic waves.

Assistant Professors

Atlas, Les, Ph.D., 1983, Stanford; electronics.

Belcher, Edward O.* (Research), Ph.D., 1976, Washington; communication systems, digital signal processing, automatic control.

El-Sharkawi, Mohamed A.,* Ph.D., 1980, British Columbia; large-scale power system dynamic analysis and control, electric drives.

Kim, Yongmin,* Ph.D., 1982, Wisconsin; electronics, computer engineering, biomedical engineering.

Kuga, Yasuo (Research), Ph.D., 1983, Washington; short light propagation.

Liu, Chen-Ching, Ph.D., 1983, California; power systems, transient stability.

Soma, Mani,* Ph.D., 1980, Stanford; integrated circuits, bioelectronics.

Swaszek, Peter F.,* Ph.D., 1982, Princeton; communication theory, systems theory, statistics, signal detection.

Lecturer

Potter, William W., M.S., 1959, Monterey; electronics.

Course Descriptions

Courses for Undergraduates

E E 231 Introduction to Electrical Circuits and Systems (4) AWSp Basic principles of modern circuits and systems theory in circuit analysis. Resistors, sources, and simple circuits, resistance networks; capacitors and inductors, first-order circuits; second- and higher-order circuits; solutions of linear differential equations representing equilibrium equations of networks by time-domain techniques. Prerequisites: MATH 238, which may be taken concurrently, and PHYS 122.

E E 299 Special Topics in Electrical Engineering (1-5) AWSpS New and experimental approaches to basic electrical engineering. May include design and construction projects. Prerequisite: permission of department Chairperson.

E E 306 Elements of Electrical Engineering (3-5) AWSp Introductory course for non-electrical engineering majors covering circuit analysis, electronic devices, and rotating machinery. 3-credit portion covers circuit analysis and electronics. 4th credit contains three laboratories to introduce electronic instrumentation and device operation. 5th credit covers machinery with additional laboratory. Prerequisites: PHYS 122, MATH 126.

E E 310 Electronics Laboratory I (3) AWSp Fundamentals of laboratory practices; fundamentals of instrumentation; switches, elementary gates, and flip-flops; elementary amplifiers, input and output impedances; use of integrated circuits and devices to typical applications, such as regulated power supplies, multipliers, operational amplifiers, and oscillators. Prerequisites: 231; and 333, 355, which may be taken concurrently.

E E 312 Electrophysics Laboratory (2) AWSp One three-hour laboratory period each week; experiments on solid-state devices, properties of materials, generation and guiding of electromagnetic waves. Prerequisites: 310, 381, 383, which may be taken concurrently.

E E 333 Circuits and Systems II (4) AWSp Continuation of 231. System functions, complex frequency, and pole-zero properties. The sinusoidal steady-state. Energy and power. Frequency response of systems. One-sided Laplace transforms, inverse Laplace transform. Response via the Laplace transform system transfer function. Prerequisites: 231, MATH 238.

E E 335 Linear Systems Analysis I (4) AWSp Analysis of linear systems in continuous and discrete time. Differential equation and discrete time difference equation models of linear systems. Z-transform, convolution methods. Continuous and discrete time steady-state response to periodic inputs. The impulse response and convolution representation of linear systems in continuous and discrete time. Fourier series and Fourier transforms. Introduction to spectral concepts and the sampling theorem. Prerequisite: 333.

E E 344 Introduction to Electric Energy Devices and Systems (5) AWSp Introduction to theory and methods of analysis in the use of typical apparatus to generate, transmit, and utilize energy in electrical form. Includes conventions of circuit description, balanced polyphase circuits, complex power concept, transformer, transmission lines, per-unit system, fundamentals of electromechanical energy conversion and practical synchronous, induction, and commutator machines. Prerequisite: 333.

E E 355 Electronics I: Introduction to Digital and Analog Electronics (4) AWSp Characteristics of p-n junctions, MOS and bipolar transistors, analysis and design of simple logic gates, fundamentals of integrated circuits layout. Prerequisites: 231; and 310, 333, which may be taken concurrently, ENGR 190.

E E 356 Electronics II: Analog Integrated Circuits (4) AWSp Analog integrated circuit technology, input stages, bipolar and FET, current sources, output stages, frequency response, feedback fundamentals and stability analysis, applications. Includes weekly laboratory. Prerequisites: 333, 355; recommended: 310.

E E 371 Fundamentals of Computer Operation and Organization (3) AWSp Organization and operation of digital computers. Representation of information, instruction formats, addressing, flow of control, processor and system components, machine operation, and data transfers. Digital computer studied at various levels (microprogramming, machine, and system). Prerequisites: ENGR 141, 190.

E E 372 Introduction to Microprocessors (3) AWSp Utilizing microprocessors, digital computer studied at assembly language level with emphasis on concepts of central processor architecture, memory organization, input/output, and interrupts. Assembly language programming concepts applied to solution of various laboratory problems. Prerequisites: 371; ENGR 141 or C SCI 241 and ENGR 190.

E E 374 Data Structures (3) AWSp Fundamental algorithms and data structures for their implementation. Techniques for solving problems by programming. Sorting, searching, linked lists, binary search trees, balanced trees, hashing. Prerequisites: 371; ENGR 141 or C SCI 241 or equivalent knowledge of programming.

E E 381 Electrophysics I (4) AWSp Electromagnetic waves in linear media; some effects of boundaries; transmission lines; electrostatic and magnetostatic fields. Prerequisites: PHYS 123, MATH 238; recommended: MATH 327.

E E 383 Semiconductor Materials and Devices (4) AWSp Introduction to the basic electronic properties of semiconductor materials and devices. Energy bands, dynamics of electrons and holes, equilibrium statistics, carrier mobility and recombination. Electrostatics of p-n junction FETs, capacitors, and MOSFETS. I-V characteristics of p-n junctions and bipolar transistors. Prerequisites: 231, PHYS 123 and admission to Electrical Engineering.

E E 399 Special Topics in Electrical Engineering (1-5) AWSpS New and experimental approaches to current electrical engineering problems. May include design and construction projects. Prerequisite: permission of department.

E E 401 Introduction to Compilers Construction (3) W Fundamentals of compilers and interpreters. Symbol tables, lexical analysis, syntax analysis, semantic analysis, code generation, and optimization for general-purpose programming languages. Offered jointly with C SCI 401. Prerequisites: 371, 374.

E E 411 Introductory Network Synthesis (3) A Network representations in the complex frequency domain, realizability criteria for driving-point and transfer functions, canonical forms, and application of the digital computer in synthesis procedures. Prerequisites: 333 and senior standing.

E E 415 Computer-Aided System Analysis (3) Sp *Daniels* Concepts, principles, and techniques concerned with the design, testing, and application of general-purpose problem-oriented computer programs for analyzing large-scale systems. Prerequisites: ENGR 141 and senior standing.

E E 417, 418 Introductory Communication Theory I, II (4,3) W,Sp Techniques of analog and digital communications. Elementary concepts of probability, random variables, and processes. Signals, spectra, random signals, and noise. Base-band communication by digital and analog methods. Modulation techniques including AM, FM, PM, PAM, PCM, etc. Information theory, channel capacity, and error-control coding. Prerequisites: 335 and STAT 390 or permission of instructor.

E E 421 Electroacoustics (4) A Fundamentals of acoustics and the electroacoustical aspects of electromechanical systems. Characteristics of transducers. Includes laboratory to be arranged. Prerequisite: 383 or permission of department.

E E 433 Electronic Circuit Design (4) AWSp Electronic circuit design using modern electronic devices. Topics include application of integrated-circuit amplifiers and multipliers, design of solid-state amplifiers for low noise, wide bandwidth, high frequency, high power output, and the application of modulation theory to modern systems. The design aspect of solid-state electronic circuitry is emphasized. Prerequisite: 356.

E E 436 Medical Instrumentation (4) Sp *Spelman* Introductory course in the application of instrumentation to medicine. Topics include transducers, signal-conditioning amplifiers, electrodes and electrochemistry, ultrasound systems, electrical safety, and the design of clinical electronics. Laboratory included. Offered jointly with BIOEN 436. For upper-division and first-year graduate students who are preparing for careers in bioengineering—both research and industrial. Prerequisite: 433 or permission of department.

E E 440 Linear Systems Analysis II (4) A Development of advanced Fourier methods, concentration on applications to engineering problems. Analog and digital filters; applications of discrete Fourier transform, including aliasing, short data sets, average transforms, system identification; orthogonal functions for boundary-value problems, two-dimensional Fourier transforms with application to image processing and aperture antennas. Prerequisite: 335.

E E 442 Digital Signals and Filtering (3) W Methods and techniques for digital signal processing. Review of sampling theorems, A/D and D/A converters. Demodulation by quadrature sampling. Z-transform methods, system functions, linear shift-invariant systems, difference equations. Signal flow graphs for digital networks, canonical forms. Design of digital filters, practical considerations, IIR and FIR filters. Digital Fourier transforms and FFT techniques. Prerequisite: 335 or permission of department.

E E 445 Nonlinear Systems Analysis (4) A Dynamic analysis of nonlinear circuits and of other simple systems. Exact methods, graphical methods, approximate methods, including linearization and numerical and analog computer solutions. Stability. Forced vibrations. Prerequisite: 333 or permission of department.

E E 446 Control System Analysis I (4) AWSp Linear servomechanism theory and design principles. Pole-zero analysis, stability of feedback systems by root-locus and real-frequency response methods. Design methods of Bode and Nichols. Introduction to advanced topics in automatic control theory. Prerequisite: 335 or permission of department.

E E 447 Control System Analysis II (3) Sp State-space formulation of multivariable feedback control system problems. Dynamic performance, including stability evaluation, by vector-matrix methods. Application of discrete time methods of feedback control problems. Introduction to nonlinear feedback system analysis including state-space methods, Lyapunov stability theory, and describing functions. Prerequisite: 446 or permission of department.

E E 453 Electric Drives (5) A Elements of drive systems, speed-torque characteristics of electric motors and industrial loads. Starting and braking methods of loaded motors. Speed control of electric motors. Solid-state drives. Transient analysis of loaded motors. Special forms of individual- and multi-motor drives. Prerequisite: 344.

E E 454 Power System Analysis I (4) A Introduction to methods of analyzing power systems. Symmetrical components, calculations of line parameters, representation of transmission lines and power system components, and power flow control. Prerequisite: 344.

E E 455 Power System Analysis II (4) W Analysis of symmetrical and unsymmetrical power systems' networks, fault analysis, and stability studies. Prerequisite: 344 or permission of department.

E E 456 Power System Analysis III (4) Sp Static and dynamic analysis of large power networks. Load flow, optimal generation allocation, state estimation, transient stability, and automatic generation control. Experience in analyzing and designing power systems using modern computer algorithms. Prerequisite: 455 or permission of department.

E E 457 Electric Energy Distribution Systems (4) W Introduction to electric utility distribution systems. Primary and secondary network analysis and design, distribution substation problems, distribution transformers, capacitor application, overcurrent and overvoltage protection. System planning and reliability. Prerequisite: 344 or permission; background in system analysis desirable.

E E 461 Electrochemistry (3) Sp Fundamentals of electrochemistry with applications to batteries and industrial processes. Emphasis is on obtaining a basic working knowledge in the field. Offered jointly with CH E 461. Prerequisite: senior standing in engineering or permission of department Chairperson.

E E 467 Introduction to Radio Science (3) W Radiation and radio science; antenna fundamentals and applications; receivers and radiometry; wave propagation and earth's environments; remote sensing and geophysical exploration. Prerequisites: 335, 381.

E E 468 Applied Optics (4) W Fundamentals of optical image formation, data processing, holography, interferometry, laser principles, optical detection, material interactions, scattering, and fiber optics. Prerequisite: 381.

E E 469 Transmission Lines and Wave Propagation (4) A Guided waves on two-conductor transmission lines: steady-state and transient considerations; lossy transmission lines. Oblique incidence of electromagnetic waves on boundaries; reflection and refraction. Mode structures of guided waves in hollow conductors and dielectrical rods; surface-wave propagation on coated conductors and dielectrics. Wave propagation in material media of practical importance. Emphasis on problem-solving approaches in electromagnetics; applications to radio science, microwaves, optics, and bioengineering. Prerequisite: 381.

E E 471 Computer Architecture and Structure (3) AW Major elements of modern computational systems: processors, control units, and methods, including micro programming, main memory usage, and organization, and system I/O and interconnection. Prerequisites: 371, 372.

E E 473 Wave Shaping (4) WSp Generation and transmission of special waveforms, including pulses, square waves, and linear ramps; clipping, clamping, and DC restoration; astable, monostable, and bistable multivibrators; applications to analog and digital systems. Includes one four-hour laboratory on alternate weeks. Prerequisite: 356.

E E 474 Fundamentals of Operating Systems (5) AW Introduction to operating systems: Hardware/software interface, process management, primary and secondary, storage management, processor management, performance, networks, and case studies of current operating systems. Prerequisites: 371, 374.

E E 475 Digital Electronics and Microprocessors (4) AWSp Hardware-oriented course concerned with synthesis of digital systems, integrated circuit logic, digital code conversion, and analog to digital conversion. Emphasis on microprocessor hardware, MPU operation, addressing modes, data loaders and storage, memories, and interface operation and equipment. One four-hour laboratory on alternate weeks. Prerequisite: 371, 372.

E E 476 Computer-Aided Design of Digital Systems (3) WSp An elementary knowledge of combinational logic and sequential machines is assumed. More advanced topics in the above subjects are covered. APL is used as a digital design and simulation language to represent and assist in the design of arithmetic functions, machine control, storage, and communication between system components. Prerequisite: 371.

E E 477 Digital Computer Applications (4) ASp Advanced topics in numerical analysis and their application to the solution of engineering problems using digital computers. Includes general numerical methods for solving nth order nonlinear differential equations; least squares approximation; Chebyshev approximation; fast Fourier transform and application to digital signal processing. Prerequisite: FORTRAN or permission of department.

E E 478 Design of Computer Subsystems (4) AW Design of digital computer subsystems and systems, using SSI, MSI, and LSI digital components. Combinational logic, sequential logic, ALU and control-unit designs, memory hardware design, I/O hardware and interface designs, data-acquisition system design, and digital troubleshooting. One three-hour laboratory each week. Prerequisites: 355, 371, 372, and permission of department.

E E 479 Microcomputer System Design (5) WSp *Moritz* Intensive course covering microprocessor architecture and operation, assembly language instructions and programming, system design criteria and techniques for integrating hardware and software into actual systems. Principal emphasis on system design and documentation. Weekly laboratory and a design project included. Prerequisites: 371, 372, and permission of department; highly recommended: 478, which may be taken concurrently.

E E 481 Microwave Electronics (4) A *Dow* Microwave circuits. Smith charts. S-parameter analysis. Waveguides and resonators. Measurement techniques. Microwave integrated circuits. Design of microwave amplifiers and other functional elements. Microwave system concepts. Three hours of laboratory per week. Prerequisites: 335, 381.

E E 485 Semiconductor Devices (4) ASp Physics of p-n junctions and semiconductor surfaces; operating principles of various semiconductor devices. Development of small-signal and switching circuit models. Includes junction transistors, controlled rectifiers, field effect transistors, microwave and integrated circuit devices. Prerequisite: 383 or equivalent.

E E 486 Fundamentals of Integrated Circuit Technology (3) W *Afromowitz* Processing physics, chemistry, and technology, including evaporation, sputtering, epitaxial growth, diffusion, ion implantation, laser annealing, oxidation, chemical vapor deposition, photoresists. Design considerations for bipolar and MOS devices. material and process characterization. Future trends. Prerequisite: 485 or permission of department.

E E 488 Laser Systems and Devices (4) Sp Elementary theory of the interaction of high-frequency and optical radiation with atomic and molecular systems. Practical design technology of gase-

ous and solid-state stimulated emission devices. Laser system materials and components. Use of lasers for communications, recording, and engineering measurement. Prerequisite: 383 or permission of department.

E E 498 Control System Components and Measurements (3) Sp Study of control system components and formulation of their mathematical models. Amplifiers, servomotors, synchros, gyroscopes, and fluid-power devices. Experimental determination of dynamic parameters, and behavior of closed-loop systems. Two three-hour laboratories per week. Prerequisite: 446 or permission of department.

E E 499 Special Projects (2-5, max. 10) AWSpS Assigned construction or design projects carried out under the supervision of the instructor. Prerequisite: permission of department Chairperson.

Courses for Graduates Only

E E 503 Real-Time Computer System Design (3) W *Zick* Engineering aspects of the development of real-time computer systems. Investigates the use and implementation of real-time computers in practical applications. Topics include system architecture, system software, internetwork and intersystem communications, man-machine interaction and system debugging. Emphasis in three areas: the structured approach to design of the overall system, defensive interfacing to ensure reliability and maintainability, and communication standards and protocols including IEEE-488, CAMAC, and SDLC. Prerequisites: 371 and 474 or 479, or permission of department Chairperson.

E E 505 Introduction to Probability and Random Processes (4) A *Lytle, Swaszek* Foundations for the engineering analysis of random processes: set theoretic fundamentals, basic axioms of probability models, conditional probabilities and independence, discrete and continuous random variables, multiple random variable, sequence of random variables, limit theorems, models of stochastic processes, noise, stationarity and ergodicity, Gaussian processes, power spectral densities. Prerequisite: graduate standing.

E E 506, 507 Communication Theory I, II (3,3) W,Sp *Lytle, Swaszek* Review of stochastic processes. Communication system models. Channel noise and capacity. Optimum detection, modulation and coding, convolutional coders and decoders. Typical channels, random and fading channels. Waveform communication, optimum filters. Prerequisite: 505 or equivalent.

E E 508 Stochastic Processes (3) W *Lytle, Swaszek* Modeling and analysis of random processes encountered in engineering applications. Stationarity and ergodicity. Harmonic analysis, power spectral densities. Karhunen-Loeve expansions. Poisson, Gaussian, and Markov processes. Stochastic integrals and differential equations. Prerequisite: 505 or permission of department Chairperson.

E E 509 Engineering Applications of Linear Graphs (3) W *Andersen* Elementary theory of linear graphs, incidence, cut-set and circuit matrices, matrix formulation of loop, node, and state equations, topological analysis and synthesis of networks, signal flow graphs, applications to switching circuits, automata and communication nets. Prerequisite: graduate standing or permission of department Chairperson.

E E 510 Mathematical Foundations of System Theory (4) A *Damborg, Lytle* Mathematical foundations for system theory are presented from an engineering viewpoint. Topics include set theory, functions and inverse functions, metric spaces, finite dimensional linear spaces, linear operators on finite dimensional spaces. Applications to engineering systems are stressed. Prerequisite: graduate standing or permission of department Chairperson.

E E 511 Principles of Network Synthesis (3) W Network representation in the complex frequency domain, realizability criteria, synthesis of driving point and transfer impedance and coupling networks for prescribed transfer characteristics, canonical forms, and network equivalents, frequency and time domain aspects of approximating response functions. Prerequisite: 411 or permission of department Chairperson.

E E 513 Active Circuit Theory (3) Sp *Andersen* Principles of analysis and synthesis of linear active circuits. Emphasis on general principles, including conservation theorems, invariants, performance limitations in the presence of parasitic elements and realizability conditions. Illustrative applications related to negative resistance amplifiers, feedback amplifiers, and active filters. Prerequisite: 335 or permission of department Chairperson.

E E 517 Introduction to System Optimization (3) W *Hsu* Systems engineering and optimization; classical optimization techniques; equality constraints and inequality constraints; Kuhn-Tucker conditions; linear inequalities and linear programming; nonlinear optimization and programming; Fibonacci, Golden-section, and min-max search; gradient search; method of Davidson, Fletcher, and Powell; method of conjugate gradients; elements of quadratic and geometric programming; applications to engineering systems. Prerequisite: 510 or permission of department Chairperson.

E E 518 Digital Signal Processing (4) Sp Digital representation of analog signals. Frequency domain and Z-transforms of digital signals and systems. Design of digital systems; IIR and FIR filter design techniques, fast Fourier transform algorithms. Sources of error in digital systems. Analysis of noise in digital systems. Offered jointly with C SCI 518. Prerequisites: knowledge of Fourier analysis techniques and graduate standing, or permission of department Chairperson.

E E 519 Stochastic Analysis of Data From Physical Systems (4) W *Albrecht* Computer systems for acquisition and processing of stochastic signals. Calculation of typical descriptors of such random processes as correlation functions, spectral densities, probability densities. Interpretation of statistical measurements made on a variety of physical systems (e.g., electrical, mechanical, acoustic, nuclear). Lecture plus laboratory. Prerequisite: 505 or equivalent.

E E 520 Spectral Analysis of Time Series (4) A Estimation of spectral densities for single and multiple time series. Basic theory for nonparametric estimation of spectral density, cross-spectral density and coherency for stationary time series, real and complex spectrum techniques. Bispectrum. Digital filtering techniques. Aliasing, prewhitening. Choice of lag windows and data windows. Use of the fast Fourier transform in spectral estimation and computation of correlation functions. The parametric autoregressive spectral density estimate for single and multiple stationary time series. Spectral analysis of nonstationary random processes, and for randomly sampled processes. Techniques of robust spectral analysis. Offered jointly with STAT 520. Prerequisite: 411 or STAT 342, 390, or permission of instructor.

E E 525 Acoustics in Engineering I (3) W *Chalupnik, Ishimaru, Merchant, Sigelmann* Acoustic wave transmission, reflection, refraction, and diffraction in solids, liquids, and gases. Includes review of continuum mechanics and examples from electromechanical systems. Offered jointly with M E 525. Prerequisite: graduate standing in electrical or mechanical engineering or permission of department Chairperson.

E E 526 Acoustics in Engineering II (3) Sp *Auth, Chalupnik, Merchant, Sigelmann* Continuation of 525. Material differs each year, covering such topics as scattering, moving media, ultrasonics, acoustic holography, optoacoustics, transducer propagation in anisotropic medium, etc. Offered jointly with M E 526. Prerequisite: 525 or permission of department Chairperson.

E E 529 Optical Electronics (4) A *Auth* Radiation coupling to microsystems. Theory of laser oscillation. Design and characterization of laser sources. Tensor formulation of optical constants. Nonlinear optics and parametric amplifiers. Electrooptic and acoustooptic modulation. Photodetectors. Modern applications. Prerequisite: 383 or equivalent.

E E 530 Electromagnetic Properties of Materials (4) Sp *Auth, Bjorkstam, Yee* Quantum theory; semiclassical theory of incoherent and coherent interaction between EM radiation and matter, including spontaneous (noise) and stimulated (lasing) emission, superradiance, photon-echoes, parametric oscillation and amplification; quantum concepts in coherence and detection (photon counting). Prerequisites: 383 and some introductory quantum mechanics or permission of instructor.

E E 533 Advanced Semiconductor Devices (3) W Analysis of selected devices with heavy emphasis on extreme operating conditions of bias, temperature, and frequency; includes p-n junctions. Schottky barriers, microwave devices; recent developments from the current literature. Prerequisite: 485 or permission of department Chairperson. (Offered odd-numbered years.)

E E 534 Power Electronics (4) A *Lauritzen* Application of power semiconductor switches to energy conversion and control circuits, including switchmode dc power supplies, ac/dc converters, dc/ac inverters, and frequency changers. Related transformer and inductor design, semiconductor device protection, computer-aided circuit simulation and integrated circuit controllers are included. Prerequisites: 344, 356, or permission.

E E 535 Digital Integrated Circuits (3) Sp *Soma* Analysis and design of digital integrated circuits. Emphasis on MOS and bipolar LSI technology and devices including static and dynamic MOS and I^2L bipolar logic. Circuits include basic logic elements, shift registers, memories, microprocessors, and programmed logic arrays. Prerequisite: 485 or permission of department Chairperson.

E E 537 Electronic Amplification Devices and Applications (3) W *Helms* Present state-of-the-art linear amplification devices and circuits are reviewed and foreseeable future developments anticipated, with the objective of providing a timely introduction to analog circuit design at the graduate level. Focus is on both the internal design and operation of integrated devices to prompt understanding of limitations, and the application of standardized modules to electronic systems design. Prerequisite: graduate standing or permission of department Chairperson.

E E 538 Topics in Electronic Circuit Design (1-5) AW *Atlas, Guilford, Helms, Lauritzen, Reynolds, Soma* Topics of current interest in electronic circuit and system design. Course content varies from year to year, based on current professional interests of the faculty member in charge. May be repeated for credit by permission. Prerequisite: permission of department Chairperson.

E E 539 Advanced Topics in Solid-State Electronics (1-5, max. 5) AWSp *Auth, Bjorkstam, Yee* Lectures or discussions of topics of current interest in the field of solid-state electronics for advanced graduate students having adequate preparation in solid-state theory. Subject matter may vary according to the interests of students and faculty. Prerequisite: permission of department Chairperson.

E E 546 Advanced Topics in Control System Theory (1-5) AWSp Topics of current interest in control system theory for advanced graduate students with adequate preparation in linear and nonlinear system theory. Prerequisite: permission of department Chairperson. (Offered when adequate enrollment develops prior to close of advance registration.)

E E 547 Neural Communication and Control in Biological Systems (3) W Neural processing of the visual image and communication between levels of the central nervous system. Feedback and its role in movement by organisms. Description and analysis of the means by which electrochemical events generate, modulate, and demodulate neuronal signals, and the parallel interaction between these signals in transduction of images and other information. Prerequisite: advanced graduate standing or permission of instructor.

E E 548 Applied Optimal Control and Estimation I (3) W Review of calculus of variations, definition of the dynamic optimization problem, constraints and Lagrange multipliers, the Pontryagin minimum principle, necessary conditions for optimality, extremal fields and sufficiency conditions, the Hamilton-Jacobi equation, singular arc problems, transformation techniques for singular arc problems. Offered jointly with A A 548. Prerequisite: 584 or equivalent or permission of department Chairperson.

E E 549 Applied Optimal Control and Estimation II (3) Sp Review of continuous random processes, definition of the LQ optimal control/estimation problem for continuous systems in the presence of noise, the certainty-equivalence principle, duality of regulator/follower-filter/smoother problems, necessary conditions for optimality synthesis of steady-state regulators and filters using eigenvector decomposition techniques, relationship to classical control techniques. Offered jointly with A A 549. Prerequisites: 548 or A A 548, 505 or equivalent or permission of department Chairperson.

E E 550 Applied Optimal Control and Estimation III (3) A Review of discrete random processes, definition of the discrete LQ optimal control/estimation problem, factorization methods for discrete filters, Luenberger observers, reduced order filters, suboptimal filters. Offered jointly with A A 550. Prerequisite: 549 or A A 549 or permission of department Chairperson.

E E 551 Power System Protection (4) The protection of electric power systems from overcurrents and overvoltages. Overcurrents resulting from faults, lightning induced or otherwise, or from excessive loads or power swings. Overvoltages resulting from switching transients or lightning. Principal concern is with relays and lightning arrestors as protection means. Prerequisite: 455 or equivalent.

E E 552 Power Systems Dynamics and Control (4) Sp *El-Sharkawi* Advanced computer modeling and analysis of power systems and application of modern systems and control theories to power systems. Prerequisites: 344 and 455 or permission of instructor. (Offered alternate years.)

E E 559 Special Topics in Electrical Energy Systems (1-5) AWSpS *Damborg, El-Sharkawi, Liu, Venkata* Topics of current interest in electrical power and energy devices and systems. Content varies from year to year, based on current professional interests of faculty member in charge. May be repeated for credit by permission. Prerequisite: permission of instructor.

E E 565 Computer-Communication Networks (3) Sp *Medlitch* Principles of terrestrial, satellite, ground-radio, and local area data-communication networks. Network concepts and technology; queuing theory, network modeling, performance analysis, design, and optimization methods; multiaccess techniques; protocols and distributed algorithms for network control. Study of some existing networks; discussion of research topics. Prerequisite: 505 or permission of instructor.

E E 570 Antenna Engineering (3) A *Peden* Theory of radiation; impedance characteristics and radiation patterns of thin linear antenna elements; antenna arrays; pattern synthesis; aperture antennas. Prerequisite: graduate standing or permission of department Chairperson.

E E 572 Electromagnetic Theory and Applications I (4) A *Ishimaru, Sigelmann, Tsang* Electromagnetic waves in layered medium; complex waves, leaky and slow waves, waves in periodic structures, optical fibers, ionosphere and other guiding structures; transients and dispersive medium; waveguides and cavities; eigenfunctions and eigenvalues. Prerequisite: graduate standing or permission of department Chairperson.

E E 573 Electromagnetic Theory and Applications II (4) W *Ishimaru, Sigelmann* Scattering and absorption of electromagnetic waves, Rayleigh scattering, Born approximations, Green's functions, integral equations, numerical techniques and moment method, high-frequency and low-frequency approximations, saddle point method, and variational principle. Prerequisite: 572 or permission of department Chairperson.

E E 574 Electromagnetic Theory and Applications III (4) Sp *Ishimaru, Sigelmann, Tsang* Geometric theory of diffraction, wave fluctuations, antenna noise temperature, data-processing antennas, remote-sensing techniques and tomography applications, diffraction and scattering, discontinuities. Prerequisite: 573 or permission of department Chairperson.

E E 575 Waves in Random Media (4) A *Ishimaru, Strelmann, Tsang* Propagation and scattering of electromagnetic, optical, and acoustic waves in turbulence and random media, and scattering from rough surfaces and randomly distributed particles. Examples include atmospheric turbulence, fog, rain, smog, clear-air turbulence detection, scattering from blood cells and tissues, and scattering by ocean waves. Applications to atmospheric sciences, bioengineering, and ocean engineering. Prerequisite: graduate standing or permission of department Chairperson.

E E 583 Nonlinear Control Systems (4) Sp *Noges* Dynamic analysis of nonlinear control systems. Analytical, graphical, numerical, and simulation techniques for solving nonlinear control system problems. Lyapunov functions, phase space and describing functions. Introduction to contraction mapping methods. Prerequisite: 584.

E E 584 Continuous and Discrete State Variable Methods (3) AW *Alexandro, Clark, Hsu* Dynamic control systems using state variable methods. Review of vector space concepts, state variable selection in physical systems, coordinate transformation, canonical forms, state transition matrix for continuous time and discrete time systems, controllability and observability, full-state feedback, observers. Prerequisite: graduate standing or permission of instructor. Recommended: MATH 303.

E E 585 Digital and Sampled-Data Systems (3) Sp *Alexandro, Hsu* Sampling process and data holds, state variables and state transition equations for sampled-data systems, frequency domain and time domain analysis of sampled-data systems, stability of sampled-data systems, digital compensation of sampled-data systems. Prerequisite: 584.

E E 586 Advanced Computer Applications I (3) A *Holden* Basic analytical methods related to man-machine communication by voice and vision. State-of-the-art review of speech and image understanding systems. Each student does a self-chosen project. Prerequisite: graduate standing or permission of department Chairperson.

E E 587 Advanced Computer Applications II (3) W *Johnson* Lecture/seminar examining classic and contemporary papers. State-of-the-art approaches to such subjects as fault-tolerant computation, optimization, adaptive or learning models, heuristic problem solving, system reduction. Prerequisite: 586 or equivalent experience.

E E 588 Advanced Logical Design of Digital Computers I (3) Sp *Johnson* Advanced concepts of combinational circuit design, multiple output logics, logical completeness, classes of combinational functions. Advanced concepts of sequential machines, limitations, reduction, state assignment. ROMs and array logics. Bubble memories and logics. Universal logic modules, cellular logics. Prerequisite: 476 or equivalent.

E E 590 Advanced Topics in Digital Computers (2-5, max. 15) AWSp *Golde, Holden, Johnson, Kim, Zick* Lectures or discussions of topics of current interest in the field of digital computers. Subject matter may vary from year to year. Prerequisite: permission of department Chairperson.

E E 595 Advanced Topics in Communication Theory (1-5) AWSp *Lytle, Marks, Swaszek* Extension of 507, 508, 518, 519, 520. Material differs each year, covering such topics as: detection theory, decision theory, game theory, adaptive communication systems, nonlinear random processes, etc. May be repeated for credit by permission. Prerequisite: permission of department Chairperson.

E E 599 Selected Topics in Electrical Engineering (*) AWSpS Prerequisite: permission of department Chairperson.

E E 600 Independent Study or Research (*) AWSpS

E E 700 Master's Thesis (*) AWSpS

E E 800 Doctoral Dissertation (*) AWSpS

Industrial Engineering

143 Mechanical Engineering

The industrial engineering program is administered through the Department of Mechanical Engineering, and faculty members responsible for the program hold appointments in that department.

Industrial engineering concerns the best use of people, materials, equipment, and energy to achieve the aims of manufacturing and other organizations. The industrial engineer is engaged in management systems design and in collecting, analyzing, and arranging factual information that is economically useful to management.

Typical activities of industrial engineers include selecting operating processes and methods; developing work performance measures and standards; selecting proper tools, machines, and equipment; designing facilities and layout of buildings; designing control systems for financial planning and cost systems; and devising ways to improve productivity and worker morale.

Undergraduate Program

Bachelor of Science in Industrial Engineering Degree

ENGR 141, 210, 230, 260, and 123 are engineering college program requirements for the B.S.I.E. degree. ENGR 170 is strongly recommended. Satisfaction of the minimum professional engineering requirements results from completion of the listed courses plus 9 credits of approved electives. A total of 180 applicable credits is required for graduation, with a grade-point average of at least 2.00 in all engineering courses in the program, which, as well as approved electives, may *not* be taken on a satisfactory/not satisfactory basis.

Sources of Information

All inquiries concerning the industrial engineering program should be addressed to the industrial engineering adviser in care of the Department of Mechanical Engineering.

Materials Science and Engineering

318 Roberts

Materials science and engineering is an interdisciplinary field that addresses the scientific fundamentals of materials, their processing, and their engineering design for technological applications. Basic principles of chemistry and physics are applied to provide an understanding of the structure of materials and the manner in which the structure determines the properties. Scientific processing is then applied to yield the necessary properties, which then can be integrated with, and designed to accommodate, the needs of modern technology.

Faculty

Chairperson

Richard C. Bradt

Professors

Anderson, Donald I. (Emeritus), B.Sc.Min.E., 1941, Illinois; mining engineering.

Archbold, Thomas F.,* Ph.D., 1961, Purdue; physical metallurgy, diffusion in solids, electron microscopy, diffraction, oxidation.

Bradt, Richard C.,* Ph.D., 1967, Rensselaer Polytechnic Institute; thermal and mechanical properties of ceramics, glasses, and refractories.

Fischbach, David B.* (Research), Ph.D., 1955, Yale; ceramic materials science (especially the structure of properties of carbon materials), general physical ceramics and metallurgy.

Mueller, James I.,* Ph.D., 1949, Missouri; high-temperature chemistry, crystal structures.

Polonis, Douglas, H.,* Ph.D., 1955, British Columbia; physical metallurgy, phase transformations in solids, mechanical properties of materials, structure and properties of alloys.

Rao, Y. Krishna,* Ph.D., 1965, Pennsylvania; chemical and extractive metallurgy and ore dressing.

Scott, William D.,* Ph.D., 1961, California (Berkeley); mechanical properties, interfacial phenomena.

Stoebe, Thomas G.,* Ph.D., 1965, Stanford; physics of solids, diffusion in solids, mechanical behavior of ionic solids.

Whittemore, Osgood J.,* Cer.E. (Professional), 1950, Iowa State; ceramic processing, refractories, industrial minerals.

Associate Professors

Aksay, Ilhan A., Ph.D., 1973, California (Berkeley); ceramic processing science, phase equilibria and transitions, composite materials.

Campbell, Robert J., Jr.* (Emeritus), M.S.Cer.E., 1954, Washington; electronic ceramics, processing.

Miller, Alan D.,* Ph.D., 1967, Washington; chemical bonding, instrumental analysis, high-temperature equilibria.

Stang, Robert G.,* Ph.D., 1972, Stanford; mechanical properties, high-temperature deformation of solids.

Ceramic Engineering

Ceramic materials are high-temperature resistant, chemically durable, strong, and rigid. The ceramic engineering program provides students with an understanding of the chemical, electrical, optical, mechanical, and thermal properties of ceramics; of the processing methods and their effects on the structure and properties; and of the feasibilities and economics of manufacture of ceramic materials for engineering applications.

Undergraduate Program

Bachelor of Science in Ceramic Engineering Degree

Entrance to the program requires the equivalent of at least 45 credits earned at the University of Washington, or their equivalent, with a 2.00 grade-point average and attainment of 2.0 in specified courses. Entrance requirement details may be obtained from the department or the University's Office of Admissions. Application forms to enter the program are available from the department office. Continuation in the program is subject to the policy defined by the College of Engineering.

Lower-division courses required in addition to the minimum college requirements are: CHEM 150; ENGR 123, 170, 220; E E 306 and ENGR 331 or equivalent. The upper-division professional program consists of 72 credits or required courses, plus a choice of a 4- or 6-credit senior problem. 10 credits of free electives also are required, for a total of 190 credits for the B.S.Cer.E. degree.

Other Sources of Information

Planning information for undergraduates is available from the department office.

Graduate Program

William D. Scott, Graduate Program Coordinator

The ceramic engineering program in the Department of Materials Science and Engineering offers programs leading to the degrees of Master of Science in Ceramic Engineering and Doctor of Philosophy. The department also provides an option leading to the college-wide Master of Science degree.

Ceramic engineering graduate programs are designed to develop basic understanding of the physical, chemical, and structural relationships that influence the properties and use of ceramic materials. Processing, the development of microstructure, and the relationships of microstructure to properties are considered in a fundamental way applicable to a broad range of materials. Special interdisciplinary courses are offered in structural design with brittle materials that combine mechanics and materials in a practice-oriented design program.

Research and the development of research skills are important components of the graduate programs. Current research areas include sintering studies, mechanical properties of single crystal and polycrystalline ceramics, fracture mechanics, carbon materials, and the formation and fabrication of silicon nitride. A Master of Science program with a nonthesis option, but requiring an independent or group project and report, is also available.

Master of Science in Ceramic Engineering Degree

A baccalaureate degree in engineering is required. If field of specialization is other than ceramic engineering, certain background courses are necessary. Two degree options exist, and a total of 39 credits are required for each. The thesis option requires the completion of a suitable research thesis for a minimum of 9 credits. The nonthesis option requires that all credits be in academic or problem courses and the completion of a suitable report on a faculty-approved problem.

Master of Science Degree

Students with undergraduate majors in science, particularly chemistry or physics, may work for this degree after completing basic undergraduate courses in ceramics. The same academic and thesis program is required for this degree as that described for the degree of Master of Science in Ceramic Engineering.

Doctor of Philosophy Degree

Students who have completed at least one year of satisfactory graduate study may request an examination to determine their eligibility for work leading toward the Doctor of Philosophy degree. Accepted students must complete an approved program of study and a research program that makes a definite creative contribution to the knowledge of the field.

Financial Aid

A limited number of assistantships and fellowships are available for financial support of graduate students. More information is available from the graduate program coordinator.

Research Facilities

Facilities are available for high-temperature fabrication, optical and electron microscope analysis, pore-size analysis, x-ray diffraction, vacuum and nitrogen atmosphere sintering, and room-temperature and high-temperature mechanical testing.

Correspondence and Information

Ceramics Graduate Program
318 Roberts, FB-10

Metallurgical Engineering

Metallurgical engineering is concerned with the processing, fabrication, and utilization of metals, alloys, and other engineering materials. Extractive metallurgy relates to the processing and refining of metals and their compounds. Physical metallurgy is concerned with the structure and properties of materials, the development of new materials with improved properties, and the application and performance of materials in modern engineering systems and design.

Undergraduate Program

Bachelor of Science in Metallurgical Engineering Degree

Entrance to the program requires the equivalent of at least 45 credits earned at the University of Washington with a 2.00 grade-point average, with attainment of 2.0 in specified courses. Entrance requirement details may be obtained from the department or the University's Office of Admissions. Application forms to enter the program are available from the department office. Continuation in the program is subject to the policy defined by the College of Engineering.

Lower-division courses required in addition to the minimum college requirements are 3 credits of chemistry or physics laboratories, ENGR 170, 210, 220, and 331 or 332 or equivalent. Remaining lower-division courses are selected with the adviser's approval from among those recommended. Metallurgy majors must complete a 6-credit, upper-level science requirement, chosen with the adviser's approval. Recommended courses to fulfill this requirement include CHEM 350, 351, 455, 456, and PHYS 224, 225. The technical electives (20 credits) approved by a metallurgical engineering adviser must include a minimum of 9 credits in metallurgical engineering classes at the 400 level, excluding MET E 499. In addition to the college and departmental requirements specified above, sufficient free electives must be completed to satisfy the minimum graduation requirement of 180 credits.

Other Sources of Information

Planning information for undergraduates is available from the department office.

Graduate Program

William D. Scott, Graduate Program Coordinator

The Department of Materials Science and Engineering offers programs leading to the degrees of Master of Science in Metallurgical Engineering and Doctor of Philosophy. The department also provides an option leading to the college-wide Master of Science degree.

Graduate programs in metallurgical engineering encompass a variety of courses and research programs related to the physical and chemical aspects of metals, alloys, and other engineering materials. Active research programs in the physical metallurgy and materials science areas include the structure and properties of alloys, phase transformations, biomaterials, lattice defects, the optical properties of nonmetallic solids, failure analysis, x-ray diffraction, and the mechanical behavior of materials at room and elevated temperatures. The research activities in the area of extractive metallurgy and minerals processing include metallurgical thermodynamics, rate phenomena, extractive process design, and carbothermic reduction processes.

Research Facilities

The metallurgical engineering laboratories are equipped with facilities for scanning and transmission electron microscopy, optical metallography, x-ray diffraction analysis, induction melting, levitation melting, metal fabrication, physical properties measurements, tensile and creep testing, thermogravimetric measurements, flotation, electrostatic and magnetic separation. Excellent computer facilities and extensive library services are also available to graduate students.

Special Requirements

Qualified graduates of accredited curricula in metallurgical engineering or materials science usually may undertake work leading directly to the Master of Science in Metallurgical Engineering degree. Students with undergraduate majors in other engineering disciplines are normally required to complete selected undergraduate courses in metallurgical engineering in addition to the requirements for the graduate degree.

Master of Science in Metallurgical Engineering Degree

The minimum requirements include 30 credits of course work and the satisfactory completion of an M.S. thesis research problem (9 credits of MET E 700). At least 18 graded credits of 500- and 600-level courses are required, including MET E courses 511, 524, 541, and 561; also required are MSE 421 and MSE 466 or their equivalents. Registration for the graduate seminar, MSE 520, is required every quarter. Three full quarters of residence are required; a full quarter of residence is any quarter or combination of part-time quarters in which at least 9 credits of 400-to-800-level courses are acceptably completed.

The thesis research problem is generally selected by the student following consultation with the faculty members.

Master of Science Degree

Students with undergraduate majors in science, particularly in chemistry of physics, may work toward the college-wide M.S. degree; the undergraduate preparation for students in this option is determined in consultation with the graduate program coordinator. The same academic and thesis program is required for this degree as that described for the degree of Master of Science in Metallurgical Engineering.

Doctor of Philosophy Degree

Students who have completed one year of graduate work may request an examination to determine whether or not the faculty will advise proceeding to the General Examination for the degree of Doctor of Philosophy. A critical examination of the applicant's record, recommendations, and proposed course of study will be pertinent to this decision. In addition to course work, each student is required to prepare for a General Examination on a list of subjects selected by a Supervisory Committee. The General Examination is sufficiently comprehensive to demonstrate the student's ability to deal with broad aspects of materials science, as well as with a specialized subject area. Proficiency in basic research is of paramount importance. Each prospective candidate is required to present a written dissertation that makes an original and independent contribution to knowledge.

Financial Aid

A limited number of teaching and research assistantships and fellowships are available for the financial support of graduate students in metallurgical engineering. More information and application materials can be obtained by contacting the graduate program coordinator.

Correspondence and Information

Metallurgy Graduate Program
308 Roberts, FB-10

Course Descriptions

Courses for Undergraduates

Ceramic Engineering

CER E 198 Career Planning II (1) ASp Career opportunities in ceramic engineering and the required educational curricular planning. Offered on credit/no credit basis only.

CER E 300 Introduction to Ceramic Raw Materials and Processing (4) A Raw materials, fabrication processes, and process control of interest to ceramic engineers. Natural and synthetic raw materials, forming, drying, firing, temperature measurement, physical measurements.

CER E 303 Ceramic Processing: Methods (5) Sp Technology of ceramic fabrication processes. Material characterization at processing stages for control. Laboratory study of all operations in the manufacture of selected ceramic products.

CER E 306 Ceramic Engineering Excursion (1) A Plant inspection trip. Offered on credit/no credit basis only. 2 credits required.

CER E 399 Introduction to Research and Design (1) Sp Research planning, the engineering design problem, and structural material design problems are introduced to facilitate student selection of senior year research or design options in ceramic engineering. Prerequisites: junior standing, ceramic engineering major.

CER E 400 Ceramic Materials (3) W Nature and properties of ceramic materials and their relation to ceramics in engineering design. Atomic structure, microstructure, and macrostructure of ceramics related to their stability in electrical, mechanical, and thermal environments. For nonmajors only.

CER E 401 Equipment and Plant Design (3) A The design process and its application in ceramic engineering. Design projects. Prerequisite: MSE 302.

CER E 404 Ceramic Process Analysis (3) Sp *Whittemore* Case histories of ceramic industrial facilities. Plant visits. Economic factors and overall process integration, including raw materials, processes, fuels, personnel, distribution. Prerequisite: junior standing.

CER E 411 Vitreous State (4) A Chemistry and physics of glass, glazes, and porcelain enamels; structure and properties and processing of vitreous materials. Prerequisite: MSE 316 or permission of instructor.

CER E 413 Physical Ceramics: Thermal and Mechanical Properties (4) A Physical models for heat capacity, thermal expansion, and thermal conductivity of ceramic materials; validity and utility of models; elastic and plastic deformation; nature of strength and failure with emphasis on the brittle mode; statistical nature of strength of brittle materials; elements of life prediction; thermal gradient stresses; composition gradient stresses; thermal shock and thermal compositional strengthening. Prerequisite: ENGR 220.

CER E 414 Physical Ceramics: Electromagnetic Properties (4) W Optical properties. Ionic and electronic conduction in crystalline and noncrystalline inorganic solids. Dielectric and ferroelectric behavior. Magnetic properties of ferrimagnetic materials. Prerequisite: E E 306.

CER E 420 Colloidal Ceramics (3) Properties and surface chemistry of ceramic colloids. Topics include absorption, adsorption, gels and their contributions to cementitious bonding, ion exchange, rheological properties, and analytical techniques applicable to these studies.

CER E 441 Undergraduate Seminar (1, max. 3) AWSp Employment selection, résumé writing and correspondence, personnel contacts, interview planning and job-selection campaign. Individual technical presentations.

CER E 450 Introduction to Carbon Materials (3) Sp Nature and capabilities of crystalline and disordered forms of pure carbon as engineering materials. Influence of structure on behavior. Preparation methods, structure and properties of diamond; synthetic and natural graphites; glassy, coke, pyrolytic, black, and fiber carbons.

CER E 470 Refractories (3) W Chemical and mineralogical composition; processing methods; thermal, physical, and chemical properties and tests; application.

CER E 476 Introduction to Design With Brittle Materials (3) W Properties and behavior of ceramic materials are related to their use in advanced technology structures. Analytical and numerical methods required for probabilistic design and current case studies utilized. Offered jointly with A A 476, CESM 476, M E 476, and MET E 476. Prerequisites: ENGR 220 or equivalent, senior or graduate standing.

CER E 496 Brittle Material Design Project (3) Sp Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CESM 496, M E 496 and MET E 496. Prerequisite: 476.

CER E 498 Special Topics (1-5, max. 8) AWSpS Special topics in ceramic engineering offered as a course with lectures, conferences, or laboratory. Prerequisite: permission of division head.

CER E 499 Special Projects (1-4, max. 4) AWSp Problems in ceramics; laboratory investigations and bibliographic research.

Materials Science and Engineering

MSE 301 Optical Microscopy (3) A Use of the optical microscope as a tool for the observation and analysis of the microstructure of materials. Light, interaction of light with matter, and principles of image formation and image interpretation using both reflected and transmitted light techniques.

MSE 302 Materials Processing: Transport (3) W Transport in materials processing systems; fluid flow, heat flow, mixing and application to high-temperature processing.

MSE 305 X-Ray Diffraction (4) W Theory and applications of X-ray diffraction; lattice parameters, indexing, reciprocal lattice, crystal orientation, qualitative and quantitative analysis; line profile analysis; quiz and laboratory work related to these topics. Prerequisite: 314.

MSE 314 Structures of Materials (5) A Structure of ideal and real solids, the shapes and distributions of phases in solids, equilibrium diagrams, nonequilibrim transformations, surfaces. Prerequisite: ENGR 170.

MSE 315 Kinetic Processes and Transformations in Materials (5) W Applications of thermodynamic and chemical kinetics principles to the study of engineering materials. Reaction rates in solids, liquids, and gases; solid-state diffusion; phase changes, nucleation and growth; microstructure modification, including solidification, recrystallization, precipitation; sintering and vitrification. Prerequisites: 314, ENGR 170.

MSE 316 Mechanical Behavior of Materials III (5) Sp Influence of structure on the mechanical properties of ideal and real solids. Mechanical behavior in metallic and ceramic systems. Prerequisite: 315.

MSE 322 Thermodynamics in Materials Systems (4) Quantitative applications of thermodynamics to systems of interest to metallurgical and ceramic engineers. Detailed review of thermodynamic quantities and equations of state.

MSE 421 Thermodynamics of Solids (3) W Applications of thermodynamics to the solid state. Statistical interpretation of entropy. Heterogeneous equilibria. Theories of solutions. Thermodynamics of surfaces and of defects in solids. Prerequisite: 322 or equivalent.

MSE 423 Fiber Composite Materials (3) W Theory, properties, and practice in fibrous composite materials. Micromechanics of load transfer from matrix to fiber; properties of individual phases; properties of the interfacial region; elastic and failure properties of composites; composite fabrication. Study of polymer, metal, and ceramic matrix composites with appropriate reinforcement. Prerequisite: ENGR 170 or permission of instructor.

MSE 444 Nuclear Materials (3) Sp Structure, properties, and performance of materials in nuclear reactor applications; engineering requirements and selection of materials for reactors; technology of materials for reactor fuels, moderators, shields, control elements, and structural components; corrosion and oxidation; effects of radiation on the structure and properties of materials. Offered jointly with NUC E 444. Prerequisite: ENGR 170 or equivalent.

MSE 455 Advanced Modern Analytical Instrumentation (3) Sp Instruments for materials analysis: scanning and scanning transmission electron microscopy, electron microprobes, energy and wave-length dispersive systems, computerized data reduction programs, Auger electron spectroscopy, X-ray photoelectron spectroscopy, ion scattering spectrometry, secondary ion mass spectroscopy, X-ray diffraction texture and residual stress analysis, atomic absorption, other selected topics.

MSE 466 Electron Theory of Materials (3) Introduction to elementary solid-state concepts in materials. Atom bonding, statistical mechanics, free electron and band theories. Application of principles to conduction in metals, insulators, semiconductors, and to magnetic and optical processes in solids.

MSE 467 Electronic Materials Processing (3) Sp Materials and processes used in the manufacture of electronic components. Basic principles of crystal growth, deposition doping, diffusion, component delineation, and packaging as they apply to hybrid and integrated circuits and devices.

MSE 481 Mineral Industry Economics (4) W World mineral resources, their distribution, exploitation, and depletion; social, economic, and political effects; international control and trade, industrial organization, government policies, taxation, tariffs, marketing, and pricing; elements of production costs. Offered jointly with GEOL 481. Prerequisite: GEOL 205 or permission of instructor.

MSE 498 Special Topics (1-5, max. 8) AWSpS Special topics in materials science engineering offered as a course with lectures, conferences, or laboratory. Prerequisite: senior standing or above and permission of faculty member.

MSE 499 Special Projects (*, max. 5) AWSpS Problems in materials science; field or laboratory investigations on an independent basis.

Metallurgical Engineering

MET E 198 Career Planning in Metallurgy (1) WSp Introduction to the field of metallurgical engineering. Includes interdisciplinary aspects of the field, lecture-demonstrations, introduction to laboratory tools and techniques, and discussions of curriculum and career opportunities with current students.

MET E 326 Process Metallurgy (3) Sp Application of transport theory to metal process engineering. Prerequisite: MSE 302.

MET E 423 Corrosion of Engineering Materials (3) Sp Applications of physical chemical principles to the reaction of materials with their environments. Prevention and control of corrosion and oxidation processes. Corrosion problems in materials applications, including chemical process industries, nuclear engineering, and marine environments.

MET E 426 Extractive Metallurgy II (4) A Application of physical and chemical principles to high-temperature and electrolytic extraction and refining of metals. Descriptions of processes and unit operations, with emphasis on the thermodynamic and kinetic aspects involved. Prerequisites: MSE 322 and metallurgical science requirement.

MET E 461 Engineering Physical Metallurgy (3) A Strengthening mechanisms in alloys, microstructure-property relationships, heat treatment and microstructure control, fracture toughness, and alloy design.

MET E 462 Mechanical Behavior of Materials (5) Theories of elastic and plastic deformation in materials. Application of these theories in design, stress and strain, tensile and compresson loading, yielding and plastic deformation, fracture, introduction to fracture mechanics, creep and fatigue.

MET E 463 Reliability and Design in Metallurgical Systems (3) W Properties of commercially important engineering alloys. Metallurgical design problems and failure analysis. Prerequisite: MSE 316.

MET E 464 Extractive Process Analysis (3) Sp Extractive processes analyzed by the methods of material and energy balances, computational thermodynamics, process kinetics and reactor theory. Introduction to process optimization. Prerequisite: MSE 322 or equivalent.

MET E 488 Undergraduate Seminar (1, max. 3) AW Offered on credit/no credit basis only.

MET E 473 Mineral Process Plant Design (2) General arrangement planning and design calculations on a project basis.

MET E 475 Pollution Control of Metallurgical Plants (3) Current topics related to the causes and control of pollution in metallurgical extraction and processing plants. Analysis of environmental pollution in terms of plant systems and processes involving solids, liquids, and gases; the importance of the fundamental properties of these phases in control techniques. Current research and plant design are discussed.

MET E 476 Introduction to Design With Brittle Materials (3) W Properties and behavior of ceramic materials are related to their use in advanced technology structures. Analytical and numerical methods required for probabilistic design and current case studies utilized. Offered jointly with A A 476, CER E 476, CESM 476, and M E 476. Prerequisites: ENGR 220 or equivalent, senior or graduate standing.

MET E 496 Brittle Material Design Project (3) Sp Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CER E 496, CESM 496, and M E 496. Prerequisite: CER E 476.

MET E 499 Special Projects (*, max. 5) AWSpS Laboratory investigation of a metallurgical problem on an independent basis. Maximum of 5 credits may be counted toward graduation.

Courses for Graduates Only

Ceramic Engineering

CER E 501 Process Ceramics I (3) W Technology of ceramic fabrication processes. Characterization of ceramic materials at stages of processing. Prerequisite: 303 or equivalent or permission of instructor.

CER E 511 Advanced Physical Ceramics I (3) W Theories and principles of diffusion in solids; phenomenological and atomistic concepts; equilibrium defects; impurity, chemical potential gradient, grain boundary and dislocation effects in metals and nonmetals.

CER E 513 Kinetics and Mechanisms of Reactions and Transformations (3) Kinetics, mechanisms of reactions, and transformations. Homogeneous reactions. Heterogeneous reactions. Reaction rate theory and activation energy. Nucleation and growth. Diffusion controlled reactions. Oxidation. Diffusionless (martensitic) reactions. Thermodynamics of irreversible processes. Capillarity and surface phenomena: grain growth, sintering, Ostwald ripening. Recovery, recrystallization, and grain growth. Polymorphic changes. Spinodal decomposition.

CER E 514 Thermodynamic Topics in Ceramics (3) Applications of thermodynamics to predict behavior of materials at high temperature. Techniques of measurement and estimation of high-temperature thermodynamic properties, use of estimated values for thermodynamic calculations.

CER E 521 Mechanical Behavior of Ceramics (3) Sp Dislocation structures in ceramics; influence of dislocations on the deformation and fracture of single crystals and polycrystalline ceramics; brittle fracture and theoretical strength. Prerequisite: 511 or permission of instructor.

CER E 536 Brittle Material Design Problem (3, max. 9) AWS Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CESM 536 and MET E 536. Prerequisite: 496.

CER E 590 Industrial Minerals Research (*) AWSpS

CER E 599 Special Topics in Ceramics (*) AWSpS

CER E 600 Independent Study or Research (*) AWSpS

CER E 700 Master's Thesis (*) AWSpS

CER E 800 Doctoral Dissertation (*) AWSpS

Materials Engineering

MSE 520 Seminar (1, max. 6) AWSpS Review of research problems in recent literature. Registration required for all graduate students. Offered on credit/no credit basis only.

Metallurgical Engineering

MET E 511 Advanced Theory of X-ray Diffraction (3) W Use of the reciprocal lattice concept and Fourier analysis in the study of atomic arrangements in crystals. Line shape and diffuse scattering analysis. Analytical interpretation of diffraction patterns. Prerequisite: MSE 305 or equivalent.

MET E 512 Transmission Electron Microscopy (3) Sp Fundamentals of electron optics as applied to microscopy. Applications of contrast theory and electron diffraction with emphasis on defect and multiphase structures in crystalline solids. Prerequisite: 511 or equivalent.

MET E 523 Advanced Extractive Metallurgy (3) A Physical chemistry of metals, mattes, fused salts, and slags. Discussion of papers from current literature. Prerequisite: basic course in thermodynamics or physical chemistry or permission of instructor.

MET E 524 Applied Rate Phenomena (3) A Application of reaction rate and diffusion theories to metallurgical processes; solid/gas reactions as in calcining, roasting, sintering, and reduction; liquid/gas reactions as in refining and solid/liquid reactions as in leaching. Prerequisite: basic course in transport phenomena or permission of instructor.

MET E 525 Thermodynamic Topics in Metallurgy (3) Sp Selected topics in application of classical and statistical thermodynamics to systems of current metallurgical interest.

MET E 526 Dynamic Behavior of Metallurgical Systems (3) W Interpretation of the behavior of metallurgical systems by application of the methods of process analysis and control theory; modeling of systems, exploration of their characteristics by stimulus-response, and review of current industrial control processes. Prerequisite: graduate standing in engineering or permission of instructor.

MET E 536 Brittle Material Design Problem (3, max. 9) AWSp Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CER E 536 and CESM 536. Prerequisite: CER E 496.

MET E 541 Theoretical Structural Metallurgy (3) A Detailed study of the general properties and effects of point, line, and surface defects in crystalline solids. Prerequisite: 462.

MET E 542 Theoretical Structural Metallurgy II (3) Dislocation arrays in crystals and their plastic properties; the elastic and plastic properties of real crystals; cold work, annealing, polygonization, recrystallization and grain boundaries; creep; cleavage. Prerequisite: 541.

MET E 561 Phase Transformations in Metals and Alloys I (3) W Thermodynamics and kinetics of solid-state reactions in metals, phase stability, theories of nucleation and growth, precipitation from solid solutions, applications to specific metal and alloy transformations.

MET E 566 Magnetic Materials and Phenomena (3) Theories of magnetic phenomena, including diamagnetism, paramagnetism, ferromagnetism, and ferrimagnetism. Details of magnetization processes in materials; anisotropy, magnetostriction; domain energies and configurations; applications to magnetic materials. Prerequisite: MSE 466.

MET E 567 Electronic Processes in Materials (3) Lattice dynamics, including vibrational modes and phonon effects. Brillouin zone theory, and fermi surfaces with applications in the theory of electrical conduction and in the semiconduction theory. Optical properties of solids, including color centers and luminescence. Prerequisite: MSE 466.

MET E 599 Special Topics in Metallurgy (*) AWSpS

MET E 600 Independent Study or Research (*) AWSpS

MET E 700 Master's Thesis (*) AWSpS

MET E 800 Doctoral Dissertation (*) AWSpS

Mechanical Engineering

143 Mechanical Engineering

Mechanical engineering is the broadest of the engineering professions, encompassing the design, analysis, economics, manufacture, and control of mechanical devices and systems. Major subfields of mechanical engineering include: (1) utilization of thermal energy from the sun and from fossil fuels for motive power and human comfort; (2) design, analysis, and fabrication (cutting, forming, welding) of mechanical devices; (3) analysis of vibration and failure of machines and their components; and (4) the management and control of systems of men and machines.

The undergraduate programs in industrial engineering and in mechanical engineering require a sound educational basis in the mathematical, chemical, and physical sciences, and in computational, graphical, and written communication skills.

Undergraduate Program

Bachelor of Science in Industrial Engineering Degree

See listing for Industrial Engineering in this section of the catalog.

Bachelor of Science in Mechanical Engineering Degree

Entrance into the department program is by application and is limited to the number of students who can be effectively educated with the available faculty and laboratory facilities. The minimum entrance requirements are 45 credits in courses applicable to the degree, a minimum grade-point average of 2.50 in specific preparatory courses, and an overall grade-point average of 2.00. Details of the current entrance requirements may be obtained from the department or the Office of Admissions of the University.

The Department of Mechanical Engineering requires that CHEM 150 and ENGR 170, 210, and 230 be included from the College of Engineering program. PHYS 123, 131, 132, 133, CHEM 151, and ENGR 123 (Graphical Analysis) are strongly recommended. The mathematics required beyond MATH 238 (differential equations) may be satisfied with courses selected from MATH 205, 327, 328, and 329, ENGR 401, 402, and 403, or other mathematics courses after consultation with the undergraduate adviser.

Satisfaction of the minimum professional engineering requirements results from the completion of the listed courses plus 12 credits of mechanical engineering option courses (400 level). A minimum of 180 applicable credits and a minimum grade-point average of 2.00 in all engineering courses are required for graduation.

Continuation Policy

The department policy on continuation is consistent with the continuation policy of the college. Details may be obtained from the department.

Sources of Information

All inquiries concerning the mechanical engineering program should be addressed to the undergraduate program adviser in the Mechanical Engineering Advising Offices.

Graduate Program

The Department of Mechanical Engineering offers graduate programs leading to the degrees of Master of Science in Mechanical Engineering and Doctor of Philosophy. The department also provides an authorized option leading to the college-wide Master of Science in Engineering degree. These provide a balanced combination of formal instruction and independent research or design experience. Individual projects may be drawn from a wide spectrum of areas, which include mechanical and energy conservation systems, applied mechanics, computer-aided design and manufacturing, production systems, materials behavior, and applications of mechanical engineering science to a variety of such interdisciplinary fields as bioengineering, ocean engineering, and acoustics. Flexible requirements for course work provide opportunities both for a broad scientific and professional background and for specialty training.

Research Facilities

The department has well-equipped laboratories for pursuing research in various disciplinary fields in mechanical engineering and for constructing specialized research equipment. The former includes experimental stress analysis; materials testing; synthesis and simulation of electromechanical control systems; foundry, welding, and other metal fabrication operations; PDP 11/44, 11/40, and 11/23 computer systems for CAD/CAM research; wind tunnels for boundary-layer and high-speed flow analysis; combustion engine performance and diagnosis; acoustics, vibration, and dynamic testing and measurements; fuels analysis; radiation, conduction, and convection (including multiphase) heat transfer analysis, bioengineering flow facility; and forest engineering research.

Financial Aid

Financial aid is offered to full-time graduate students so far as funds permit. This aid may be in the form of a research assistantship for sponsored programs, a fellowship provided by government agencies, or a teaching assistantship.

Correspondence and Information

Graduate Program Coordinator
141 Mechanical Engineering, FU-10

Faculty

Chairperson

David T. Pratt

Professors

Alexander, Daniel E., Ph.D., 1977, Washington State; engineering design.

Ballse, Peter L.,* S.M., 1950, Massachusetts Institute of Technology; systems analysis and control.

Chalupnik, James D.,* Ph.D., 1964, Texas; sound and vibration, wave propagation.

Childs, Morris E.,* Ph.D., 1956, Illinois; fluid mechanics, gas dynamics, turbulent boundary layers.

Corlett, Richard C.,* Ph.D., 1963, Harvard; energy systems and combustion.

Daly, Colin H.,* Ph.D., 1966, Glasgow; bioengineering, materials.

Day, Emmett E.,* M.S., 1946, Massachusetts Institute of Technology; materials, experimental stress analysis.

Depew, Creighton A.,* Ph.D., 1960, California (Berkeley); heat transfer, fluid mechanics.

Emery, Ashley F.,* Ph.D., 1961, California (Berkeley); bioengineering, energy conservation in buildings and air conditioning.

Firey, Joseph C. (Emeritus), M.S.M.E., 1941, Wisconsin; combustion, lubrication.

Galle, Kurt R.,* Ph.D., 1951, Purdue; instrumentation, controls, bioengineering.

Gessner, Fred B.,* Ph.D., 1964, Purdue; fluid mechanics, turbulence.

Jorgensen, Jens E.,* (Forest Resources), Sc.D., 1969, Massachusetts Institute of Technology; systems analysis, manufacturing, automation and controls, forest engineering.

Kippenhan, Charles J.,* Ph.D., 1948, Iowa; energy conservation in buildings, heating ventilating and air conditioning, heat transfer, fluid mechanics.

Kobayashi, Albert S.,* Ph.D., 1958, Illinois Institute of Technology; fracture mechanics, bioengineering.

Kosály, George,* (Nuclear Engineering),† D.Sc., 1956, Budapest; reactor dynamics (especially noise), two-phase flow characterization, applications of theory of stochastic processes in physics and engineering.

Love, William J. (Emeritus), Ph.D., 1952, Illinois; design, mechanics, power systems.

Malte, Philip C.,* Ph.D., 1971, Michigan; combustion, thermodynamics, fluid mechanics.

McFeron, Dean E. (Emeritus), Ph.D., 1956, Illinois; heat transfer and thermal power processes.

McIntyre, Harry J. (Emeritus), M.B.A., 1923, Washington; steam power plants

Mills, Blake D. (Emeritus), M.E., 1947, Washington; material processing.

Morrison, James B. (Emeritus), M.S.M.E., 1954, Washington; design, dynamics.

Murphy, Stanley R.,* (Oceanography),† Ph.D., 1959, Washington; ocean engineering, acoustics.

Pratt, David T.,* Ph.D., 1968, California (Berkeley); turbulent combustion, computer simulation.

Schaller, Gilbert S. (Emeritus), M.B.A., 1925, Washington; material processing.

Taggart, Raymond,* Ph.D., 1956, Queen's (Belfast); mechanical metallurgy.

Vesper, Karl H.,* (Management and Organization, Institute of Marine Sciences),† Ph.D., 1969, Stanford; design, ocean engineering, entrepreneurship.

Walbler, Paul J. (Emeritus), Ph.D., 1958, Illinois; heat transfer, thermodynamics.

Wolak, Jan,* Ph.D., 1965, California (Berkeley); mechanics of materials, manufacturing processes.

Associate Professors

Adee, Bruce H.,* Ph.D., 1972, California (Berkeley); naval architecture, ocean engineering.

Bodola, John R.,* Ph.D., 1959, Carnegie Institute of Technology; fluid mechanics, heat transfer, solar energy.

Calkins, Dale E.* (Research), Ph.D., 1976, California (Berkeley); dynamics of marine systems, marine fluid dynamics.

Chalk, William S., (Nuclear Engineering),† M.S.M.E., 1961, Washington; design graphics.

Crain, Richard W. (Emeritus), M.S.M.E., 1946, Washington; steam power plants.

Drui, Albert B.,* M.S.I.E., 1957, Washington (St. Louis); industrial engineering, human factors.

Ford, Paul W. (Emeritus), M.S.M.E., 1959, Washington; manufacturing processes, metal casting.

Forster, Fred K.* (Research), Ph.D., 1972, Stanford; bioengineering, application of ultrasound in medicine physiologic fluid flow, cardiovascular dynamics, large deformation elasticity.

Guldon, Michael III (Emeritus), M.S.M.E., 1952, Washington; internal combustion.

Holt, Richard E. (Emeritus), M.S.Met.E., 1957, Washington; manufacturing processes, welding.

Hyman, Barry I.,*‡ Ph.D., 1965, Virginia Polytechnic Institute; solar energy, energy conservation, science policy.

Kieling, William C. (Emeritus), M.S.M.E., 1959, Washington; design, dynamics, and kinematics.

Marshall, Frank R., M.S., 1953, Montana; quantitative science.

Messer, Rowland E. (Emeritus), B.S.M.E., 1935, Washington; graphics.

Riley, James J.,* Ph.D., 1971, Johns Hopkins; fluid mechanics, especially turbulence.

Roberts, Norman H.,* Ph.D., 1958, Washington; reliability and probability theory.

Sandwith, Colin J.* (Research), Ph.D., 1966, Oregon State; corrosion, material science, design, manufacturing.

Sherrer, Robert E. (Emeritus), Ph.D., 1978, Wisconsin; solid mechanics.

Sladky, Joseph F. (Research), M.Sc.M.E., 1969, West Virginia; design, propulsion, high-speed marine craft.

Assistant Professors

Anderson, Jay W., M.S.M.E., 1961, Washington; industrial safety.

Butler, George W. (Research), Ph.D., 1979, Washington; gas dynamics.

Garbini, Joseph L.,* Ph.D., 1978, Washington; manufacturing automation.

Om, Deepak (Research), Ph.D., 1982, Washington; gas dynamics, fluid mechanics.

Reinhall, Per G., Ph.D., 1982, California Institute of Technology; nonlinear dynamics, vibrations.

Storch, Richard L.* (Research), Ph.D., 1978, Washington; vessel stability, vessel safety.

Storti, Duane W., Ph.D., 1984, Cornell; nonlinear dynamics and vibrations, perturbation theory.

Lecturer

Sleight, Richard L., M.Hd., 1980, Washington; graphics.

Course Descriptions

Courses for Undergraduates

Mechanical Engineering

M E 304 Manufacturing Processes (3) AWSpS *Wolak* Study of manufacturing processes, including interrelationships between the properties of the material, the manufacturing process, and the design of component parts. Prerequisite: 343.

M E 320 Thermodynamics (4) AWSp *Depew* Introduction to classical macroscopic thermodynamics, including development of the basic laws applicable to energy transformations, with reference to engineering applications. Prerequisites: MATH 126 and CHEM 140.

M E 323 Thermodynamics (4) AWSpS *Depew* Applications of thermodynamic principles: properties of pure substances from an advanced point of view, nonreactive gas mixtures, energy analysis of reactive mixtures, chemical equilibria, combustion, power, and refrigeration cycle analysis. Prerequisite: 320 or ENGR 260.

M E 331 Introduction to Heat Transfer (4) AWSp *Emery* Study of heat transfer by conduction, radiation, and convection; elementary heat-exchanger design. Prerequisites: 320 or ENGR 260, and 333 or CIVE 342.

M E 333 Introduction to Fluid Mechanics (4) AWSp *Gessner* Introduction to the basic fluid laws and their application. Conservation equations, dynamic similarity, potential flow, boundary layer concepts, effects of friction, compressible flow, fluid machinery, measurement techniques. Prerequisites: 320 or ENGR 260, and MATH 238.

M E 342 Industrial Materials and Processes (3) Sp *Wolak* Properties, mechanics, and behavior of materials to provide a logical basis for material selection in design. Lecture and laboratory. Prerequisite: junior standing in industrial design or permission of instructor. (Offered odd-numbered years.)

M E 343 Behavior of Engineering Materials (3) AWSpS *Daly* Study of the nature, properties, and behavior of engineering materials, involving strength, deformation, fracture, impact, creep, fatigue, and corrosion. Lecture and laboratory. Prerequisite: ENGR 220 or permission of instructor; recommended: ENGR 170.

M E 352 Mechanics of Solids (4) AWSp *Kobayashi* Development of relationships among loads, stresses, and deformations in the elastic behavior of machine or structural elements in tension, bending, or torsion. Prerequisite: ENGR 220.

M E 353 Machine Design Analysis (4) AWSpS *Taggart* Analysis, design, and selection of mechanical subsystems and elements, such as gears, linkages, cams, and bearings. Lecture and laboratory. Prerequisites: 343, 352.

M E 373 Introduction to System Dynamics (4) AWSpS *Jorgensen* Introduction to mathematical modeling and analysis of physical dynamic systems involving energy storage and transfer, by lumped parameter linear elements. Time domain response and stability of linear systems via analytical methods and computer applications. Prerequisites: MATH 238, ENGR 230.

M E 374 Systems Dynamic Analysis and Laboratory (3) AWSp *Jorgensen* Extension of 373, frequency response analysis, generalized impedance concepts and applications, Fourier series analysis and Laplace transform techniques. Introduction to nonlinear modeling. Laboratory experiments and computer exercises. Prerequisite: 373.

M E 401 Metal Casting Theory and Design (3) Sp *Ford* Physical phenomena involved in metal casting processes and their effects on casting quality. Principles of casting design. Lecture and laboratory. Prerequisites: 304 and 343, or permission of instructor.

M E 403 Material-Removal Processes (3) A *Wolak* Cutting and noncutting processes for material removal in the shaping of manufactured products. Study of forces and of power consumption in the various processes, and relative costs. Prerequisites: 304 and 343, or permission of instructor.

M E 404 Theory of Welding (3) W Theory of arc welding and flame cutting of metals. Prerequisites: 304 and 343, or permission of instructor.

M E 405 Introduction to Plastic Metal Forming (3) A *Wolak* Plastic behavior of metals; energy of deformation; estimates of working loads for wire drawing and extrusions. Introduction to slip-line and velocity fields with applications to indentation, extrusion, and drawing through axisymmetric dies. Principles of tube making; rolling of flat slabs; friction and lubrication in metal working. Prerequisite: 343 or equivalent.

M E 406 Corrosion and Surface Treatment of Materials (3) W *Sandwith* Corrosion fundamentals and forms (galvanic, crevice, pitting, stress corrosion, erosion, hydrogen and leaching). Principles of design, materials selection, cathodic protection and surface treatments (coatings, carburizing, nitriding and plating) applied to reduce corrosion. Failure analysis applied to case studies.

M E 422 Microscopic Thermodynamics (4) W *Malte* Introduction to kinetic theory and statistical thermodynamics. A preliminary treatment of transport phenomena, mathematical probability statistics and relevant mathematical procedures. Prerequisite: 320 or ENGR 260. (Offered odd-numbered years.)

M E 424 Combustion Power Systems (3) A *Malte* Combustion and furnace theory. Flame characteristics. Analysis and design practice: gas-, oil-, and coal-fired systems. Wood-fired combustors. Corrosion and pollutant control. Prerequisites: 323, 331, or permission of instructor.

M E 425 Air Conditioning (3) SpS *Kippenhan* Topics in air conditioning, heating, and ventilating of buildings. Human comfort characterization, dynamic load calculations, air-distribution systems, simultaneous heat and mass transfer devices. Project studies. Prerequisites: 331, 333.

M E 426 Solar Energy Engineering (3) Sp *Bodola* Introduction to the engineering design and analysis of systems directed toward the collection and utilization of solar energy. Fundamental principles of heat transfer, thermodynamics, and fluid mechanics are directed toward the analysis of collector and storage devices and to the synthesis of such devices into energy-delivery systems. Includes a limited examination of the availability of solar resources and of life cycle cost analysis of solar devices. Prerequisite: 331 or equivalent.

M E 428 Noise Control (3) W *Chalupnik* Introduction to design for noise control. Includes summary of acoustical phenomena as they pertain to noise control and measurement. Noise rating schemes, particularly in relation to machine noise in the work environment. Prerequisite: junior standing in engineering.

M E 430 Thermal Environmental Engineering (3) W *Depew* Fundamentals of thermodynamics, heat transfer, and fluid mechanics are reviewed and applied to practical engineering situations. Applications include: absorption refrigeration, cryogenics, solar energy, and effects of thermal environment on human beings. Prerequisites: 323, 331.

M E 432 Gas Dynamics (3) Sp *Childs* Dynamic and thermodynamic relationships for the flow of a gas. Application of thermodynamic processes involving nozzles, diffusers, compressors, and turbines. Prerequisites: 320 or ENGR 260, and 333 or CIVE 342.

M E 433 Turbomachinery (4) W *Depew* Basic principles of turbomachinery operation, design, and testing. Prerequisite: 333.

M E 434 Advanced Mechanical Engineering Laboratory (3) AWSp Introduction to engineering measurement problems and techniques, including interpretation of experimental data, based upon the theories of probability and statistics. Experiments in all areas of mechanical engineering using single-component and multicomponent systems. Prerequisites: 323, 331, 333, 343, 374, and MEIE 315.

M E 436 Friction and Lubrication (3) A *Wolak* Fundamental principles of friction and lubrication with applications to rolling and hydrodynamic bearing design. Prerequisites: 333, 353, or permission of instructor.

M E 440 Mechanical Behavior of Solids (3) W *Wolak* Mechanics of deformable bodies; transformation of stress and strain; yield criteria; equations of compatibility; elastic constants of crystalline and polycrystalline solids. Application to design and manufacturing. Prerequisite: 343 or permission of instructor.

M E 445 Fracture of Engineering Materials (3) A *Taggart* Deformation processes leading to fracture, and the basic mechanics of materials fracture from microscopic and macroscopic viewpoints. Principles of design and testing for fracture resistance. Lecture and laboratory. Prerequisite: 343 or permission of instructor.

M E 460 Kinematics and Linkage Design (3) W *Chalk* Synthesis of linkage-type mechanisms, using graphical and computer methods. Prerequisite: senior standing in engineering or permission of instructor.

M E 465 Welding Design (3) Sp Theory of joint design, sequence, fixturing, and dimensional control in fusion welding. Prerequisite: senior standing in mechanical engineering or permission of instructor.

M E 468 Air-Pollution Control Equipment Design (3) Designs to control air pollutants from stationary sources. Procedures for calculating design and operating parameters. Fundamental mechanisms and processes of gaseous and particulate control equipment for absorption and adsorption of gaseous pollutants; electrostatic precipitation and filtration of particular pollutants. Actual case studies. Offered jointly with CH E 468 and CEWA 468. Prerequisite: senior standing or permission of instructor.

M E 469 Applications of Dynamics in Engineering (3) AWSp *Chalupnik* Application of the principles of dynamics to selected engineering problems, such as suspension systems, gyroscopes, electromechanical devices. Includes introduction to energy methods and wave propagation in fluids and solids. Prerequisites: 373 and ENGR 230 or permission of instructor.

M E 470 Mechanical Vibrations (3) Sp *Chalupnik* Single-degree-of-freedom linear systems techniques. Matrix techniques for multi-degree-of-freedom linear systems. Applications in vibration isolation, transmission, and absorption problems and instrumentation. Prerequisite: 373 or permission of instructor.

M E 471 Automatic Control (3) A *Galle* Engineering analysis of automatic control systems. Dynamic system modeling; system error; performance and stability analysis by Routh, root locus, and frequency response techniques; computer simulation. Lecture and laboratory. Prerequisite: 374 or permission of instructor.

M E 473 Instrumentation (3) W *Galle* Principles and practice of industrial measurement. Dynamics of instrument response; theory of transducers for temperature, pressure, flow, and other measurements. Lecture and laboratory. Prerequisite: 374 or permission of instructor.

M E 474 Systems Modeling and Simulation (3) W *Balise* Unified approach to modeling of systems, and computer simulation of systems behavior. Selecting system variables; writing state, loop, and node equations; modal response and state transition response; system functions and convolution; analogs. Applications to control, vibrations, and other problems. Prerequisite: 374.

M E 476 Introduction to Design With Brittle Materials (3) W Properties and behavior of ceramic materials are related to their use in advanced technology structures. Analytical and numerical methods required for probabilistic design and current case studies utilized. Offered jointly with A A 476, CER E 476, CESM 476, and MET E 476. Prerequisites: ENGR 220 or equivalent; senior or graduate standing.

M E 477 Microcomputers in Mechanical Systems (4) *Garbini, Jorgensen* Analysis of electromechanical systems employing microcomputers for control or data acquisition. Microcomputer architecture, memory organization, assembly language programming, interfaces, and communications. Particular emphasis on design of hardware and software interfaces for real-time interaction with mechanical systems. Weekly laboratory. Prerequisites: 373, 374, E E 306, or permission of instructor.

M E 481 Internal Combustion Engine Principles (3) ASp *Malte* Study of Otto and Diesel cycles; fuels, carburetion, ignition, combustion, and engine performance characteristics. Prerequisite: 323 or permission of instructor.

M E 482 Internal Combustion Engine Applications (4) W *Malte* Principles of engine selection and design to meet load requirements, economic requirements, and emission regulations. Prerequisite: 481 or permission of instructor.

M E 490 Naval Architecture (3) A *Adee* Theory of naval architecture; ship's lines, hydrostatic curves, intact and damaged stability, launching. Offered jointly with O ENG 490. Prerequisite: junior standing in engineering or permission of instructor.

M E 491 Naval Architecture (3) W *Adee* Theory of naval architecture; strength, A.B.S. rules, water waves, ship and platform motions. Offered jointly with O ENG 491. Prerequisite: junior standing in engineering or permission of instructor.

M E 492 Naval Architecture (3) Sp *Adee* Theory of naval architecture; dimensional analysis, resistance, model testing, propellers, steering. Offered jointly with O ENG 492. Prerequisite: junior standing in engineering or permission of instructor.

M E 495 Mechanical Engineering Design (3) AWSpS *Alexander* Design laboratory involving the identification and synthesis of engineering factors to plan and achieve specific project goals. Current literature and prerequisite texts are used as reference sources. Lecture and laboratory. Prerequisites: 353 and senior standing in mechanical engineering.

M E 496 Brittle Material Design Project (3) Sp *Bollard, Emery, Hartz, Kobayashi, Love, Miller, Mueller, Scott, Taggart, Whitemore* Interdisciplinary efforts in the solution of design problems involving brittle (ceramic) materials. Student teams of an interdisciplinary mix and team teaching are utilized. Offered jointly with CER E 496, CESM 496 and MET E 496. Prerequisite: CER E 476.

M E 498 Special Topics in Mechanical Engineering (1-5, max. 6) AWSp Lecture and/or laboratory. Maximum of 6 credits may be applied toward an undergraduate degree. Prerequisite: permission of instructor.

M E 499 Special Projects (2-5, max. 9) AWSpS Prerequisite: permission of department Chairperson.

Mechanical Engineering Industrial Engineering

MEIE 313 Engineering Operations Research (4) WSp *Marshall* Introduction to the major tools and techniques to operations research as used by industrial engineers and management scientists. Topics include linear, dynamic, and integer programming, as well as the theories of games, inventory, and queuing. Laboratory sessions stress current practice by plant visits, projects in industry, and case studies. Prerequisites: 315, ENGR 141.

MEIE 315 Statistical Analysis of Engineering Measurements (3) AWSpS *Roberts* Application of probability theory and statistics to engineering problems, distribution theory and discussion of particular distribution of interest in engineering, statistical estimation and data analysis. Illustrative statistical applications may include quality control, linear regression, analysis of variance, and experimental design. Prerequisite: MATH 238.

MEIE 317 Work Systems Design (4) AW *Drui* Work design and measurement principles; time utilization, flow and operations studies, principles of motion economy, time study principles and practices, physiological and psychological aspects of work. Lectures and studies in local industry as laboratory.

MEIE 351 Human Factors in Design (3) WSp *Drui* Engineering considerations of the abilities and limitations of the human aspect in the design of operational systems and components. Functional, psychological, physiological, and environmental considerations. Studies with local industry used as laboratory exercises. Prerequisite: 315.

MEIE 408 Manufacturing Optimization (3) AW *Garbini* Design and optimization of manufacturing systems. Computer-assisted manufacture. Sensing and control methods for efficient use of automation. Managing the automated factory. Tool and production planning. Laboratory exercises and applications in local industrial plants. Prerequisite: M E 304 or permission of instructor.

MEIE 410 Industrial Organization and Management (3) ASpS *Drui* Overview of the operations of an industrial organization, interrelationship of functions, and fundamental principles of management that lead toward effective coordination and control. Lectures and case studies from industry.

MEIE 411 Engineering Economy (3) AWSpS *Marshall* The evaluation of engineering alternatives. Use of interest computations, valuation; depreciation, and cost estimates to predict the economic result of the application of engineering products or processes.

MEIE 412 Industrial Cost Analysis (4) AW *Drui* Examination of systems that provide economic and performance data for management decisions. Use of quantified information from standard cost systems, inventory costs, product cost budgeting, overhead and cost accounting.

MEIE 419 Work Environment Design (3) WSp *Drui* Design of new or expanding facilities. Considers layout, heating, ventilation, power, acoustics, sanitation, illumination, protection, and other environmental factors. Lectures and local industry as laboratory.

MEIE 420 System Safety and Reliability Engineering (4) ASp *Roberts* Applications of statistical and algebraic techniques to system reliability. Derivation and discussion of failure distributions; quality control; analysis of reliability test data; maintenance policies and Monte Carlo simulation techniques. Prerequisite: 315.

MEIE 431 Ship Production Systems (3) A *Storch* Introduction to shipyard organization, ship production processes, techniques of production planning and control, and the role of the computer in modern shipbuilding. Principles of advanced shipbuilding, product-oriented work breakdown structure, and zone construction. Offered jointly with O ENG 431. Prerequisite: 317 or permission of instructor.

MEIE 450 Operations Scheduling and Quality Control (4) ASp *Storch* Continuous flow, intermittent, and project production processes and tools for managing them. Assembly-line balancing, job shop scheduling, project planning and control, quality assurance, improvement curves, work force scheduling, and vehicle scheduling. Offered jointly with OPMGT 450 and O ENG 451. Prerequisite: 315.

Courses for Graduates Only

Mechanical Engineering

M E 502 Plastic Metal Forming (3) Sp *Wolak* Stress-strain and stress-strain-rate relations in metal forming; plastic instability. Work of deformation. The slip-line field. Load bounding. Metal characteristics and forming. Applications frames, drawing, forging, and extrusion.

M E 506 Friction and Wear (3) Sp *Wolak* Nature of the processes of friction and wear. Temperature rise at contact surfaces during sliding. Boundary friction. Tribological properties of materials. Prerequisite: graduate standing in engineering or permission of instructor.

M E 518-519-520 Seminar (0-0-1, max. 6) Offered on credit/no credit basis only.

M E 521 Thermodynamics (3) A *Depew, Emery, Kippenhan, Malte, Pratt* Fundamental concepts of temperature, thermodynamic properties, and systems. The first, second, and combined laws. Development of the relations of classical thermodynamics. Prerequisites: 323 and graduate standing in mechanical engineering or permission of instructor.

M E 522 Thermodynamics (3) W *Corlett, Depew, Emery, Malte, Pratt, Roberts* Topics from statistical thermodynamics, including the Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Solutions of the Schrodinger wave equation and evaluation of the partition function for translation, rotation, and vibration. Prerequisite: 521 or permission of instructor. (Offered odd-numbered years.)

M E 524 Combustion (3) Sp *Corlett, Malte, Pratt* Chemical and physical processes of combustion with applications to design of combustors, fuel selection, and consideration of environmental effects. Prerequisite: graduate standing in mechanical engineering or permission of instructor. (Offered even-numbered years.)

M E 525 Acoustics in Engineering I (3) W *Chalupnik, Sigelmann* Acoustic wave transmission, reflection, refraction, and diffraction. Review of continuum mechanics and examples from electromechanical systems. Offered jointly with E E 525. Prerequisite: graduate standing in mechanical or electrical engineering, or permission of instructor.

M E 526 Acoustics in Engineering II (3) Sp *Chalupnik, Sigelmann* Continuation of 525. Material differs each year, covering such topics as scattering, moving media, ultrasonics, acoustic holography, optoacoustics, transducer design, propagation in anisotropic medium, etc. Offered jointly with E E 526. Prerequisite: 525 or permission of instructor.

M E 528 Acoustics of Environmental Noise (4) A *Chalupnik* Measurement and evaluation of environmental noise. Mathematical, physical, and psychological aspects of community noise; sources, scales for rating, propagation, and control of noise. Laboratory demonstration of lecture principles. Offered jointly with CEWA 528. Prerequisite: permission of instructor.

M E 530 Radiative Heat Transfer (3) W *Corlett, Depew, Emery, Malte* Fundamentals of thermal radiation for black, gray, nongray, diffuse, and specular surfaces. Gaseous radiation and special applications of thermal radiation. Prerequisite: graduate standing in mechanical engineering or permission of instructor. (Offered even-numbered years.)

M E 531 Conductive Heat Transfer (3) A *Corlett, Depew, Emery* Analysis of steady-state and transient heat conduction in single and multidimensional systems by mathematical, graphical, numerical, and analogical methods. Prerequisite: graduate standing in mechanical engineering or permission of instructor. (Offered odd-numbered years.)

M E 532 Convective Heat Transfer (3) Sp *Depew, Emery* Introduction to fluid flow and boundary layer theory as applicable to forced- and natural-convection heat transfer. Condensation and boiling heat transfer. Prerequisite: graduate standing or permission of instructor.

M E 533, 534 Fluid Mechanics (3,3) WSp *Bodola, Corlett, Gessner, Riley* Basic conservation laws and kinematics of fluid flow, two-dimensional inviscid flow, wave motion and shock waves in inviscid compressible flow, exact solutions and boundary layer analyses of laminar and turbulent viscous flow, analysis of non-Newtonian flow, applications. Prerequisite: 533 or permission of instructor for 534.

M E 535 Computational Techniques in Heat Transfer (3) A *Emery, Pratt, Walbler* Advanced heat transfer studies of interest to mechanical engineers. Subject coverage varies from year to year. Prerequisite: permission of instructor.

M E 537 Topics in Fluid Mechanics (3) Sp *Emery, Gessner, Pratt, Riley* Selected fluid mechanics research topics relevant to current advances in mechanical engineering practice. Topics selected vary with faculty and student interest, but are drawn predominantly from the general areas of energy conversion, energy management, and manufacturing processes. (Offered odd-numbered years.)

M E 538 Turbulent Boundary Layer Theory (3) A *Gessner, Riley* Characteristic features of turbulent boundary layers; development of the turbulent boundary layer equations; equilibrium boundary layers; integral methods of solution based on power law and wall-wake velocity profiles; methods of solution based on higher order constitutive equations; application to diffuser flows and free shear flows; new developments and physical models. (Offered odd-numbered years.)

M E 541 Advanced Engineering Materials (3) W *Daly, Taggart* Behavior of engineering materials as affected by various conditions of loading and environment. Lecture, laboratory. Prerequisite: graduate standing in mechanical engineering or permission of instructor.

M E 542 Topics in Engineering Materials (3) Sp *Daly, Taggart* Selected topics of current importance concerning the nature and behavior of engineering materials. Lecture, laboratory. Prerequisite: 541 or permission of instructor. (Offered odd-numbered years.)

M E 543, 544 Fluid Turbulence (3,3) W,Sp *Gessner, Riley, Sleicher* Statistical and phenomenological theories of turbulence. Introductory concepts, velocity correlations, the energy spectrum, the decay of turbulence, scalar fields, turbulent transport, shear turbulence, wall turbulence, phenomenological theories of energy transport, turbulence modeling, instrumentation, recent literature. Offered jointly with CH E 543, 544. Prerequisite: 538 or 6 credits in graduate fluid mechanics. (Offered even-numbered years.)

M E 551 Applied Elasticity (3) A *Kobayashi* General equilibrium and stress-strain relations in homogeneous, isotropic, elastic materials. Elastic stress distributions in machine components; plane-stress and plane-strain problems. Prerequisite: graduate standing in mechanical engineering or permission of instructor.

M E 552 Applied Plasticity (3) W *Kobayashi* Elastic-plastic stress distributions in machine components; stress-strain relations in the plastic range; yield in thick-walled pressure vessels, rotating cylinders and disks; torsion and bending of machine members; thermal stresses in shells, rotating disks, and plates. Prerequisite: 502 or permission of instructor.

M E 553 Applied Viscoelasticity (3) Sp *Daly, Emery, Kobayashi* Time-dependent aspects of stress and strain, and stability in mechanical engineering design. Stress analysis in the presence of creep and stress relaxation. Cyclic variation of load and temperature. Prerequisite: 551 or permission of instructor.

M E 555 Thermoelasticity (3) W *Emery* Basic equations of thermoelasticity for isotropic elastic solids. Analysis of disks, cylinders, spheres, beams, and plates under steady temperature and sudden and slow heating and cooling. Introduction to thermoelastic stability. Prerequisite: 551 or permission of instructor. (Offered even-numbered years.)

M E 556 Experimental Stress Analysis (3) A *Day* Theory and practice of experimental techniques including photoelasticity; brittle coatings; birefringent coatings, and interferometry. Lecture and laboratory. Prerequisite: graduate standing or permission of instructor.

M E 557 Experimental Stress Analysis (3) W *Day* Continuation of 556 with extended applications and theory of experimental mechanics techniques. Holography; residual stress analysis methods; moire; three-dimensional photoelasticity; acoustoelasticity. Lecture and laboratory. Prerequisite: 556 or permission of instructor.

M E 558 Experimental Stress Analysis (3) Sp *Day* Seminar and individual research on special problems in experimental mechanics. Prerequisite: 557 or permission of instructor. (Offered odd-numbered years.)

M E 559 Applied Fracture Mechanics (3) WSp *Kobayashi* Applications of linear fracture mechanics to failure analysis and fracture control based on actual case studies. Fracture toughness and fatigue testing techniques, crack initiation and propagation fatigue life prediction of mechanical components subjected to environmental effects.

M E 560 Advanced Theory of Fracture (3) Sp *Kobayashi* Theories of linear fracture mechanics, fracture dynamics, ductile fracture, stable crack growth and mixed mode fracture. Discussion of advanced topics from recent literature. Prerequisite: 559 or permission of instructor.

M E 564 Mechanical Engineering Analysis (3) A *Balise, Galle, Storti* Application of mathematical methods to the description and analysis of systems in mechanical engineering. Analogies in heat transfer, fluid flow, stress distribution, dynamics, and feedback control. Prerequisite: graduate standing in mechanical engineering or permission of instructor.

M E 565 Mechanical Engineering Analysis (3) W *Balise, Emery, Galle, Storti* Applications of vectors, matrices, and partial differential equations to mechanical engineering systems, including computational techniques and analogies. Prerequisite: graduate standing in mechanical engineering or permission of instructor.

M E 571 Servomechanisms (3) W *Balise, Galle, Garbini, Jorgensen* Linear and introductory nonlinear feedback system analysis and design. Prerequisite: 471 or permission of instructor.

M E 572 Servomechanisms (3) Sp *Balise, Galle, Garbini, Jorgensen* Continuation of 571, to include topics of current importance. Further study of nonlinear control, statistical analysis of feedback systems, sampled-data methods, self-adaptive systems. Prerequisite: 571 or permission of instructor.

M E 575 Systems Theory (3) Sp *Balise, Garbini* State variable approach as applied to multivariable systems. Continuous and discrete variables, system vectors and matrices, distinct and multiple eigenvalues, controllability and observability, computer algorithms. Geometrical and physical interpretations of the mathematical models. Prerequisite: 474 or permission of instructor.

M E 579 Fluid Power Systems (3) W *Garbini, Jorgensen* Design, analysis, and control of fluid power systems. Steady state analysis of valves, actuators, and transmissions. Dynamic modeling, response, stability, and control analysis via linear element representation and computer simulation. Prerequisite: graduate standing in mechanical engineering or permission of instructor.

M E 584 Gas Turbines (3) Sp *Corlett, Malte* Applications of the gas turbine; gas turbine cycles; compressors; turbines; combustion systems, gas turbine power plant materials; plant performance. Prerequisite: graduate standing in engineering or permission of instructor. (Offered even-numbered years.)

M E 588 Dynamics and Vibrations (3) A *Chalupnik, Reinhall* Variational techniques, Hamilton's principle, Lagrange's equations applied to dynamics of particles and rigid bodies. Vibration analysis of multi-degree-of-freedom and continuous systems. Prerequisite: graduate standing in engineering or permission of instructor.

M E 589, 590 Vibrations (3,3) W,Sp *Chalupnik, Reinhall* Study of systems with nonlinear damping and restoring forces excited by deterministic or random inputs. Applications in measurement, testing, and design of mechanical systems. Nonlinear systems are emphasized in 589 and random inputs in 590. Prerequisite: 588 or permission of instructor. (Offered even-numbered years.)

M E 598 Topics in Research (1) AWSp Doctoral seminar. May be repeated for credit. Offered on credit/no credit basis only.

M E 599 Special Projects (1-5, max. 9) AWSpS Written report required. Prerequisite: permission of department Chairperson.

M E 600 Independent Study or Research (*) AWSpS Written report required.

M E 700 Master's Thesis (*) AWSpS

M E 800 Doctoral Dissertation (*) AWSpS

Mechanical Engineering Industrial Engineering

MEIE 511 Management Decision Models (3) Sp *Drui, Ford, Marshall* A quantitative approach, using decision models, for engineering and management problems in increasing the output per hour of work. Concepts of management decisions, deterministic models, probabilistic models, and in-depth study of an actual work situation. Capacity measures, allocation and scheduling resources, and time-money evaluation of alternatives recognizing risk. Offered on credit/no credit basis only. Prerequisites: 315 and 411, or equivalent, or permission of instructor.

MEIE 513 Advanced Topics in Operations Research (3) A *Marshall* Revised simplex and decomposition methods for computer management of large-scale linear programming problems; stochastic models in queuing theory and in inventory theory; introduction to methods used in nonlinear programming; simulation modeling. Prerequisite: 313 or equivalent.

MEIE 516 Advanced Topics in Engineering Statistics (3) W *Marshall, Roberts* Topics are flexible and tailored to the needs of the particular student group involved. Topics usually considered: regression, correlation, experimental design, Monte Carlo techniques, Markov processes, extreme value theory, time-series analysis. Prerequisite: graduate standing or permission of instructor.

MEIE 599 Special Projects in Industrial Engineering (1-5, max. 9) AWSpS Prerequisite: permission of department Chairperson.

Nuclear Engineering

303 Benson

Undergraduate Program

Bachelor of Science in Engineering Degree

NUCLEAR ENGINEERING EMPHASIS

The course of study for the Bachelor of Science in Engineering degree with a nuclear engineering emphasis provides a student with (1) a background in the fundamental mathematics and physics needed for nuclear energy applications; (2) an introduction to nuclear technology appropriate for either advanced study in nuclear engineering or employment at the baccalaureate degree level; and (3) a solid foundation in an area of engineering that complements nuclear engineering as a discipline.

The Department of Nuclear Engineering requires that PHYS 123, CH E 330 or MSE 302, and either ENGR 260 or M E 320 be included in the engineering college program as technical preparation for department courses. The departmental requirements are: nuclear technology, 18 credits minimum—ENGR 305, NUC E 444, 484, 485, 486, 488, 489 or 490, 498, 499, 565; engineering mathematics and natural sciences, 30 credits minimum—at least 9 credits from MATH 327, 328, 329; ENGR 401, 402, 403, PHYS 324, 325, 327, 424, 425, 426, A A 370, 470. The remaining 21 credits may be chosen from any University courses offered in engineering, mathematics, or natural sciences at or above the 300 level, except that 15 of these credits may be from any level of natural science offerings. Elective technology option: 18 credits—a sequence of courses prepared by the student that must be approved by the student's adviser and the nuclear engineering B.S.E. coordinator. A description of the B.S.E. program requirements appears under the Interdisciplinary Engineering Studies heading in the College of Engineering section. Fields of study that provide a sound complement to the disciplines of nuclear engineering include, but are not limited to:

Applied mathematics: An option that involves the application of mathematical techniques to the solution of problems in nuclear engineering. Numerical methods and computer use are emphasized.

Chemical systems: Emphasis placed on the development and application of such processes and equipment as those used in the nuclear fuel cycles in which matter is treated to induce a change of state (or phase), energy content, or chemical composition.

Electrical/electronic systems: An area concerned with the control of electricity and the electrical properties of materials with applications in system theory, computers, physical electronics, and instrumentation and control.

Environmental engineering: An area that offers an understanding of the growing problems of air, water, and land pollution. This includes the quality and quantity of present production of wastes, their known environmental effect, practical methods of control, and prospects for the future.

Materials technology: An area oriented toward the materials sciences, with emphasis placed on atomic, molecular, and crystalline structure, the physical properties of solids, thermodynamic properties of materials, reactions, and mechanical behavior. The preparation, properties, and applications of metals and alloys in various environments also are considered.

Thermal-hydraulic systems: An area that provides a strong background in thermodynamics, fluid flow, and heat transfer. It provides the necessary preparation for advanced work in the design and analysis of thermal-hydraulic systems in nuclear steam-supply systems, and nuclear reactor safety analysis.

Graduate Program

The Department of Nuclear Engineering offers programs of study leading to the degrees of Master of Science in Nuclear Engineering and Doctor of Philosophy. Undergraduate training in nuclear engineering is not a prerequisite for entrance into the program: any student who has a baccalaureate degree in engineering, in a physical science, or in mathematics is eligible for admission if he or she meets the general requirements for admission to the Graduate School. The Graduate Record Examination is required of all students with a baccalaureate degree from a university not in the United States or Canada.

The first-year program includes courses in reactor theory, reactor engineering, nuclear engineering design, fusion engineering and advanced fission engineering, and plasma physics as well as supporting courses in mathematics, physics, and engineering sciences. Laboratory courses introduce the student to important research techniques involving the use of a 100-kilowatt nuclear reactor and related nuclear instruments and equipment. Other laboratory facilities available include extensive equipment for experimental research in plasma physics, reactor noise, and neutron spectroscopy.

Although a thesis is required for the master's degree, it is generally possible to complete the degree requirements in four or five quarters. Following completion of the first-year program or equivalent, a student may begin a program of specialized study toward the Doctor of Philosophy degree.

Typical areas of specialization include: nuclear analysis of nuclear reactors; engineering analysis of nuclear-reactor systems; bionuclear engineering; nuclear materials; nuclear-chemical processes; nuclear reactor system dynamics; plasma physics and controlled thermonuclear fusion; fusion reactor engineering; radioisotope usage and environmental engineering.

Research Facilities

In addition to the facilities available for teaching and research on the campus, certain specialized facilities for research are available through the Joint Center for Graduate Study, at Richland, Washington.

Financial Aid

The department has substantial financial support for qualified graduate students. Traineeships, scholarships, fellowships, research assistantships, and teaching assistantships are awarded to aid students in meeting the expenses of study and research in nuclear engineering.

Correspondence and Information

Chairperson
Department of Nuclear Engineering, BF-10

Faculty

Chairperson

Gene L. Woodruff

Professors

Albrecht, Robert W.,* (Electrical Engineering),† Ph.D., 1961, Michigan; reactor dynamics and stochastic processes, two-phase flow characterization, reactor instrumentation.

Babb, Albert L.,* (Chemical Engineering),† Ph.D., 1951, Illinois; reactor engineering, bionuclear engineering.

Garlid, Kermit L.,* (Chemical Engineering),† Ph.D., 1961, Minnesota; nuclear fuel cycles and radioactive-waste management, process dynamics, reactor safety analysis.

Kosaly, George,* (Mechanical Engineering),† Dsc., 1956, *Budapest*; reactor dynamics (especially noise); two-phase flow characterization, applications of theory of stochastic processes in physics and engineering.

McCormick, Norman J.,* *Ph.D., 1965, Michigan*; reliability and risk analysis, reactor physics, neutron and photon transport.

Pietrzyk, Z. Adam* (Research), Ph.D., 1966, Polish Academy of Science; plasma diagnostics, laser plasma interaction, linear thermonuclear reactors.

Ribe, Fred L.,* Ph.D., 1951, Chicago; experimental and theoretical plasma physics, fusion reactor design.

Robkin, Maurice A.,* (Environmental Health), Ph.D., 1961, Massachusetts Institute of Technology; radiation dosimetry, environmental impact of energy production.

Vlases, George C.,* (Physics), Ph.D., 1963, California Institute of Technology; plasma physics and controlled fusion, magnetohydrodynamics, laser-plasma interactions.

Woodruff, Gene L.,* Ph.D., 1966, Massachusetts Institute of Technology; neutronics experiments, fusion reactor technology.

Associate Professor

Reynolds, Larry O.* (Research), Ph.D., 1975, Washington; radiative transport, electromagnetic scattering and wave propagation, biomedical engineering.

Assistant Professor

Brooks, Robert D. (Research), Ph.D., 1979, Washington; experimental plasma physics, laser-plasma interactions, plasma diagnostics.

Course Descriptions

Courses for Undergraduates

NUC E 444 Nuclear Materials (3) Sp *Miller* Structure, properties, and performance of materials in nuclear reactor applications; engineering requirements and selection of materials for reactors; technology of materials for reactor fuels, moderators, shields, control elements, and structural components; corrosion and oxidation; effects of radiation on the structure and properties of materials. Offered jointly with MSE 444. Prerequisite: ENGR 170 or equivalent or permission of instructor.

NUC E 484 Introduction to Nuclear Engineering (4) A *McCormick, Woodruff* Introductory course in nuclear engineering for seniors, graduate students, and practicing engineers. The course is designed to demonstrate the application of the principles of nuclear science to the processes associated with the release, control, and utilization of all forms of energy from nuclear sources, including nuclear reactors; elementary nuclear reactor theory; control of nuclear reactors; thermonuclear reactions. Prerequisite: MATH 238 or permission of instructor.

NUC E 485 Nuclear Instruments (3) W *Woodruff* Principles, measurements, and detection of various types of radiations encountered in nuclear energy systems. Demonstrations include the use of Geiger, proportional, and scintillation detectors; ionization chambers; analog-digital data logging equipment; and multichannel analyzers. Sources of radiation include the University's nuclear reactor and pulsed neutron generators. Prerequisite: junior standing.

NUC E 486 Nuclear Power Plants (3) Sp *Babb* Applications of nuclear energy to power generation. Discussions of various types of nuclear reactor systems include pressurized water, boiling water, high-temperature gas-cooled, sodium graphite, as well as advanced converter and breeder reactors. Particular attention is given the problem of world energy resources and the United States and world views of the availability and consumption of nuclear fuels. Various design concepts including radiation shielding and materials selection are considered. Licensing and safety aspects of nuclear steam supply systems are discussed in some detail. The economics of nuclear power is emphasized throughout the course. Prerequisite: senior standing; recommended: 484.

NUC E 488 Nuclear Systems Design I (4) A *Chalk* Design laboratory involving the synthesis of nuclear systems, engineering analysis, material specifications, and economics to meet the design specifications for modern nuclear industry applications. Prerequisite: 484 or permission of instructor.

NUC E 490 Reliability and Risk Analysis (3) W *McCormick* Principles of reliability and safety analysis, including fault-tree and event-tree construction; introduction to fundamental concepts in risk analysis; risk analyses for nuclear reactors of various types, nuclear materials transportation, and nuclear-waste disposal. Prerequisite: senior standing or permission of instructor.

NUC E 498 Special Topics in Nuclear Engineering (1-6, max. 6) AWSpS Discussions, conferences, and lectures on topics of current interest in nuclear fission and fusion engineering. Prerequisite: permission of department Chairperson.

NUC E 499 Undergraduate Research Projects (1-6, max. 6) AWSpS Independent research projects in nuclear engineering. Prerequisite: permission of department Chairperson.

Courses for Graduates Only

NUC E 500 Nuclear Reactor Theory (5) A *Albrecht, McCormick* Fission reactor theory covering interactions of neutrons with matter; the angle-dependent transport equation and reduction to specialized forms; multigroup, multiregion diffusion theory; calculations of eta, thermal utilization, and resonance escape probabilities; reactor kinetics; perturbation theory. Prerequisites: PHYS 327 and MATH 238, or equivalent.

NUC E 506 Nuclear Engineering Laboratory (4) Sp *Robkin, Woodruff* Advanced laboratory course in which experimental research is conducted. Selected experiments are performed that involve the use of such equipment as the reactor as a neutron and gamma ray source, pulsed neutron generator, helical neutron monochrometer, neutron diffraction spectrometer, pile oscillator, pile-noise analysis equipment, time-of-flight equipment, and analog and digital computers. Prerequisite: 485 or permission of instructor.

NUC E 510 Nuclear Reactor Engineering (3) A *Babb, Garlid* Advanced course in engineering analysis of nuclear reactor systems. The course covers core design methods; heat generation and distribution in nuclear reactor systems; the removal and utilization of heat for power production; fuel cycles; shielding of nuclear radiations, safety analysis and licensing procedures. Prerequisite: 500, which may be taken concurrently, or permission of instructor.

NUC E 512 Nuclear System Design (4) W Design laboratory involving the synthesis of reactor theory, engineering analysis, material specifications, and economics in the conceptual and preliminary designs of systems, facilities, or processes associated with nuclear fission and fusion devices. Projects are selected from topics of current interest, and one is usually engaged by team effort. Prerequisite: 510 or permission of departmental adviser.

NUC E 521, 522, 523 Graduate Seminar (1,1,1) A,W,Sp Offered on credit/no credit basis only.

NUC E 524 Seminar in Nuclear Systems Analysis (1) AWSp Studies of recent advances in nuclear systems analysis with students, faculty, and visiting scientists and engineers reporting on recent research and publications. Only open to students having a master's degree or equivalent. Offered on credit/no credit basis only.

NUC E 530 Nuclear Reactor Statics (4) Sp *McCormick* Emphasis on methods for calculation of neutron and gamma-ray distributions in nuclear reactors and shields. Covers the linear Boltzmann equation and the spherical harmonics, discrete ordinate, and Monte Carlo techniques. Explicit solutions to simple transport problems are obtained. Prerequisite: 500 or permission of instructor.

NUC E 540, 541 Health Physics I, II (3,3) W,Sp *Robkin* Physical basis of the quantification of the exposure to ionizing radiation. Includes mathematics and physics of sources, interactions, spectrometry and dosimetry of ionizing radiation. Offered jointly with RAD S 540, 541.

NUC E 542 Environmental Impact of Radioactivity (3) *Robkin* Dispersion, rate, and environmental significance of radionuclides released into environment. Includes dispersion, deposition, environmental transport, uptake, biological effects, protection from, and regulations relating to, radionuclides released into environment. Examples taken from academic, research, and industrial sources with emphasis on central station nuclear power plants. Offered jointly with RAD S 542.

NUC E 556 Introduction to Plasma Theory (4) W *Ribe, Vlases* Review of electromagnetic theory, dynamics of charged particles in electromagnetic fields, development of plasma fluid equations from kinetic theory, plasma transport theory, with examples drawn principally from the field of controlled nuclear fusion.

NUC E 557 Plasma Theory II (3) Sp *Ribe, Vlases* Magnetohydrodynamic equilibrium and stability, waves in plasmas, heating techniques. Applications primarily to magnetic fusion research. Prerequisite: 556 or permission of instructor.

NUC E 558 Plasma Kinetic Theory (3) *Ribe, Vlases* Collisionless Boltzmann (Vlasov) equation, oscillations and instabilities in homogeneous and inhomogeneous plasmas, quasilinear diffusion, wave-particle interactions, collisional Boltzmann (Fokker-Planck) equation, transport problems of full ionized plasmas. Prerequisites: 556, 557, or permission of instructor. (Offered even-numbered years.)

NUC E 560 Nuclear Reactor Dynamics (4) W *Albrecht* Nuclear reactor dynamic equations, delayed neutron representations, response of reactors to various perturbations, operational techniques of system analysis, feedback mechanisms, stability criteria, power coefficients. Prerequisites: 500, MATH 427, 428, or permission of instructor.

NUC E 565 Fusion Reactor Fundamentals (3) A *Ribe, Woodruff* Introductory course covering the basic engineering features of thermonuclear-driven power plants. After a brief description of the fundamental physics underlying fusion processes, the emphasis is on those areas currently presenting the greatest technological obstacles to development of economic fusion power, such as materials problems, magnet design, and nuclear heating. Prerequisite: PHYS 327 or permission of instructor.

NUC E 566 Fusion Reactor Engineering (4) Sp *Ribe* Physical and technological aspects of large fusion experiments and conceptual reactors based on the Tokamak, magnetic-mirror, stellarator, and inertial fusion concepts. One hour per week devoted to computer instruction, with application to a significant fusion reactor problem. Prerequisites: 556, 565, or permission of instructor.

NUC E 588 Nuclear Fuel Management (3) Sp *Garlid* Technical and economic principles for management of nuclear fuels, including: energy resources, fuel cycle schemes, fuel cycle economics, irradiated fuel processing, isotopic separations, utilization of fission products and other radioactive isotopes. Prerequisite: 484 or permission of instructor.

NUC E 599 Special Topics in Nuclear Engineering (*) AWSp Discussions and readings of topics of current interest in the field of nuclear engineering research. Subject matter may include reactor fuels and materials, reactor dynamics and control, instrumentation, thermonuclear processes, direct conversion problems. Prerequisite: permission of department Chairperson.

NUC E 600 Independent Study or Research (*) AWSpS

NUC E 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

NUC E 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Ocean Engineering

326 Mechanical Engineering

An interdisciplinary ocean engineering program has been established to provide students an opportunity to acquire education and training needed to pursue careers in marine-related industries. Its location at the University provides a complete range of marine environments for testing and research. Courses offered both within the College of Engineering and outside the college provide students with a broad range of opportunities for study and research.

Undergraduate Program

Students may follow a program of study in ocean engineering through a departmental degree program or by entering the interdisciplinary Bachelor of Science in Engineering degree program. The B.S.E. program offers students flexibility in selecting courses appropriate to their degree objectives and integrating these courses into a carefully planned program. Areas of concentration include: coastal and harbor engineering; marine structures; social, legal, and economic dimensions of ocean engineering; and instrumentation, data gathering, and analysis.

Graduate Program

Ocean Engineering is an interdisciplinary program offering the graduate student a wide variety of opportunities in pursuing the course work and research required for an advanced degree.

A graduate student may elect either the Master of Science in Engineering (M.S.E.) degree offered by the College of Engineering or work toward a degree in one of the established departments of the College of Engineering. The objective is to provide a coherent path toward the master's degree by permitting the student to formulate a program with special emphasis on his or her fields of interest. In addition to the general admission requirements of the University, admission to the M.S.E. degree program ordinarily requires a baccalaureate degree in engineering, mathematics, or science with a junior-senior grade-point average of at least 3.00 or better. A minimum of 39 credits is required for the M.S.E. degree, normally comprising 30 credits of approved course work and 9 credits devoted to a thesis.

Students who wish to pursue a Ph.D. program must be admitted to one of the departmental programs.

Research Facilities

The diverse ocean engineering research program is housed in various areas around the campus. At the Applied Physics Laboratory, the emphasis is on underwater acoustics and instrumentation research. Wave channels and hydraulic modeling are the main facilities in use at the Harris Hydraulics Laboratory. The Mechanical Engineering Building houses computer facilities, including a computer-controlled data-acquisition system and a small laboratory used to support field experiments. A large portion of the laboratory activities involve field experiments. Where wave measurement is required, a mobile semi-submersible wave-measuring platform is available and has been used extensively in conjunction with radio-controlled ship-model tests. Activities undertaken by the faculty include research in development of floating breakwaters, marine acoustics, submarine soil mechanics, marine hydrodynamics, coastal structures, marine materials, and marine transportation safety.

Financial Aid

A limited number of research and teaching assistantships are available. Applications should be submitted to the Director.

Correspondence and Information

Director
Ocean Engineering Program, FU-10

Faculty

Director

Bruce H. Adee

Professors

Childs, Morris E.,* (Mechanical Engineering), Ph.D., 1956, Illinois; fluid mechanics, gas dynamics, turbulent boundary layers.

Ehrenberg, John E.* (Research), (Electrical Engineering), Ph.D., 1973, Washington; communications, signal processing, marine acoustics.

Hawkins, Neil M.,* (Civil Engineering), Ph.D., 1961, Illinois; structures and materials.

Lytle, Dean W.,* (Electrical Engineering), Ph.D., 1957, Stanford; communication and stochastic systems analysis, marine acoustics.

Neco, Ronald E.,* (Civil Engineering), Sc.D., 1958, Massachusetts Institute of Technology; hydraulic engineering

Associate Professors

Acker, William C. (Research), M.S.E.E., 1963, Washington; underwater acoustics, instrumentation.

Adee, Bruce H.,* (Mechanical Engineering), Ph.D., 1972, California (Berkeley); vessel safety and stability, floating structures, waves, ship resistance, model testing.

Calkins, Dale E.* (Research), (Mechanical Engineering), D.Eng., 1976, California (Berkeley); ship hydrodynamics and motions, naval architecture, computer-aided design, and engineering (CAD/CAE).

Sandwith, Colin J.* (Research), (Mechanical Engineering), Ph.D., 1967, Oregon State; corrosion, material science, design, manufacturing.

Sladky, J. F., Jr. (Research), M.S.M.E., 1969, West Virginia; design, propulsion, marine vehicles, power plants.

Assistant Professor

Storch, Richard L.* (Research), (Mechanical Engineering), Ph.D., 1978, Washington; shipyard productivity, vessel safety and stability.

Course Descriptions

Courses for Undergraduates

O ENG 401 Introduction to Ocean Engineering (3) A *Adee* Special design considerations for the ocean environment, including corrosion, biological encrustation, hyperbaric loading, wave, current and tidal forces, as well as various sea floor and coastal conditions. Selected examples of major ocean engineering projects are reviewed with attention given not only to technical function but also to safety and the environmental and social implications of operational failure. Students carry out a project requiring special ocean engineering considerations in design, operation, and maintenance. Prerequisite: MATH 238 or permission of instructor.

O ENG 425 Introduction to Underwater Acoustics (3) A *Ehrenberg, Lytle* Introduction to acoustic propagation, refraction, and reflection in the ocean. Characteristics of transducers, time and frequency representation of acoustic signals, sources and characteristics of acoustic noise and acoustic signal-processing systems. Prerequisite: senior standing in engineering, MATH 238, or permission of instructor.

O ENG 431 Ship Production Systems (3) A *Storch* Introduction of shipyard organization, ship production processes, techniques of production planning and control, role of computer in modern shipbuilding. Principles of advanced shipbuilding, product-oriented work breakdown structure, and zone construction. Offered jointly with MEIE 431. Prerequisites: MEIE 317, 419, or permission of instructor.

O ENG 444 Coastal Engineering I (3) W *Yeh* Linear theory of water waves, wave transformations due to boundary conditions, sediment motion, elementary tidal theory; applications illustrated by laboratory experiments and selected case histories. Offered jointly with CEWA 444. Prerequisite: CIVE 342.

O ENG 450 Marine Corrosion and Its Prevention (3) Sp *Sandwith* Causes and prevention of corrosion damage by marine environments (immersed, tidal, atmospheric). Behavior (pitting, rusting, cracking, fatigue, and fracture) of engineering materials (metals, plastics, and ceramics) in the ocean. Case studies are used to understand methods of reducing corrosion damage by design, materials selection, cathodic protection, coatings, and maintenance. Technical report(s) to be prepared. Prerequisites: senior standing in engineering and M E 343 or equivalent materials course.

O ENG 451 Operations Scheduling and Quality Control (4) AWSp *Storch* Continuous flow, intermittent, and project production processes and tools for managing them. Assembly-line balancing, job shop scheduling, project planning and control, quality assurance, improvement curves, work force scheduling and vehicle scheduling. Offered jointly with OPMGT 450 and MEIE 450. Prerequisite: MEIE 315.

O ENG 490 Naval Architecture (3) A *Adee* Theory of naval architecture; ship's lines, hydrostatic curves, intact and damaged stability, launching. Offered jointly with M E 490. Prerequisite: junior standing in engineering or permission of instructor.

O ENG 491 Naval Architecture (3) W *Adee* Theory of naval architecture; strength, A.B.S. rules, water waves, ship and platform motions. Offered jointly with M E 491. Prerequisite: junior standing in engineering or permission of instructor.

O ENG 492 Naval Architecture (3) Sp *Adee* Theory of naval architecture; dimensional analysis, resistance, model testing, propellers, steering. Offered jointly with M E 492. Prerequisite: junior standing in engineering or permission of instructor.

O ENG 498 Special Topics in Ocean Engineering (1-5, max. 6) AWSpS Special topics in ocean engineering offered with lecture and/or laboratory. Prerequisite: permission of ocean engineering adviser.

Courses for Graduates Only

O ENG 531 Advanced Ship Production Technology (3) W *Storch* Detailed studies of shipyard organization, ship production processes, techniques of production planning and control, and role of the computer in modern shipbuilding. Principles of advanced shipbuilding, product-oriented work breakdown structure, zone construction, and group technology.

O ENG 541 Hydrodynamics in Water Quality (3) W *Nece* Theoretical, field study, and laboratory model approaches to diffusion and dispersion in problems of concern to water resources engineers. Offered jointly with CEWA 541. Prerequisite: CIVE 342 or permission of instructor.

O ENG 544 Coastal Hydraulics (3) Sp *Yeh* Theory of water waves. The classical water-wave problem and approximate solution techniques. Evolution equations for wave systems and their solutions. Stability analysis. Random waves analyzed by time series techniques. Offered jointly with CEWA 544. Prerequisite: familiarity with linear wave theory and FORTRAN.

O ENG 580 Strain Measurements and Instrumentation (3) W Experimental determination of strain under static and dynamic loads; strain gauges; transducers for displacement velocity and acceleration; photoelasticity, brittle coating and other methods; problems of instrumentation, data collection, and analysis of data; use of modern IC electronic components and computers or microprocessors for data collection and analysis. Offered jointly with CESM 580. Prerequisite: graduate standing or permission of instructor.

O ENG 590 Wind, Wave, and Earthquake Response of Structures (3) Sp *Reed* Fundamental principles governing the static or dynamic response of suspended structures, transmission lines, tall stacks, and other flexible structures subject to deflection, overturning, or oscillation as a result of wind, wave, and earthquake action. Offered jointly with CESM 590. Prerequisite: graduate standing in engineering.

O ENG 599 Special Topics in Ocean Engineering (1-5, max. 9) AWSpS Prerequisite: permission of ocean engineering adviser.

Scientific and Technical Communication

Undergraduate Program

An interdisciplinary degree program provides students with the education and training needed for careers in scientific and technical communication. Students with this career goal may earn a Bachelor of Science degree in the College of Engineering or a baccalaureate degree in the General Studies program of the College of Arts and Sciences. Following either of these paths, students meet the general requirements of their respective colleges, acquire a background in science and/or engineering, and combine this with a required set of core courses in scientific and technical communication (19 credits minimum—STC 401, 402, 403, 415, and 495), plus electives in related aspects of communication. For a description of the core and other scientific and technical communication courses, see the course descriptions at the end of this section.

Faculty

Director

James W. Souther

Professors

Souther, James W., M.A., 1948, Washington; communication process and communication in organizations, document design.

White, Myron L. (Emeritus), Ph.D., 1958, Washington; technical editing and publications management.

Associate Professor

Coney, Mary B., Ph.D., 1973, Washington; writing and theories of technical discourse.

Assistant Professors

Farkas, David K., Ph.D., 1976, Minnesota; the composing process, technical writing, editing, document design.

Ramey, Judith A., Ph.D., 1983, Texas; computer documentation, computers and information management.

Lecturers

Spyridakis, Jan, M.A.T., 1972, Washington; technical writing and editing.

Williams, Thomas R., M.C., 1981, Washington; production editing and publications management, science writing.

Course Descriptions

STC 300 Practice in Technical Reporting (1) Application of the fundamentals of technical reporting to the specific reporting activity of students who are enrolled in a laboratory, project, or other designated course in the College of Engineering.

STC 401 Scientific and Technical Writing (4) ASp *Coney, Souther* Principles and practices of writing to communicate scientific and technical information to a variety of readers, including the expert, general scientific and technical reader, manager, and general public. Required of students taking an interdisciplinary degree in scientific and technical communication. Prerequisite: junior standing or permission of instructor. Entry card required.

STC 402 Scientific and Technical Editing (4) AW *Farkas, White* Editorial responsibilities and practice in the communication of scientific and technical information; the editor's role both as editor and as supervisor of publication groups. Required of students taking an interdisciplinary degree in scientific and technical communication. Prerequisite: 401 or permission of instructor.

STC 403 Publication Project Management (4) Sp *Ramey, White* Responsibilities and practice in managing publication projects in scientific and technical organizations. Project design, coordination, production, and evaluation, including planning, organizing, staffing, and directing. Required of students taking an interdisciplinary degree in scientific and technical communications. Prerequisite: 402 or permission of instructor; recommended: 415.

STC 407 Computer Documentation (3) AW *Ramey* Writing documentation for computer hardware, software, and integrated systems. Examines kinds of documentation needed for computer products; introduces use of the computer in its own documentation and resulting innovations in the field. Prerequisites: ENGR 141 or C SCI 201, upper-division standing. Entry card required.

STC 408 Special Documents: Proposals, EIS, and Manuals (3) W *Spyridakis* Preparing special documents with emphasis on writing proposals, EIS, and manuals. Established guidelines and practices, planning, organizing, writing, and submitting the documents. Documents and the decision-making process. Prerequisite: upper-division standing or permission of instructor.

STC 409 Writing for Publication (3) Sp *Coney, Williams* Writing for professional and trade periodicals in science, engineering, and technology: examination of the publication process, including the roles of author, editor, and reviewer; selecting the appropriate periodical; organizing and writing the article. Prerequisite: upper-division standing or permission of instructor.

STC 415 Production Editing (4) AWSp *Farkas, Williams* The editorial role in the preparation of text and visual materials for production (typesetting, layout, printing, binding, distribution). The editor's responsibilities and prerogatives as they relate to those of other professionals in the production phase of the publications field. Offered jointly with CMU 415. Prerequisite: 402 or permission of the instructor.

STC 495 Professional Practice (3-5, max. 10) AWSpS *Farkas, Staff* Supervised internship in a working publications organization approved by the faculty adviser. A minimum of one internship is required of students taking an interdisciplinary degree in scientific and technical communication. Offered on credit/no credit basis only. Prerequisites: 401 and 402 or permission of instructor and approval of faculty sponsor.

STC 498 Special Topics (1-5, max. 10) Special topics in scientific and technical communication to be offered occasionally by permanent or visiting faculty members. May be repeated for credit.

STC 499 Special Projects (2-5, max. 10) AWSpS *Souther* Individual undergraduate projects in scientific and technical communication. Prerequisite: permission of instructor.

College of Forest Resources

Dean

David B. Thorud
102A Anderson

Associate Dean (Academic Affairs)

Thomas R. Waggener
107B Anderson

Associate Dean (Research)

Dale W. Cole
107A Anderson

Founded in 1907, when professional forestry education was in its infancy, the college holds a position of national and international leadership in both instruction and research. Its location in one of the world's largest forest regions provides unique opportunities for field classes and research, actual management of forested lands, exposure to wood-based industries, and awareness of resource-use issues. Enrolled in the college are approximately 250 undergraduate and two hundred graduate students, taught by more than fifty faculty members. Thus, students enjoy small classes and close association with faculty, as well as the diversity and superior facilities of a large university.

College Facilities

The college occupies three buildings: Alfred H. Anderson Hall, the Hugo Winkenwerder Forest Sciences Laboratory, and Julius H. Bloedel Hall. In addition, the Center for Urban Horticulture occupies a plant laboratory and annex, including greenhouse facilities. Thus, the college has excellent areas and equipment for scientific laboratories, classrooms, seminar rooms, special collections, and administrative offices.

The Forest Resources library, a branch of the University's Suzzallo Library, houses more than twenty-six thousand bound volumes and thirty-three thousand pamphlets, reports, and monographs. It also has an excellent collection of approximately twenty-five hundred periodicals and many indexes to current literature in forestry and supporting sciences. Under the nationwide Farmington Plan, sponsored by the Special Library Association, the Forest Resources library has assumed responsibility for collecting foreign material published in the fields of forestry and pulp and paper technology, providing an unusual opportunity for academic research. The Center for Urban Horticulture also maintains a library at the Arboretum. The herbarium supplements forest resources students' fieldwork in dendrology. Containing representative plant material from all parts of the United States, the collection includes dried, mounted specimens of shrubs, hardwood trees, and conifers. Fruit specimens and a complete cone collection of American conifers are maintained apart from the mounted collection. Another herbarium, complete in range plants and maintained by the Department of Botany, is available for use by forest resources students.

The laboratory facilities of the college represent an extensive array of modern equipment for research. The many available research tools include optical equipment, electronic instrumentation for a wide variety of uses, gas chromatographs, spectrophotometers, and physical test equipment. Specific laboratories are designed to study soil chemistry and soil physics, hydrology, polymer chemistry, meteorology, tree physiology, genetics, wood and extractives chemistry, physics of fibrous composites, applied mechanics, wood process technology, pathology, entomology, recreation, horticultural physiology, and horticultural plant materials. The college computing facilities include teletype and cathode-ray-tube terminals and a remote input-output connection with the main University CDC computer. Several research programs at the college also maintain microcomputer systems dedicated to a specific research area.

Institute of Forest Resources

Director

David G. Thorud
102A Anderson

Associate Director

Dale W. Cole
107B Anderson

The Institute of Forest Resources administers the research branch of the college, directing the overall research programs with its related lands and facilities. This includes the McIntire-Stennis Research Program, College Lands (see Field Research Areas and Facilities), Word Processing Unit, Publications, shops and equipment, research and analytical laboratories, computer facilities, external- and internal-funded research, and the production of special reports. The Institute serves to coordinate the submission of research proposals with the faculty, University administration, and federal, state, and private agencies. The employment of graduate and undergraduate students on research is administered by the Institute. Many students earn research and thesis credit toward advanced degrees by working on major forest resources problems supported by grants or contracts.

Research is carried out by the faculty through its divisional affiliation of Forest Resources Management, and Forest Products and Engineering. Present and future research plans include the management of forest stands, multiresource management and planning, forest protection, wildlife management, impacts on forest ecosystems, forest policy, forest logging and engineering, wood science and technology, and pulp and paper. Research in the biological areas, reflecting interests of the faculty members working on highly diverse biological-based investigations, range from basic considerations of plant growth to the application of such information to the analysis of forest ecosystems. Topics of study are selected not only to foster the interests of individuals and groups in the region, but also to promote the scientific community at large. In addition, international research programs of interest to the state of Washington are administered within the Institute.

Research projects include both individual studies and highly interdisciplinary programs. Associated groups support and broaden the interdisciplinary direction of the college, including the Center for Urban Horticulture, National Park Service Cooperative Park Studies Unit, Center for Quantitative Sciences, and the Quaternary Research Center. The college has cooperative agreements with the National Park Service and the U.S. Forest Service to promote collaborative efforts among scientists in research.

The college participates with Cooperative Extension of Washington State University to jointly undertake cooperative extension forestry programs. The primary purpose is to provide educational opportunities for citizens of the state, particularly in the nonindustrial forestry area.

The Office of College Publications oversees the publishing needs of the college, including word processing, graphics, editing, printing, distribution, and sales. Publications are distributed to national and international institutes and libraries as well as to the general public.

Field Research Areas and Facilities

The college field facilities include three major forested areas covering more than ten thousand acres, an arboretum, two reserves, and two cooperative research centers and stations. These lands offer a wide variety of terrestrial and aquatic characteristics favorable to a full range of scientific investigations. They also provide a general natural science laboratory for the many disciplines in the college specifically related to, or concerned with, the research and teaching of natural resources behavioral patterns and management.

The Charles Lathrop Pack Demonstration Forest of approximately 4,100 acres, is located sixty-five miles south of the University, near Eatonville. This forested property is the focal point for on-the-ground academic work in forest management and engineering, both at the undergraduate and graduate levels. Broad forest type and soil type diversity has led to extensive biological, management, and engineering research, much of which may be characterized as a "pioneering effort." A full-time resident staff manages this facility, harmonizing its demonstration objectives with academic and research objectives. Rustic, but comfortable, facilities, which provide housing and support to academic and research programs, also are used extensively for conferences both within and outside the University.

The Lee Memorial Forest, of approximately 160 acres, is located about twenty-two miles northeast of the University near Maltby. This forested property provides valuable academic and research opportunities near the campus. Characterized by forest types and soils common to western Washington lowlands, Lee forest is used extensively for part-day trips and for research and demonstration projects especially useful in a land base where long-term study commitments are difficult to achieve.

The 7,200-acre Gordon D. Marckworth Experimental Forest is managed jointly by the State Department of Natural Resources and the University. About thirty miles from campus and offering a wide variety of forest soil and water conditions, the forest is an ideal site for study and research. Many ponds, beaver dams, streams, and swamps are studied for all types of recreation use, as well as for the operation of programs in ecological and management phases related to the forest resource.

The Allan H. Thompson Research Center in the Cedar River watershed is maintained by the college in cooperation with the water department of Seattle for studies in forest hydrology and mineral cycling in the forest ecosystem.

The Washington Park Arboretum, a two-hundred-acre collection of trees and shrubs growing in a naturalistic setting, is only a fifteen-minute walk from the University campus. Managed and operated by the Center for Urban Horticulture, under an agreement with the City of Seattle Department of Parks and Recreation, the Arboretum contains some fifty-two hundred different kinds of woody plants that are available for research and academic study. The Arboretum was established in 1934 and many of its original specimens are now approaching maturity. Classes in botany, dendrology, horticulture, and landscape architecture make use of the collections, while the grounds are used for studies in soil science, ecology, and various research projects. The Arboretum also serves as an important public service area to the University, offering various formal and informal classes for the general public and, in addition, serving the community as a public park and as open space.

The Union Bay facility, a fifty-five-acre tract adjacent to Lake Washington and the main campus, is devoted to research and teaching in the Center for Urban Horticulture. It includes a research nursery area, research arboretum, and a large ecological grassland.

A 130-acre property on Bainbridge Island in the middle of Puget Sound, the Bloedel Reserve is managed through the Center for Urban Horticulture for the study of plant/human interactions. Consisting of both landscaped and natural areas, it is a focus for research and teaching programs of the University in landscape architecture, pest management, and urban horticulture.

Forest Resources Management Division

Chairperson

Robert G. Lee
123J Anderson

Taught by the Forest Resources Management Division are basic and applied subject matter in social sciences, management techniques, forest biology, and quantitative sciences for all curricula, as well as specific curricula in forest management. Basic subjects in ecology, including plants, animals, climate, and soils, also are included in the teaching responsibility of this division.

Forest Products and Engineering Division

Chairperson

Gerard F. Schreuder
296 Bloedel

Courses for which the Forest Products and Engineering Division is responsible include those in wood utilization and properties, the organization of the wood-using industry, and principles of timber harvest for all curricula, as well as specific programs of study in pulp and paper technology, wood and fiber science, and logging engineering.

Undergraduate Program

Courses of Study

In addition to the University's general admission requirements, students who plan to enter the College of Forest Resources should have completed Algebra III (intermediate), trigonometry, and at least one unit each of biological and physical science.

The College of Forest Resources offers four undergraduate curricula leading to a Bachelor of Science in Forest Resources degree: Forest Resources Management, Logging Engineering, Pulp and Paper Science, and Wood Science and Technology.

The first two years of study emphasize general preparation, followed by an upper-division professional program. Each curriculum contains a number of elective credits selected at the student's discretion. Students are encouraged to take a number of these credits outside the college to broaden their preparation. An honors program in each curriculum also is available to qualified students. Information is available from the honors program adviser.

In addition to University regulations concerning requirements and grading, college regulations state that no required course may be taken on a satisfactory/not satisfactory basis. Some classes include field trips, laboratory supplies, or material duplication at extra expense to the students.

Students who intend to complete curricula other than Pulp and Paper Science are classified as premajors until they have completed 75 credits of required course work with a minimum cumulative grade-point average of 2.00. At this point, subject to completion of lower-division requirements, students may be admitted to a specific upper-division curriculum. Students intending to complete the Pulp and Paper Science curriculum should seek admission to the specific curriculum as soon as they are admitted to the college.

Students interested in forest resource management or logging engineering should note that upper-level course work may be taken only after completion of the required field camp at Pack Forest.

Students planning to enter the college from community colleges or from other universities should check with their advisers to ensure their prior programs of study include the proper prerequisites.

Student advising is the joint responsibility of the College Advising Center, 116 Anderson, and the divisions. Student files are located in the advising center, and the curriculum adviser is available to assist with scheduling and questions.

Pack Forest Residential Field Classes

Students enrolled in the forest resource management and logging engineering curricula must attend the Pack Forest program at the end of the sophomore year. This program is conducted as a field residential program at the Charles Lathrop Pack Demonstration Forest near LaGrande, sixty-five miles from Seattle. Classes include field measurements, surveying and drafting, and forest ecology.

Students taking course work at Pack Forest must live at the field residential station, paying room-and-board charges in addition to regular tuition. Students may apply for admission to the Pack Forest program approximately two months preceding the quarter they wish to attend. Admission is based on completion of lower-division course work and available space. Application forms and information are available from the curriculum adviser, 116 Anderson.

Scholarships and Financial Aid

Information about undergraduate scholarships and awards that are available specifically to students in the College of Forest Resources may be obtained from the Office of Student Financial Aid, 105 Schmitz, or from the Student Services Office, 116 Anderson. The Washington Pulp and Paper Foundation, Inc., provides scholarships for students preparing for careers in the pulp and paper industry,

with awards based on professional promise and scholastic achievement. The foundation is supported by companies of the pulp and paper industry and by supplier companies. Information may be obtained from Prof. William T. McKean, 344 Bloedel.

Accreditation

The curricula in forest resource management and logging engineering are accredited by the Society of American Foresters (SAF). Other curricula include electives that may be used toward qualification for SAF and the Forester rating for the United States Civil Service. Students should consult with advisers in planning their schedules to include the specific class requirements for SAF and civil service qualification.

Employment

The college provides assistance to its majors in obtaining summer employment while in school and permanent employment upon graduation. Summer work may be available through federal and state agencies and in the numerous private companies in the wood-using industry of the region. Although field experience is not required for graduation, students are strongly urged to seek summer employment relevant to their major and career goals. As in any applied technical field, practical experience is as important as academics in preparing for a professional career.

In the description of courses of study listed below, explanations for footnotes are found at the end of the curricula listing.

Forest Resource Management Curriculum

LOWER-DIVISION REQUIREMENTS

Forest Resources—FOR M 100, Introduction to Forest Resources Management (5 credits); FOR M 250,[3] Computer Programming (4); FOR M 252, Introduction to Natural Resources Sociology (3); FOR B 300, Dendrology (4). *Mathematics*[1]—Q SCI 290, Introduction to Mathematics for Biologists (4); Q SCI 291, Analysis for Biologists (4); Q SCI 381, Introduction to Probability and Statistics (5). *Humanities*—ENGL 181,[4] Expository Writing (5); SPCH 220, Introduction to Public Speaking (5). *Physical Sciences*—CHEM 101, General Chemistry (5); CHEM 102, General and Organic Chemistry (5); PHYS 114, General Physics (4); PHYS 117, General Physics Laboratory (1). *Earth Science*[5]—(5). *Social Sciences*—ECON 200, Introduction to Microeconomics (5); elective[6]—(5). *Biological Sciences*—BIOL 101, General Biology (5-); BIOL 102, General Biology (-5). *Electives*—(11).

UPPER-DIVISION REQUIREMENTS

At Pack Forest—FOR P 340, Forest Surveying and Drafting (5 credits); FOR M 360, Forest Mensuration I—Field Studies (5); FOR B 320, Forest Community Ecology (5). *Core Upper Division*—FOR B 321, Silvics (3); FOR B 322, Silvicultural Methods (3); FOR B 310, Forest Soils (4); FOR M 362, Aerial Photos in Forestry (3); FOR M 365, Forest Economics (5); FOR M 361, Forest Mensuration II—Methods (3); FOR M 370, Forest Policy, Law, and Planning (3); FOR P 304, Wood Properties and Products (3); FOR B 350, Wildlife Biology and Conservation (3); FOR M 351, Introduction to Wildland Recreation (3); FOR M 469, Forest Resources Management Case Studies (5).

Forest Land Use Planning Option

Political Science—POL S 452, Political Processes and Public Opinion in the U.S. (5 credits) or POL S 465, Law and Public Policy in the U.S. (5). *Forest Resources*—FOR M 307, Environmental Impact Assessment and Regulation in Forest Resource Management (3); FOR M 355, Resource Planning Processes (3); FOR M 366, Quantitative Methods in Forest Resource Management (3); FOR M 368, Forest Regulation (3); FOR M 460, Economics of Forest Use (3); FOR M 482,[7] Forest Land Use Case Studies (4); FOR B 311, Soils and Land Use (3); FOR P 415, Applied Forest Hydrology (4); FOR B 333, Forest Protection (4). *Electives*—(1).

Timber Management Option

Protection Block—(two of three courses) FOR M 430, Introduction to Wildland Fire Management (3 credits); FOR B 432, Forest Pathology (4); FOR B 435, Forest Entomology (3). *Silviculture-Soils Block*—(two of four courses) FOR B 422, Reproduction Methods in Silviculture (3); FOR B 429, Intermediate Operations in Silviculture (3); FOR P 415, Applied Forest Hydrology (4); FOR B 418, Forest Soil Management (3). *Other Required Courses*—FOR P 300, Timber Harvesting Management (3); FOR M 366, Quantitative Methods in Forest Resource Management (3); FOR M 368, Forest Regulation (3); FOR M 466, Economics of Timber Production (3); FOR M 468, Timber Resources Management Case Studies (5). *Electives*—(5-7).

Wildland Recreation Option

Forest Resources—FOR M 353, Interpreting the Environment (5 credits); FOR M 454, Advanced Park and Recreation Management (3); FOR M 355, Resource Planning Processes (3); FOR M 460, Economics of Forest Use (3); FOR M 452, Sociology of Leisure and Outdoor Recreation (3); FOR B 311, Soils and Land Use (3); FOR M 450, Natural Resources Law Enforcement (2); FOR B 333, Forest Protection (4). *Wildland Recreation Block*—(one of three courses) FOR M 453, Advanced Environmental Interpretation (5); FOR M 456, Wilderness Preservation and Management (3); FOR M 455, Advanced Outdoor Recreation Planning: Regional (5). *Electives*—(0-2).

Silviculture and Protection Option

Protection Block—FOR M 430, Introduction to Wildland Fire Management (3 credits); FOR B 432, Forest Pathology (4); FOR B 435, Forest Entomology (3). *Forest Soils Block*—(one course) FOR B 418, Forest Soil Management (3); FOR P 415, Applied Forest Hydrology (4). *Silviculture Block*—(two of three courses) FOR B 422, Reproduction Methods in Silviculture (3); FOR B 429, Intermediate Operations in Silviculture (3); FOR B 427, Forest Genetics (3). *Miscellaneous Block*—(one course) FOR B 420, Forest Chemicals (3); FOR B 326, Range and Wildlife Habitat (3). *Timber Harvesting*—FOR P 300, Timber Harvesting Management (3). *Case Study*—FOR M 468, Timber Resources Management Case Studies (5). *Electives*—(5-6).

Urban Forestry Option

Forest Resources—FOR B 420, Forest Chemicals (3 credits); FOR B 430, Silvicultural Methods for Special Uses (3); FOR M 307, Environmental Impact Assessment and Regulation in Forest Resource Management (3); BOT 331, Ornamental Plants (3); L ARC, 421, Landscape Horticulture (3); FOR B 333, Forest Protection (4); FOR M 455, Advanced Outdoor Recreation Planning: Regional (5); URB P 481, Legal Basis for Planning (3). *Administration*—A ORG 440, Organization Theory (3). *Electives*—(6).

Student-Specific Option

Students desiring to pursue an option other than those established for the Forest Resources Management curriculum should discuss their interests with members of the faculty. Upon sponsorship of two members of the faculty, the student shall submit to the associate dean of instruction a proposed program of study consisting of at least 30 credits of course work. Upon approval by the associate dean, a copy of the approved program is returned to the student and a copy placed in the student's file in the College Advising Center. This program is binding as a graduation requirement in lieu of one of the specified options. All other requirements of the curriculum, including the core requirements and senior case study, must be satisfied.

Pulp and Paper Science Curriculum

LOWER-DIVISION REQUIREMENTS

Chemistry—CHEM 140, General Chemistry (4 credits); CHEM 150, General Chemistry (4); CHEM 151, General Chemistry Laboratory (2); CHEM 160, General Chemistry (4); CHEM 231, Organic Chemistry (3); CHEM 232, Organic Chemistry (3); CHEM 241, Organic Chemistry Laboratory (3). *Mathematics*—MATH 124, Calculus With Analytic Geometry (5); MATH 125, Calculus With Analytic Geometry (5); MATH 126, Calculus With Analytic Geometry (5); MATH 238, Elements of Differential Equations (3); Q SCI 381, Introduction to Probability and Statistics (5). *Physics*—PHYS 121, Mechanics (4); PHYS 122, Electromagnetism and Oscillatory Motion (4); PHYS 123, Waves (4). *Engineering*—ENGR 141, Introductory FORTRAN Programming (4); ENGR 260, Thermodynamics (4). *Forest Resources*—FOR P 102, Introduction to Pulp and Paper Manufacture (3); FOR P 205, Pulp and Paper Processes Analyses (3). *Social Sciences/Humanities*—ENGL 181, Expository Writing (5). *Electives*[9]—(13).

UPPER-DIVISION REQUIREMENTS

Chemistry—CHEM 350, Elementary Physical Chemistry (3 credits); CHEM 351, Elementary Physical Chemistry (3). *Chemical Engineering*—CH E 310, Material and Energy Balances (4); CH E 330, Transport Processes I (4); CH E 340, Transport Processes II (4); CH E 436, Chemical Engineering Laboratory I (3). *Forest Resources*—FOR P 400, Wood and Fiber Structure (5); FOR P 403, Fibrous Structure and Rheology I (3); FOR P 406, Wood Chemistry I (3); FOR P 407, Wood Chemistry I Laboratory (2); FOR P 476, Pulping and Bleaching Processes (3); FOR P 477, Papermaking Processes (3); FOR P 478, Pulp and Paper Laboratory (2); FOR P 479, Pulp and Paper Laboratory II (2); FOR P 481, Pulp and Paper Unit Operations (3); FOR P 482, Pulp and Paper Process Design and Economics (3); FOR P 485-, Undergraduate Research (1-1-1); FOR P 488, Polymer Chemistry (3); FOR P 497, Pulp and Paper Internship I (1); FOR P 498, Pulp and Paper Internship II (1); FOR B 323, Forest Biology I (3). *Social Sciences/Humanities*—ECON 211, General Economics (3). *Electives*[8]—(8). *Technical electives*—(18).

Logging Engineering Curriculum

LOWER-DIVISION REQUIREMENTS

Forest Resources—FOR M 100, Introduction to Forest Resources Management (5 credits); FOR M 250, Computer Programming (4); FOR B 310, Forest Soils (4); FOR B 300, Dendrology (4); FOR P 243, Mechanics in Forestry (4); FOR P 377, Materials Science in Forestry (4); FOR P 343, Introductory Soil Mechanics (3). *Mathematics*—MATH 124, 125, 126, Calculus With Analytic Geometry (5, 5, 5); Q SCI 381, Introduction to Probability and Statistics (5). *Humanities*—ENGL 181, Expository Writing (5). *Physical Sciences*—CHEM 101, General Chemistry (5); PHYS 114, 115, General Physics (4, 4); PHYS 117, 118, General Physics Laboratory (1, 1). *Social Sciences*—ECON 200, Introduction to Microeconomics (5). *Biological Sciences*—BIOL 101-102, General Biology (5-5). *Pack Forest Field Studies*—FOR P 340, Forest Surveying and Drafting (5); FOR M 360, Forest Mensuration I—Field Studies (5); FOR B 320, Forest Community Ecology (5). *Engineering Sciences*—CIVE 213, Plane Surveying (3); ENGR 123, Introduction to Engineering Graphics (2); GEOL 205, Physical Geology (5).

UPPER-DIVISION REQUIREMENTS

Forest Resources—FOR B 321, Silvics (3 credits); FOR B 322, Silvicultural Methods (3); FOR P 342, Forest Road Engineering (4); FOR P 344, Hydraulics for Forest Roads (3); FOR P 440, Construction (4); FOR M 370, Forest Policy, Law, and Planning (3); FOR M 365, Forest Economics (5); FOR M 362, Aerial Photos in Forestry (3); FOR P 341, Forest Harvesting (4); FOR M 361, Forest Mensuration II—Methods (3); FOR P 441, Forest Engineering (5); FOR P 443, Safety Practices in Forest Industries (1); FOR P 442, Mechanics in Logging and Construction (4); FOR M 368, Forest Regulation (3); FOR P 445, Management Science in Logging Engineering (4); FOR P 446, 447, 448, 449, Senior Forest Engineering Field Studies (2, 5, 5, 3). *Mathematics*—Q SCI 392, Techniques of Applied Mathematics in Biology I (3). *Engineering*—MEIE 411, Engineering Economy (3). *Electives*—(9).

Wood Science and Technology Curriculum

LOWER-DIVISION REQUIREMENTS

Forest Resources—FOR M 100, Introduction to Forest Resources Management (5 credits); FOR M 250,[3] Computer Programming (4); FOR B 323, Forest Biology I (3); FOR P 374, Wood Utilization (3). *Mathematics*[1]—Q SCI 290, Introduction to Mathematics for Biologists (4); Q SCI 291, Analysis for Biologists (4); Q SCI 292, Analysis for Biologists (4); Q SCI 381, Introduction to Probability and Statistics (5). *Physical Science*—CHEM 101, General Chemistry (5); CHEM 102, General and Organic Chemistry (5); PHYS 114, 115, General Physics (4, 4); PHYS 117, 118, General Physics Laboratory (1, 1); ENGR 123, Introduction to Engineering Graphics (2). *Biological Sciences*[10]—BOT 110, Plants in the Human Environment (5). *Social Sciences/Humanities*—ENGL 181, Expository Writing (5); ECON 200, Introduction to Microeconomics (5); electives[11]—(8). *Electives*—(11).

UPPER-DIVISION REQUIREMENTS

Forest Resources—FOR P 243, Mechanics in Forestry (4 credits); FOR P 302, Pulp and Paper Technology (4); FOR P 375, Wood Utilization Laboratory (2); FOR P 377, Materials Science in Forestry (4); FOR P 400, Wood and Fiber Structure (5); FOR P 401, The Physics of Wood and Fiber Composites (4); FOR P 406, Wood Chemistry I (3); FOR P 407, Wood Chemistry I Laboratory (2); FOR P 421, Quality and Production Control in Wood Processing (3); FOR P 422, Wood Process Models (3); FOR P 470, Forest Products Protection (3); FOR P 472, Gluing Process Technology (3); FOR P 473, Plywood and Board Processes (4); FOR P 475, Wood Drying Technology (3); FOR P 485-, Undergraduate Research (1-1-1); FOR M 465, Forest Finance and Accounting (3); HRMGT 301, Personnel Systems and Industrial Relations (3); MEIE 411, Engineering Economy (3); MEIE 414, Industrial Safety (2). *Professional Option*—(21). *Electives*—(7).

Industrial Engineering Option

21 credits from the following list, which have been previously approved by faculty adviser, are required. *Physics*—PHYS 116, 119, General Physics and Laboratory (4, 1). *Engineering*—ENGR 331, Advanced Scientific and Technical Writing (3). *Forest Resources*—FOR P 341, Timber Harvesting (4); FOR P 410, Energy From Wood (3). *Quantitative Science*—Q SCI 482, Statistical Inference in Applied Research (5); Q SCI 483, Statistical Inference in Applied Research (5); Q SCI 391, Introduction to Matrices and Their Applications (3); Q SCI 392, Techniques of Applied Mathematics in Biology I (3). *Mechanical Engineering/Industrial Engineering*—M E 304, Manufacturing Processes (3), MEIE 315, Statistical Analysis of Engineering Measurements (3); MEIE 410, Industrial Organization and Management (3); MEIE 317, Work Systems Design (4); MEIE 414, Industrial Safety (2).

Science Option

21 credits from the following list, which have been previously approved by faculty adviser, are required. *Engineering*—ENGR 331, Advanced Scientific and Technical Writing (3). *Forest Resources*—FOR P 403, Fibrous Structure and Rheology I (3); FOR P 410, Energy From Wood (3); FOR M 368, Forest Regulation (3). *Quantitative Science*—Q SCI 482, Statistical Inference in Applied Research (5); Q SCI 483, Statistical Inference in Applied Research (5); Q SCI 391, Introduction to Matrices and Their Applications (3); Q SCI 392, Techniques of Applied Mathematics in Biology I (3).

Business Option

21 credits from the following list, which have been previously approved by faculty adviser, are required. *Administration*—A ORG 301, Behavioral Science and Administration (4); A ORG 420, Human Relations in Organizations (4); A ORG 440, Organization Theory (3); MEIE 410, Industrial Organization and Management (3) *Business Economics and Finance*—B ECN 300, Managerial Economics (3). *Marketing*—MKTG 300, Marketing Concepts for Nonbusiness Majors (4). *Others*—FOR P 443, Safety Practices in Forest Industries (1); MEIE 420, System Safety and Reliability Engineering (4).

Forestry Option

21 credits from the following list, which have been previously approved by faculty adviser, are required. FOR B 300, Dendrology (4); FOR B 310, Forest Soils (4); FOR B 320, Forest Community Ecology (5); FOR B 321, Silvics (3); FOR P 340, Forest Surveying and Drafting (5); FOR P 341, Timber Harvesting (4); FOR M 360, Forest Mensuration I—Field Studies (5); FOR M 365, Forest Economics (5); FOR M 466, Economics of Timber Production (3).

Explanation of Requirements

1. MATH 105 for Q SCI 290, MATH 124 for Q SCI 291, or equivalent mathematics courses may be substituted.
2. BOT 110, 113 may be taken by transfer students.
3. Students may substitute ENGR 141, Q METH 200, FISH 340, FOR M 470, or equivalent course.
4. Or from ENGL 111, 121, 122, or ENGR 130, 331.
5. From GEOL 101, 205, 311, or ATM S 101, 301.
6. POL S 202 is recommended.
7. FOR M 468, if FOR M 482 is not offered.
8. A minimum of 22 credits must be taken in the humanities or social sciences, or both, as well as 16 credits of approved sciences and engineering electives, of which 6 must be in laboratories.
9. Or ENGR 210.
10. Or BIOL 101-102 or 210.
11. From the social science section of the College of Arts and Science distribution list.

Graduate Programs

Thomas R. Waggener, Graduate Program Coordinator

Graduate programs in forest resources are designed to accommodate a wide range of education and career objectives. A student may concentrate on development of advanced professional skills and knowledge or on exploration of sciences basic to forest resources.

Graduate programs offered in forest resources lead to degrees of Master of Forest Resources, Master of Science, and Doctor of Philosophy. Graduate students may center their graduate study in one of the college divisions and in the special fields of study and research within the division.

Master of Forest Resources Degree

The Master of Forest Resources degree is a professional degree offered for the student who desires to acquire a greater competence in a specific subject area of forest resources. Course work may be in forest resources and in appropriate natural and social sciences. Both thesis and nonthesis options are available. A foreign language is not required.

Master of Science Degree

The Master of Science degree is a learned degree, often precursory to the Doctor of Philosophy degree. Its requirements include a minor of at least 9 credits in a field outside the major. Both thesis and nonthesis options are available. The nonthesis program requires at least 6 credits of research. A foreign language is not required.

Doctor of Philosophy Degree

The Doctor of Philosophy degree may be preceded by baccalaureate education, either in forest resources or in another discipline. The program comprises an appropriate selection of courses in forest resources and in the related natural and social sciences. The program requires passage of the General Examination in forest resources, the necessary research, and completion of the dissertation. A minimum of two years of residence at the University also is required. The time necessary to complete the degree requirements depends upon the thoroughness and applicability of prior course work. Reading proficiency in one foreign language may be required by the Supervisory Committee when the language is essential to the student's program of study.

Midcareer Education

A program has been established in the college for professionals in the field who, on a part- or full-time basis, take graduate work at midcareer to prepare themselves for new or broader responsibilities. Under this program, courses can be taught in a more flexible time arrangement to meet the constraints of participants and can be tailored to specific career needs. Professionals interested in midcareer graduate work should contact the graduate program coordinator.

Program Areas

Graduate education is offered through the academic divisions. The programs cover the following areas: forest industries management, quantitative resource management, forest resource management, forest economics and finance, sociology and leisure studies, land use planning and resource policy, resource and environmental interpretation, outdoor recreation management, silviculture, forest soils, forest genetics, forest entomology, forest pathology, forest ecology, tree physiology, forest hydrology and meteorology, wildlife science, ecosystem analysis, wood science, pulp and paper technology, forest engineering, wood utilization and technology, and urban horticulture.

Other special programs can be developed in response to particular graduate needs. In all areas of study, the college maintains a close working relationship with faculties of other colleges and schools throughout the University, including service on graduate committees. Students who prefer an interdisciplinary program of graduate study are encouraged to devise, with the assistance of faculty, a program in the appropriate specializations. Such programs are a long-standing tradition in the college.

Admission Qualifications, Background

A student who intends to work toward an advanced degree must apply for admission to the Graduate School and must meet the requirements set forth by the Graduate School and the College of Forest Resources.

Basic requirements for admission to the Graduate School are a baccalaureate degree from an institution of recognized standing, a minimum grade-point average of 3.00 in the junior and senior years of college work, approval of the Dean of the Graduate School, and approval of the college.

In addition to requesting admission forms from the Graduate Admissions Office, an applicant should obtain supplemental admission and reference forms from the College of Forest Resources. The Graduate Record Examination general test is required, and test scores must be submitted by the applicant.

Upon enrollment, the student is assigned a graduate program committee that is responsible for guidance in the early stages of the graduate program, to be followed by more formal committees as the student's program develops.

Applicants for the college are considered quarterly within the enrollment limitations for the college and the available faculty and workload limitations within the specific program area selected. Students with both undergraduate forestry degrees and other related fields are considered, although a prior forestry degree is normally expected of applicants for the professional Master of Forest Resources degree.

Financial Aid

The college has available a limited number of appointments as research assistants. Teaching and research responsibilities allow time to pursue a full academic load. Fellowships and scholarships without teaching or research obligations are also available. Requests for financial aid should be submitted by February 1 for priority consideration for the following academic year.

Correspondence and Information

Graduate Program Coordinator
107 Anderson, AR-10

Center for Quantitative Science in Forestry, Fisheries, and Wildlife

Acting Director

Vincent F. Gallucci

The Center for Quantitative Science in Forestry, Fisheries, and Wildlife is an intercollege academic unit sponsored by the College of Forest Resources and the School of Fisheries. The center offers a broad program in applied mathematics and in mathematical services directed principally to the two resource colleges, as well as to other life science departments of the University. The applied mathematics program of the Center for Quantitative Science is concerned with quantitative descriptions of the management of both aquatic and terrestrial ecosystems. The center's program consists of six areas of course offerings, which include computer programming, with particular emphasis given to problems of the management of living resources; quantitative ecology, including population, community, and systems ecology; physical processes in biological systems, emphasizing mass and energy transport in ecosystems; operations research with particular focus on the utilization of renewable resources; applied statistics, with emphasis on statistical inference and experimental design for the biological sciences; and applied analysis, consisting of differential and integral calculus applied to the life sciences. Courses in each of the six areas are interrelated in a way that meets a wide range of student interests and needs.

Center for Urban Horticulture

Director

Harold B. Tukey, Jr.
107E Anderson

The Center for Urban Horticulture is concerned with the utilization of plants to create, maintain, and enhance the quality of urban environments, and offers research, education, and public service programs. Thus, faculty and students work with such professional groups as landscape architects, municipal arborists, grounds managers, nursery garden center operators, and highway planners, as well as with garden clubs and amateur gardening groups.

The faculty of the center offers competence in horticultural physiology, including plant propagation, nutrition, growth regulation, and tree physiology; stress physiology, especially cold hardiness and chilling; horticultural taxonomy and plant materials; and continuing education, especially education techniques and programming and horticultural curriculum development. Research facilities include greenhouses and laboratories as well as the Washington Park Arboretum, a world-famous collection of mature woody plants, the Bloedel Reserve, devoted to the study of human/plant interactions, and the Union Bay Center, an outdoor growing area and research arboretum.

Center faculty members interact with faculty members of other departments, especially Landscape Architecture, soils and physiology in the College of Forest Resources, Botany, and Environmental Studies.

Faculty

Dean

David B. Thorud

Professors

Allan, G. Graham,* (Chemical Engineering),† Ph.D., 1956, Glasgow; lignin and forest products chemistry, polymers, biologically active organic heterocycles, expoxidation.

Bare, B. Bruce,* Ph.D., 1969, Purdue; systems analysis, operations research, computer modeling, forest land management, forest valuation and taxation.

Bethel, James S.,* D.F., 1947, Duke; wood science, especially anatomy and morphology, relationship of new environment to structure of wood.

Brockman, C. Frank (Emeritus), M.S., 1931, Washington; forestry.

Bryant, Benjamin S.,* D.F., 1951, Yale; wood science, mechanical behavior of wood and its structural utilization, science of wood adhesion and gluing technology.

Burke, James D.,* M.S., 1968, Washington; logging and forest engineering, forest operations planning and design.

Cole, Dale W.,* (Landscape Architecture), Ph.D., 1963, Washington; forest soils, mineral cycling in forest ecosystems, movement of elements in a soil system.

Dowdle, Barney,* (Economics), Ph.D., 1962, Yale; growth and development of forest products industries, public forest land management.

Driver, Charles H.,* Ph.D., 1954, Louisiana State; pathology of young-growth Pacific Northwest conifers, physiology of wood decay processes.

Edmonds, Robert L.,* Ph.D., 1971, Washington; forest pathology, soil microbiology, aerobiology.

Erickson, Harvey D. (Emeritus), Ph.D., 1937, Minnesota; wood science and technology.

Flores-Rodas, Marco, Ph.D., 1980, Washington; forest biometry.

Fritschen, Leo J.,* Ph.D., 1960, Iowa State; agricultural climatology, micrometeorological and instrumentation.

Gara, Robert I.,* Ph.D., 1964, Oregon State; flight and host selection behavior of bark beetles and other forest insects, tropical forest entomology.

Gardner, Howard S. (Emeritus), (Chemical Engineering),† Sc.D., 1946, Massachusetts Institute of Technology; pulp and paper technology.

Gessel, Stanley P. (Emeritus), Ph.D., 1950, California; forest soil classification, growth, ecology, and soil fertility, tree nutrition, tropical soils.

Grier, Charles C.,* Ph.D., 1972, Washington; production ecology, ecosystem analysis, nutrient cycling, forest soils.

Hatheway, William H.,* (Environmental Studies), Ph.D., 1956, Harvard; tropical forest ecology, biometrics, dendrology and model building, cold hardiness.

Hinckley, Thomas M.,* Ph.D., 1971, Washington; tree physiology.

Hrutfiord, Bjorn F.,* Ph.D., 1959, North Carolina; chemistry and biochemistry of wood extractives, influence of chemicals in trees on plant-plant, plant-insect, and plant-animal behavior.

Lee, Robert G.,* Ph.D., 1973, California (Berkeley); forest ecology.

Leney, Lawrence (Emeritus), Ph.D., 1960, New York State; wood anatomy, microtechniques, machining wood, photomicrography seasoning and preservation of wood.

Leopold, Estella B.,* (Botany),† Ph.D., 1955, Yale; palynology, paleoecology, plant ecology.

Manuwal, David A.,* Ph.D., 1972, California (Los Angeles); marine birds, effect of timber management on forest birds.

McKean, William T.,* (Chemical Engineering),† Ph.D., 1968, Washington; pulp and paper technology.

Pearce, John K. (Emeritus), B.S.F., 1921, Washington; logging engineering.

Pickford, Stewart G.,* Ph.D., 1972, Washington; forest fire science.

Robertson, James C. H. (Emeritus), D.F., 1947, Duke; forest resources.

Sarkanen, Kyosti V.,* (Chemical Engineering),† Ph.D., 1956, State University College of Forestry (New York); lignin, cellulose, and general polymer chemistry, photosynthesis, tall oil.

Schaeffer, Walter H. (Emeritus), Ph.D., 1952, Washington; forestry.

Schreuder, Gerard F.,* Ph.D., 1968, Yale; photogrammetry and management or economics and statistics.

Scott, David R. M.,* Ph.D., 1950; Yale; silviculture, forest ecology.

Sharpe, Grant, W.,* Ph.D., 1955, Washington; recreational use of wild lands.

Stenzel, George (Emeritus), M.F., 1939, Yale; forest engineering.

Stettler, Reinhard F.,* Ph.D., 1963, California (Berkeley); genetic control of morphogenesis in higher plants, reproductive physiology of forest trees.

Taber, Richard D.,* Ph.D., 1951, California (Berkeley); biology and conservation of free-living birds and mammals, wildlife and human culture.

Thomas, David P. (Emeritus), M.F., 1948, Washington; economics and technology of utilizing forest crops, kiln drying and seasoning of lumber.

Thorud, David B.,* Ph.D., 1979, Minnesota; forest hydrology, watershed management, research policy and administration.

Tukey, Harold B., Jr.,* Ph.D., 1958, Michigan State; horticultural physiology, urban horticulture, plant propagation.

Ugolini, Florenzo C.,* Ph.D., 1960, Rutgers; soil-forming processes and weathering in the forest ecosystems and cold regions, biogeochemical cycles.

Waggener, Thomas R.,* Ph.D., 1966, Washington; forest economics, public land use policy and economic development, structure of forest products industries.

Witt, Joseph A.* (Research), M.S., 1948, Washington State; horticultural taxonomy, plant materials, arboretum management.

Wott, John A.,* Ph.D., 1968, Cornell; urban horticulture, continuing education and public service programs, plant adaptation in the urban environment.

Associate Professors

Agee, James K.,* Ph.D., 1973, California (Berkeley); fire science and fire ecology.

Bledsoe, Caroline S.* (Research), Ph.D., 1970, Colorado State; tree physiology, tree nutrition, physiology of roots and mycorrhizae.

Bradley, Gordon A.,* M.L.A., 1972, California (Berkeley); recreation and resource planning.

Brubaker, Linda B.,* Ph.D., 1973, Michigan; dendrochronology.

Clark, James R.,* Ph.D., 1978, California (Davis); growth and development of woody plants, environmental horticulture.

Greulich, Frances E.,* Ph.D., 1976, California (Berkeley); logging engineering.

Hanley, Donald P., Ph.D., 1981, Idaho; extension forestry, silviculture.

Johnson, Jay A., Ph.D., 1973, Washington; wood science.

Oliver, Chadwick D.,* Ph.D., 1975, Yale; forest tree autecology, forest stand dynamics and silviculture.

Rustagi, Krishna P.,* Ph.D., 1973, Yale; operations research application to problems of forest management planning.

Schiess, Peter,* Ph.D., 1975, Washington; logging engineering.

Smith, W. Ramsay,* Ph.D., 1979, California (Berkeley); wood science and technology, wood physica.

Vogt, Kristiina A. (Research), Ph.D., 1975, New Mexico State; ecosystem microbiology.

Wooldridge, David D.,* Ph.D., 1961, Washington; hydrology of forest water sheds and influences of management on water yield and quality, forest soils.

Zasoski, Robert J.,* Ph.D., 1974, California (Davis); soil chemistry, behavior and fate of micronutrients and heavy metals in plants and soils, plant nutrition.

Assistant Professors

Briggs, David G.,* Ph.D., 1980, Washington; wood utilization, systems analysis, operations research, computer applications in wood processing.

Cunday, Terrance W., Ph.D., 1983, Utah State; hydrology.

Raedeke, Kenneth J.* (Research), Ph.D., 1979, Washington; forest wildlife habitat relations, population dynamics.

Smit-Sprinks, Barbara, Ph.D., 1983, Minnesota; woody plant physiology, cold hardiness and water relations of horticultural plants.

West, Stephen D.* (Research), Ph.D., 1979, California (Berkeley); wildlife ecology and management.

Course Descriptions

The presence of B, M, *or* P *following the prefix* FOR *indicates the disciplinary orientation of the course content.*

Biological Sciences

Courses for Undergraduates

Students taking undergraduate and graduate courses, structured or unstructured, that require field trips, special laboratory supplies, or special material duplications are required to pay appropriate amounts to cover such expenses. If a student fails to pay, the transcript may be withheld and the degree may not be conferred.

FOR B 206 Pesticides in the Environment (2) *Gara* Biological analysis of short-term benefits and costs to the ecosystem through use of pesticides. Considerations of control alternatives and their consequences to management objectives. Presentation of new trends in insect manipulation.

FOR B 300 Dendrology (4) *Brubaker, Stettler* Concepts of taxonomy, genetics, and organic evolution as applied to the classification of major tree genera of North America; lectures, laboratory demonstrations, and field exercises. Prerequisite: introductory biology.

FOR B 301 Forests in the Life of Man (3) *Edmonds* Forest as a unique ecosystem from a historical and biological perspective. Present forest ecosystems throughout the world and locally are discussed, and past use is related to present and future problems. Modern forest management in relationship to the ecological basis of continual forest production and use of the forest by man. The nature and function of trees, communities of trees making up forest ecosystems, factors that affect trees and forest ecosystems, forests of the world, the relationship of man to forests, history of land use in relationship to forests and various products of the forest. No credit for forest resources majors except as a substitute for FOR M 100 for upper-division transfer students.

FOR B 302 Forest Meteorology (3) Study of the interaction of biological and meteorological processes with applications to forestry, wildlife, and recreation. Surface energy balances in terms of evaporation, wind speed, and humidity in the lower layer of the atmosphere effects of plane, concave, and convex surfaces, vegetal coverings, and wind distribution.

FOR B 310 Forest Soils (4) *Ugolini, Zasoski* Physical, chemical, and biological properties of forest soil; soil development and classification; and soils in relation to use of forest resources. Prerequisite: 5 credits of geology or equivalent.

FOR B 311 Soils and Land Use (3) *Cole* Intended for students who are concerned with environmental problems in the Puget Sound basin, as well as those who intend to become professionally involved in land-planning decisions. Focus is on the significance of soils in understanding environmental problems and in promoting intelligent land-use decisions. Basic concepts of soil systems are presented, stressing those aspects important in making land-planning decisions.

FOR B 320 Introduction to Forest Community Ecology (5) Forest community dynamics, particularly succession and zonation as related to environmental variation; includes consideration of producers, consumers, and decomposers. Study of techniques of community quantification. Taught at Pack Forest. Prerequisites: 300, introductory biology, statistics, and forest resources major standing or permission of instructor.

FOR B 321 Silvics (3) *Hinckley, Scott* Anatomy, morphology, and physiology of forest tree species underlying ecological patterns of behavior. Prerequisite: 320.

FOR B 322 Silvicultural Methods (3) *Oliver, Scott* The theory and technique of applying silvical knowledge in controlling establishment, composition, and growth of forest stands. Includes reproduction methods and intermediate cuttings. Prerequisites: 321, FOR M 360.

FOR B 323 Forest Biology I (3) *Brubaker* Systematics, genetics, evolution, and identification of forest trees as related to structure and environment. No credit given if FOR B 300 has been taken for credit.

FOR B 324 Forest Biology II (3) *Gara* Theory and applied aspects of forest pathology and entomology. Introduction to the forest ecosystem as related to forest development, soils, and tree water relationships. Introduction to silviculture. Prerequisite: junior standing.

FOR B 325 Forest Ecology (5) *Scott* Introductory course in ecology for majors in outdoor recreation only. Lectures and field exercises on: organismal interactions as related to environment; ecological characteristics of trees; structure pattern and successional dynamics of forest communities. Prerequisites: statistics, 10 credits in biology, and permission of instructor.

FOR B 326 Range and Wildlife Habitat (3) *Driver* Theory and practice of range ecology as the basis for studying (1) the effects of domestic animals and wildlife use on plant habitats and (2) man's control on these plant community effects from the past, present, and future of natural resources management points of view.

FOR B 327 Field Studies in Range and Wildlife Habitats (2) *Driver* Four weekend field trips related to range and wildlife habitats of Washington with application of materials presented in 326. For majors in wildlife science and forest management only. Prerequisite: permission of instructor.

FOR B 329 Microclimatology (3) Sp Interaction of biological and meteorological processes with applications to forestry, recreation, wildlife, landscape design, and architecture. Surface energy balances in terms of evaporation, radiation exchange, air and soil temperature, wind speed, and humidity in the lower layer of the atmosphere. Offered jointly with ATM S 329. Prerequisite: ATM S 101 or 301; permission of instructor.

FOR B 333 Forest Protection (4) *Driver, Edmonds, Gara, Pickford* General aspects of protecting forests from diseases, insects, and fire. Applications of protection technologies to resource arrangement activities. Prerequisite: 302.

FOR B 350 Wildlife Biology and Conservation (3) *Manuwal, Taber* Wildlife ecology and population biology, and interrelationships between wild animals and man, including encouragement of wildlife population growth and productivity, control of pest populations, and preservation of endangered species with emphasis on forest environments and forest faunas. Open to nonmajors. Prerequisite: junior standing. (Formerly WLF S 350.)

FOR B 401 Biology and Conservation of Birds (3) Major principles of avian population biology; reproductive biology and conservation strategies for both game and nongame birds. Emphasis on the Pacific Northwest. Prerequisite: introductory biology.

FOR B 402 Human Culture and Wildlife Conservation (5) *Taber* Human customs, attitudes, and institutions as they affect wild bird and mammal populations, including relations of range, forest, and farm management to wildlife conservation. Emphasis on Europe and North America. Prerequisite: 350. (Formerly WLF S 402.)

FOR B 404 Biology and Conservation of Mammals (5) *Taber* Major principles of mammalian evolution, population biology, reproductive biology, ecology, and conservation. Laboratory and field trips are required, and students may be asked to share travel costs. Prerequisites: 350 or equivalent. (Formerly WLF S 404.)

FOR B 410 Forest Soil Microbiology (4) *Edmonds* Types and numbers of microorganisms in forest soils. Growth and survival in relation to environmental conditions. Quantitative methods in soil microbiology. Importance of microflora and microfauna in decomposition and nutrient cycling in natural and manipulated forest ecosystems. Integration and modeling of decomposition processes. Prerequisite: 310 or permission of instructor.

FOR B 411 Biology and Conservation of Birds, Laboratory (2) Taxonomy and identification of birds. Laboratory and field trips are required, and students may be asked to share travel costs. Prerequisite: concurrent registration in introductory biology.

FOR B 412 Soil Genesis (5) *Ugolini* Soil, the excited skin of the earth. Processes of soil formation and weathering distribution of major soils in the world. Prerequisites: CHEM 145, GEOG 205.

FOR B 414 Forest Soil Fertility and Chemistry (3) *Zasoski* Tree growth depends, in part, on the interaction between chemical and biological activities within a given soil: the biological and chemical parameters that influence the growth; soil solution chemistry and surface reactions; reactions and processes that control essential plant nutrient levels and forms in soil solutions. Prerequisite: 310.

FOR B 416 Micrometeorological Measurements and Instrumentation (5) *Fritschen* Principles and theories of biometeorological instrumentation. Accuracy, measuring solar and thermal radiation, heat flux, air and soil temperature, atmospheric moisture content, wind. Prerequisites: MATH 126, PHYS 123.

FOR B 417 Environmental Biophysics (3) *Fritschen* Introduction to the physical environment concerning the transfer of heat, mass, and momentum in nature. Principal emphasis on the movement of water in the soil-plant-atmospheric continuum and methods of estimation. Prerequisite: 302 or ATM S 329.

FOR B 418 Forest Soil Management (3) *Zasoski* Consideration of physical, chemical, and biological properties of forest soils. Forest fertility and fertilization. Use of soil maps to guide land-management activities. Provides a practical and working knowledge of soil in the practice of forestry. Prerequisite: senior standing in silviculture and protection, timber management and timber harvesting options, or permission of instructor.

FOR B 420 Forest Chemicals (3) *Gara* Covers all aspects of the use of forest chemicals in forestry: laws, safety, application techniques, and biological effects. Specific chemicals are discussed as to formulations, toxicity, timing, application rates, carriers, and unique safety problems. Prerequisite: junior standing in forest resources curriculum or permission of instructor.

FOR B 421 Dendrochronology (4) *Brubaker* Analysis of important physiological and environmental factors controlling annual tree-ring growth and a critical review of the applications of tree-ring analysis to study forest productivity, watershed hydrology, forest fires, insect epidemics, etc., in relation to yearly weather conditions. Laboratory and field exercises construct tree-ring chronologies to study environmental histories of selected forest stands. Prerequisites: introductory botany and senior or graduate standing.

FOR B 422 Reproduction Methods in Silviculture (3) *Scott* Advanced silviculture course that examines the characteristics of natural and artificial methods of regenerating forest stands. Emphasis on methods used in the Pacific Northwest; however, attention is given to problems and techniques of other forested regions. Lectures and weekly field trips. Prerequisite: 322 or equivalent.

FOR B 423 Ecology of Forest Productivity (3) W *Grier* Energy flow in forest ecosystems. Physical, biological, and successional factors influencing primary productivity. Ecosystem structure as related to productivity. Energy utilization by heterotrophic organisms. Techniques for estimating net primary productivity and net ecosystem production. Prerequisite: 321 or BOT 354.

FOR B 424 Selected Topics in Silviculture (3) Forest stand development and manipulation response. Forest stand dynamics and stand structure in pure and mixed species forests, response to minor and major disturbances, interactive changes with time, and patterns and response to manipulation. Prerequisite: previous course work in ecology.

FOR B 427 Forest Genetics (3) *Stettler* Genetic theory as applied to the biological manipulation of forest trees. Principles of genetics and organic evolution are discussed and related to management strategy and silvicultural practices. Prerequisite: 300.

FOR B 428 Forest Community Ecology (4) *Brubaker* Advanced course in forest community ecology for undergraduate and graduate students. Includes organismal interaction, community structure and classification, and forest population dynamics and productivity as influenced by environmental changes. Prerequisites: 320 or equivalent and permission of instructor.

FOR B 429 Intermediate Operations in Silviculture (3) *Oliver* For advanced undergraduate and graduate students in silviculture. Includes those operations designed to direct an existing forest into the desired form such as cleaning, weeding, thinning, irrigating, and fertilizing; all-day field trips required. Prerequisite: 322 or equivalent.

FOR B 430 Silvicultural Methods for Special Uses (3) *Agee, Scott* Theory and techniques of applying forest ecological knowledge in controlling the reproduction and development of forest ecosystems for social values other than wood. Prerequisite: 322.

FOR B 431 Ecological Aspects of Forest Fires (3) *Agee* Description of natural role of fire and ecosystem impacts from various fire frequencies and intensities. Examples from other regions are included, but emphasis is on Pacific Northwest forests. Ecological perspectives on fire behavior and fuel dynamics. Techniques and effects of fire used for hazard reduction, site preparation, wildlife production, stand structure control, and wilderness fire management. Field trips required. Prerequisite: FOR M 430 or permission of instructor.

FOR B 432 Forest Pathology (4) *Driver, Edmonds* Studies on the biology and management alternatives of major diseases of trees of Pacific Northwest forests. Emphasis on the impact of forest diseases on forest ecosystems relative to man's use. Prerequisite: 333.

FOR B 435 Forest Entomology (3) *Gara* Introduction to general entomology, characteristics, life histories, ecological relations, prevention, and control of forest insects.

FOR B 436 Laboratory in Forest Entomology (2) *Gara* Introduction to the insect orders; identification of forest insects and their damage. One field trip to study insect problems required. Prerequisite: 435, which may be taken concurrently.

FOR B 437 Ecology of Forest Insects (4) *Gara* Host-insect interactions, introduction to population dynamics, research technique, and pertinent forest entomological literature. One field trip required. Prerequisite: permission of instructor. (Offered alternate years.)

FOR B 440 Soil Physics (4) *Fritschen* Physical properties of soil and water. Thermodynamic properties of soil-water mixtures and osmotic effects. Darcy's law and application to the movement of the water table. Horizontal and vertical unsaturated flows: rain infiltration, capillary rise, soil evaporation, water redistribution and hysteresis, heterogeneous soils and instability. Soil-plant-atmosphere continuum: water balance in the root zone; movement through the plant. Prerequisite: integral and differential calculus.

FOR B 444 Forest Tree Physiology (3) *Clark, Hinckley* Introduction to basic processes of tree physiology, including such topics as seed dormancy; seedling growth; cold hardiness; nutrient storage and cycling; hormonal regulation in trees; long-distance transport of water and nutrients; photosynthetic reactions of Pacific Northwest forest species; reproductive physiology; senescence. Prerequisite: 10 credits in biology; CHEM 102 or equivalent recommended.

FOR B 452 Ecology of Marine Birds (3) W *Manuwal* Forces for adaptive radiation of marine birds; Alcidae of northern hemisphere, Procellariformes of southern hemispheric oceans. Major patterns of natural history, resource division, reproductive strategies, conservation of major marine bird groups. Two field trips required. Prerequisite: 401 or ZOOL 464 or permission of instructor. (Offered alternate years.)

FOR B 453 Concepts and Methods in Paleoecology (4) A *Brubaker, Leopold, Tsukada* Biological fossils as key evidence in reconstruction of past environments. Conceptual framework and methods of study for interpretation of fossils in sediments, tree rings, sedimentary/geochemical evidence. Past dynamic changes in plant communities and species history evaluated in context of modern ecological theory. Offered jointly with BOT 453 and QUAT 453. Prerequisite: 320 or BOT 354.

FOR B 455 Wildlife Seminar (1, max. 4) Discussion of current research and application in wildlife biology and conservation. Offered on credit/no credit basis only. Prerequisite: 350 or equivalent.

FOR B 460 Forest History (4) Sp *Leopold* Development, composition, and structure of the present woody vegetation in the Pacific Northwest. Environmental restrictions in modern species and implications for ecological management based on the historic biogeographic distributions of woody plants, edaphic features, and climatic changes. Offered jointly with BOT 439. Prerequisite: BOT 354 or equivalent.

FOR B 490, 491, 492 Undergraduate Studies (1-5, 1-5, 1-5) Individual tutorial study of topics for which there is not sufficient demand to warrant the organization of regular classes. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Entry card required.

Courses for Graduates Only

FOR B 500 Graduate Seminar (2) *Cole, Waggener* Discussion of current issues and problems in forestry and forestry research. Offered on credit/no credit basis only.

FOR B 502 Advanced Human Culture and Wildlife Conservation (5) Advanced work in human customs, attitudes, and institutions as they affect wild bird and mammal populations, including relations of range, forest, and farm management to wildlife conservation. Emphasis on Europe and North America. Prerequisites: graduate standing and permission of instructor.

FOR B 511 Mineral Cycling in Forest Ecosystems (3) *Cole* Significance of mineral cycling in the ecology and management of forest ecosystems: basic programs involved; strategies of cycling that have been observed; and various studies that have been completed in this field. Prerequisite: 310 or equivalent.

FOR B 512 Soil Geochemistry (3) Examination of soil components, their weathering and reactivity under surface conditions. Mineral stability, phase relations, colloidal chemistry exchange and sorption phenomena solution composition and reactions, and element redistribution in the soil zone are considered. Prerequisites: 412, 414, CEWA 456.

FOR B 513 Soil Distribution and Classification (5) *Ugolini* Study of the morphology, distribution, and classification of soils in relation to environmental factors. Soils and survey procedures examined by field trips throughout the unique terrestrial ecosystems of the state of Washington. Emphasis on application to forest land use and planning.

FOR B 514 Forest Influences (4) *Wooldridge* Study of the interacting effects of climate, soil, and plants as a basis for understanding the hydrologic cycle. Places special emphasis on disposition and movement of water in forest ecosystems. Prerequisite: graduate standing.

FOR B 517 Soil Plant-Atmospheric Relations (3) *Fritschen* Principles of mass and energy exchange between the earth and the atmosphere with special emphasis on the state and movement of water in soils, energy balance of the vegetated surface and individual leaves, and methods of evapotranspiration determination. Prerequisites: MATH 126, PHYS 123, ATM S 329.

FOR B 519 Forest Soils Seminar (1) *Bledsoe, Zasoski* Discussion by invited speakers on current research related to forest soils, plant nutrition, and mineral cycling. Offered on credit/no credit basis only.

FOR B 521 Current Problems in Forest Ecology (3) *Scott* Consideration of current literature and topics in forest ecology and tree physiology.

FOR B 522 Current Problems in Silviculture (3) *Scott* Detailed study of the literature dealing with recent applications of silviculture in world forestry.

FOR B 527 Advanced Forest Genetics (3) *Stettler* Discussion course relating concepts of quantitative and population genetics to forest-tree populations, both natural and artificial. Offered on credit/no credit basis only. Prerequisite: GENET 451, or equivalent.

FOR B 528 Silvicultural Prescription Preparation (4) *Scott* Advanced course in silviculture as applied to purposes other than wood production and in the preparation of silvicultural prescriptions. For midcareer students.

FOR B 529 Review of Forest Autecology (4) *Hinckley, Stettler* Review of concepts of soil formation, soil fertility, microclimate, hydrology, tree anatomy and morphology, physiology, water relations, mineral nutrition, and genetic and evolutionary mechanisms, as they relate to the adaptation and manipulation of forest-tree populations. For midcareer students.

FOR B 533 Techniques in Forest Pathology (5) Concepts and techniques used in experimental forest pathology, including culturing, sampling of airborne microbes, etc. Prerequisite: 432 or permission of instructor.

FOR B 551 Birds in the Forest Environment (5) Relationships between forests and bird populations. Focus on integrating avian ecology with forest ecology and silviculture. Mandatory field trips. Prerequisite: ZOOL 464 or equivalent.

FOR B 557 Topics in Forest Zoology (3) Graduate seminar considering applied and basic zoological topics relating to the forest environment. Different topics are selected each year. May be repeated for credit. Participants submit short papers and give oral presentations.

FOR B 590 Graduate Studies (1-5) Study in fields for which there is not sufficient demand to warrant the organization of regular courses. Entry card required.

FOR B 600 Independent Study or Research (*)

FOR B 700 Master's Thesis (*)

FOR B 800 Doctoral Dissertation (*)

Tutorial Study

Tutorial study designed to meet individual requirements is available to graduate students in the graduate studies courses listed below. Such study may include literature review and field and laboratory work. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Prerequisites include graduate standing and permission.

FOR B 510 Graduate Studies in Forest Soils (1-5) *Cole, Gessel, Ugolini*

FOR B 515 Graduate Studies in Forest Influences (1-5) *Fritschen, Wooldridge*

FOR B 516 Graduate Studies in Forest Meteorology (1-5) *Fritschen*

FOR B 520 Graduate Studies in Forest Ecology and Silviculture (1-5) *Oliver, Scott*

FOR B 523 Graduate Studies in Range and Wildlife Habitats (1-5) *Driver, Gessel, Manuwal, Taber* Prerequisite: 326 or permission.

FOR B 526 Graduate Studies in Forest Genetics (1-5) *Hatheway, Stettler*

FOR B 534 Graduate Studies in Forest Pathology (1-5) *Driver*

FOR B 535 Graduate Studies in Forest Entomology (1-5) *Gara*

FOR B 555 Graduate Studies in Wildlife Management (1-5) *Manuwal, Taber*

FOR B 556 Graduate Studies in Forest Zoology (1-5)

Management and Social Sciences

Students taking undergraduate and graduate courses, structured or unstructured, that require field trips, special laboratory supplies, or special material duplications are required to pay appropriate amounts to cover such expenses. If a student fails to pay, the transcript may be withheld and the degree may not be conferred.

Courses for Undergraduates

FOR M 100 Introduction to Forest Resources Management (5) *Gara, Lee* Survey of man's use of forest resources and the impact of social and cultural institutions on resource management. The history and the development of forest conservation and forest utilization practices and policies in the United States. Changing patterns of resource use and methods of resolving conflicts among management alternatives.

FOR M 201 Conflicts in Forest Resource Use (2) *Dowdle, Waggener* Analysis of resource management policies, with particular emphasis on the social, political, economic, and resource implications of conflicting resource uses. Examination of major policies and practices designed to deal with conflicting uses, including critical review of operational criteria for resource allocation.

FOR M 250 Computer Programming (4) *Bare, Briggs* Introduction to computer programming using BASIC and FORTRAN languages. Applications to forestry problems.

FOR M 252 Introduction to Natural Resources Sociology (3) *Lee* Sociological aspects of natural resource management and use. Study of man's values and the nature of human communities, with special emphasis on community structures dependent upon primary use of forest resources. Case examples drawn from resource communities.

FOR M 307 Environmental Impact Assessment and Regulation in Forest Resource Management (3) *Bradley, Waggener* Current environmental, forest resource, and land-use legislation affecting resource management; origin and evolution of federal, state, and local legislation and their relationship to forest resource planning and management; environmental impact assessment and its relationship to forest practices. Selected case studies of prepared forest land use plans and environmental impact statements.

FOR M 350 Field Studies in Outdoor Recreation (3) *Bradley, Sharpe* Studies of outdoor recreation in action. Introduction to the problems of managing large recreation complexes or private, county, state, or federal lands. A 2½-week field trip beginning after Labor Day. Prerequisite: outdoor recreation major.

FOR M 351 Introduction to Wildland Recreation (3) *Sharpe* The wildland recreation movement in America. Agency history and objectives. Integrating recreation with other land uses. Water, forestry, wildlife, and wilderness resources for recreation. Role of private enterprise. Topics of current interest.

FOR M 353 Interpreting the Environment (5) *Sharpe* Role of interpretive specialist in heritage and natural resource areas. Increasing visitor enjoyment, encouraging thoughtful use to reduce human impact, and promoting public understanding of agency programs. Interpretive media selection, personal and nonpersonal services, supporting activities, and professional development. Prerequisite: permission of instructor.

FOR M 355 Resource Planning Processes (3) *Bradley* Related processes in the formulation of forest resource programs; planning process as a systematic method for the identification of goals, information requirements, analytical methods, and implementation techniques in the development and implementation of forest resource plans and policies; evaluation of selected forest resource planning examples.

FOR M 357 Outdoor Recreation Internship (5) *Bradley, Sharpe* Comprehensive examination of a recreation agency or organization's policies, procedures, and operations, in the park or forest setting. Preparation of professional assessment report and internship seminar based on internship experience in recreation management, planning, and interpretation. Prerequisites: completion of one cooperative education work experience, senior standing, and permission of instructor.

FOR M 360 Forest Mensuration I—Field Studies (5) *Rustagi* Introduction to the field aspects of forest measurements. Use of instruments, individual tree measurement, sample plot measurement, site estimation, timber inventory techniques, log scaling, and regeneration surveys. Taught at Pack Forest only. Prerequisite: completion of lower-division requirements.

FOR M 361 Forest Mensuration II—Methods (3) Methods for information analyses needed by forest manager for decision making. Geometry, sampling design, and estimation procedures applied to forestry. Applications to forest inventory processes and management. Growth and yield measurements and estimation. Prerequisites: 250, 360, Q SCI 381.

FOR M 362 Aerial Photos in Forestry (3) *Pickford, Schreuder* Photo interpretation and photogrammetry with applications to forest and land management. Uses of panchromatic, infrared, color, and false color photos; remote sensing. Simple map making.

FOR M 365 Forest Economics (5) *Dowdle, Waggener* Basic concepts of supply and demand, investment, and capital theory, and their application to the management of forested properties. Prerequisites: ECON 200 and Q SCI 291, or equivalent.

FOR M 366 Quantitative Methods in Forest Resource Management (3) *Bare, Rustagi* Survey, discussion, and critique of the application of quantitative methods to forest resource management, planning, and decision making. Emphasis on methods utilized in management science, econometric, and computer science currently used by resource planners. Topics include introduction to systems analysis, linear programming, computer simulation, goal programming, forecasting, statistical techniques, and computer information systems. Offered jointly with Q SCI 366. Prerequisites: 250 and Q SCI 381.

FOR M 368 Forest Regulation (3) *Bare* Traditional concepts of sustained yield used in forest management, contemporary even-flow variants, and analytical approaches to their implementation. Prerequisites: 250 and 366.

FOR M 370 Forest Policy, Law, and Planning (3) *Bradley, Waggener* Focus on the origin, content, and implementation of programs related to the use of public and private forest resources in the United States. Emphasis on the integrated framework in which the policy-making, legal, and planning processes function in forest resource management and administration. Current issues illustrate the basic concepts in forest policy, law, and planning. Prerequisite: junior standing in forest resources management or permission of instructor.

FOR M 430 Introduction to Wildland Fire Management (3) *Pickford* Forest fire behavior; fire and ecology; organization and management of forest fire control systems; economics of fire control; use of fire in forest land management. Meteorological and thermophysical bases for forest fire behavior. Prerequisite: senior standing in forest resources or permission of instructor.

FOR M 433 Quantitative Methods in Fire Management (4) Rational planning in fire-protection management; retrieving fire occurrence and weather data from data archives; descriptive statistics; probability and probability distributions used in fire management; sampling; decision theory, linear programming, and simulation with applications in fire management; interest rates, compounding, discounting, and annuities.

FOR M 434 Economics of Forest Fire Protection (4) Forestry in regional and national economy; money and credit; equilibrium price theory; interest rates; valuation; protection economics; least-cost-plus-loss; regional microeconomics; economic decision criteria; capital budgeting; case studies of economic analyses of fire protection projects; PERT; sociology and the legal aspects of fire management; simple accounting procedures.

FOR M 435 Forest Fire and Land Management (4) Rational planning in land management; fire management's contribution to public involvement in fire management decisions; escaped fire situation analysis; fire specialists in interdisciplinary planning; fire occurrence forecasting; damage appraisal; quantitative fire prevention analysis; suppression models; implementation and monitoring of fire management plans; identifying acceptable fire management plans.

FOR M 450 Natural Resources Law Enforcement (2) W *Butterworth* Criminal, administrative, and regulatory law provisions and practices covered from the perspective of the land manager dealing with recreational, environmental, and public concerns. Issues involve federal, state, and private approaches to utilizing available judicial and executive power for decision making and problem resolution. (Offered even-numbered years.)

FOR M 452 Sociology of Leisure and Outdoor Recreation (3) *Lee* Focuses upon an understanding of human behavior in leisure settings. An examination of basic sociological concepts as well as contemporary theories concerning leisure behavior; research techniques and problems of measurement in leisure research. Implications for the management of recreational areas provide an applied orientation and integration of substantive material. Prerequisite: SOC 110.

FOR M 453 Advanced Environmental Interpretation (5) *Sharpe* Interpretive management and planning. Includes independent study projects in selected park and recreation areas. A practical approach to interpretive inventory, planning, and programming. Prerequisite: 353.

FOR M 454 Advanced Park and Recreation Management (3) Examination of the recreation enterprise: its administration, its resource, use and protection. Details of park structure, policy, and politics. The role of the manager in planning, maintenance, law enforcement, vandalism, conflicts, care of visitors, and other managerial details. Prerequisite: 351 or permission of instructor.

FOR M 455 Advanced Outdoor Recreation Planning: Regional (5) *Bradley* Integrated consideration of resource base, social factors, and management objectives in providing regional recreation opportunities. Emphasis on forecasting recreational demand, development of environmental information systems, and allocation of recreational use, based on user-resource requirements. Case study approach. Prerequisite: 355.

FOR M 456 Wilderness Preservation and Management (3) Review of American wilderness philosophies, concepts, and values. Development of the Wilderness Act. Examination of current wilderness-management policies, problems, trends in use, issues and controversies, wilderness research, social costs, and benefits of wilderness. Prerequisite: permission of instructor.

FOR M 457 Advanced Outdoor Recreation Internship (10) *Bradley, Sharpe* Application of professional field experience to develop proficiency in one of three subject areas: park interpretation, park planning, or park management. Advanced field-related course given in conjunction with a recreation agency. Preparation of evaluation of professional internship experience. Prerequisites: 357, senior standing in outdoor recreation, or permission of instructor.

FOR M 460 Economics of Forest Use (3) *Dowdle, Waggener* Application of economic concepts to use of forest lands and the allocation of lands to alternate forest uses, including outdoor recreation and other nonconsumption uses. Consideration of institutional factors as determinants of land allocation in public and private sector. Trends in forest land use and impact of public policy on growth and development of resource-based economic sections. Prerequisite: 365 or ECON 200.

FOR M 461 Advanced Forest Mensuration (3) *Rustagi* Forest tree and stand models. Studies of forest tree and stand parameters. Estimation processes. Growth and yield analysis. Prerequisites: 360, Q SCI 381 or STAT 311.

FOR M 462 Financial Analysis of Logging Equipment and Operations (4) Business investment management in logging industry, with particular emphasis on equipment replacement. Engineering performance of various typs of logging equipment. Individual student project includes some fieldwork. Prerequisite: FOR P 441.

FOR M 464 Economics of the Forest Products Industries (3) *Dowdle* Market structure of major forest-related industries. Supply and demand aspects of commercial forests on a world scale. Economic factors affecting distribution and marketing of forest products, including international, interregional, and intraregional competition. Prerequisite: 365 or ECON 200.

FOR M 465 Forest Finance and Accounting (3) Basic concepts of finance and accounting used in forestry. Introduction to principles of bookkeeping and measurement of income. Essentials of cost accounting and taxation. Treatment of property and income taxes and accounting for fixed assets. Use of ratio analysis and financial statements in decision making. Prerequisite: 365.

FOR M 466 Economics of Timber Production (3) *Schreuder, Waggener* Application of basic economic concepts to the production of timber as a commercial land use. Analysis of timber investments, alternative management programs, and regulation models. Prerequisite: 365.

FOR M 468 Timber Resources Management Case Studies (5) *Rustagi* Application of case study methodology to selected problems of forest land management. Specifically related to field aspects of operational forestry. Forest inventories and their use in management planning. Regeneration and stocking control decisions. Description of the target forest. Timber sale layout, planning, and sale. Prerequisite: senior standing in silviculture or timber management option, or permission.

FOR M 469 Forest Resources Management Case Studies (5) *Bare* Resource management today is rarely single-product oriented. Planners must function in an environment consisting of market and nonmarket goods and services, as well as a multiplicity of economic, biological, legal, social, and political constraints. Designed to familiarize students with the complexity of modern-day decision making. Emphasis on the creation of a problem situation that encourages students to function as members of a multiresource planning team and to appreciate the skills and values of persons trained in other areas of specialization. The objective is to formulate a multiple-use plan for an actual forest area.

FOR M 470 Computer Applications to Forestry Problems (3) Advanced study of computer programming solutions to forestry problems using BASIC on NOVA computer and FORTRAN on University of Washington academic computing systems. Problem organization and flows, data management and manipulation. Prerequisite: permission of instructor.

FOR M 482 Forest Land-Use Case Studies (4) *Bradley* Social, administrative, and biological principles applied to the formulation, evaluation, and implementation of forest land-use plans and policies. Application of case study methodology to selected problems of forest land-use planning, with particular emphasis on the evaluation of alternative solutions to contemporary planning problems. Prerequisite: senior standing in forest land-use planning or permission of instructor.

FOR M 488 Case Studies in Forest Recreation (5) Consideration of the natural resources bases, social factors, and management objectives in providing regional forest recreation opportunities. Emphasis on the forecasting of recreation demands, the development of environmental information systems, and the allocation of recreational use based on user-resource requirements. Case study approach. Prerequisite: senior standing in forest recreation or permission of instructor.

FOR M 490, 491, 492 Undergraduate Studies (1-5, 1-5,1-5) Individual tutorial study of topics for which there is not sufficient demand to warrant the organization of regular classes. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Entry card required.

Courses for Graduates Only

FOR M 524 Tropical Forests (3) *Bethel* Comparative study of the forests of temperate and tropical regions. Diversity in tropical ecosystems. Comparisons among tropical forest biomes. The structure and properties of tropical forest trees and woods. Problems in the utilization of tropical woods basic to the development of tropical forestry management practices. Forest land-use practices and problems in the tropical regions of the world.

FOR M 531 Forest Fire Science Seminar (2) *Pickford* Presentation and discussion of current issues in forest fire prevention, control, use, and discussion of ongoing fire research. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

FOR M 532 Planning, Management, and Analysis of Forest Fire Control Systems (3) *Pickford* The forest fire control system. Study of plans, service, finance, line, and command functions. Forest fire control and production economics, techniques of operations research and computer sciences applicable to planning and analyzing forest fire control systems. Prerequisite: permission of instructor.

FOR M 534 Fire Behavior and Wildland Fuels (5) Estimating wildland fire spread and intensity; influence of fuel bed characteristics, moisture, wind, and slope on ignition, spread, intensity, and control of wildland fires. Modeling fire growth; extreme behavior. Use of fire behavior modeling in fire management fire danger rating; fire hazard appraisal. Fuel modification techniques; evaluating fuel treatment projects.

FOR M 538 Forest Fire Thermophysics (3) Principles of combustion and heat transfer. Basic processes of ignition and flame spread; high-intensity fires. Emphasis is on free-burning fires in cellulose fuels. Offered on credit/no credit basis only. Prerequisites: MATH 105, PHYS 114, 115, or permission. (Offered alternate years.)

FOR M 540 Forest Statistics (4) *Schreuder* Applications stressed in depth include: growth and yield models, individual tree *vs.* whole-stand models; regeneration survey methods such as stock quadrat and random sampling techniques; sampling for fuels over time and space; concepts of productivity; data collection and analysis techniques used for nontimber products such as wildlife and recreation; quality-control models for monitoring environmental impacts and forest industry operations. For midcareer students. Prerequisite: Q SCI 381.

FOR M 541 Forest Statistics II (4) *Greulich, Hatheway, Rustagi, Schreuder* Applications stressed in depth include: use of time and motion studies in the logging industry; pencil bucking programs; log quality and defect estimation; industrial experimentation techniques; quality-control techniques in lumber, plywood, and pulp; and paper manufacturing. Prerequisite: Q SCI 483 or equivalent.

FOR M 542 Forest Statistics III (4) *Greulich, Hatheway, Rustagi, Schreuder* Uses of probability distributions, tests of hypothesis, interval estimation, regression analysis, experimental designs, and sampling techniques in forestry. Applications stressed in depth include: lumber recovery studies; detection of knotholes; best opening face experimentation and the glass log concept; experimentation with lumber, plywood, and pulp and paper scanners; sampling for chip quality; sampling for, and handling of, effluents; estimating wood decay rates; data collection for point and nonpoint pollution. Prerequisite: Q SCI 483 or equivalent.

FOR M 551 Current Problems in Outdoor Recreation (3) *Sharpe* Seminar approach to investigating, examining, and discussing contemporary issues and controversies in outdoor recreation. Prerequisites: graduate standing and permission of instructor.

FOR M 552 Research Processes in Forest Resources (3) Comprehensive survey of research processes for entering graduate students. Diagnostic and prescriptive evaulation of student research capabilities. Problem and hypothesis formulation, study design, multimethod strategies for gathering and analyzing data, and interpretation and presentation of results. Prerequisite: graduate standing.

FOR M 561 Forest Environmental Resource Planning (3) *Bradley* Origins and evolution of environmental planning in the forest environment. Discussion of the planning process and methodologies for environmental management and planning; selected case studies of environmental resource plans. Prerequisite: graduate standing.

FOR M 562 Advanced Forest Resources Management (3) *Bare, Rustagi* Overview of concepts and procedures involved in managing forested lands for the production of commodity and amenity values. Use of systems analysis techniques for evaluating alternative land-use programs and manipulations of the forest ecosystem. Prerequisites: graduate standing and permission of instructor. (Offered even-numbered years.)

FOR M 564 Advanced Forest Biometry (3 or 5) Classical problems in analysis of forest populations and growth theory, and principles of parametric analysis and estimation processes in forest biometry.

FOR M 567 Advanced Natural Resources Sociology (3) *Lee* Comparative study of institutional and organizational aspects of natural resources management, with special attention to forest resources. Development, persistence, and change of selected institutions in the context of preindustrial, industrial, and advanced industrial societies. Implications for policy formulation, decision making, and technology transfer.

FOR M 575 Forest Products Economics (3) *Dowdle, Waggener* Economic analysis of the forest products industries; market structure, regional impact of forest products industries, current problems in forest products economics.

FOR M 576 Multiobjective Programming in Resource Management (3) *Rustagi* Concepts and philosophy of goal programming as a tool in the evaluation of resource allocation among multiple, conflicting, often incommensurate objectives (goals). L.P. and G.P. computer programs are used to study impact of changes in relative importance of difficult goals. Goal programming applications in natural resource areas are discussed. Offered jointly with Q SCI 576. Prerequisites: familiarity with linear programming and permission of instructor.

FOR M 580 Graduate Studies (1-5) Study in fields for which there is not sufficient demand to warrant the organization of regular courses.

FOR M 600 Independent Study or Research (*)

FOR M 700 Master's Thesis (*)

FOR M 800 Doctoral Dissertation (*)

Tutorial Study

Tutorial study designed to meet individual requirements is available to graduate students in the graduate studies courses listed below. Such study may include literature review and field and laboratory work. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Prerequisites include graduate standing and permission.

FOR M 530 Graduate Studies in Forest Fire Control (1-5) *Pickford*

FOR M 533 Graduate Studies in Applied Forest Protection (1-5) *Agee, Driver, Edmonds, Gara, Pickford*

FOR M 550 Graduate Studies in Forest Recreation (1-5) *Clark, Sharpe*

FOR M 559 Graduate Studies in Forest Resource Planning (1-5) *Bradley*

FOR M 560 Graduate Studies in Forest History and Policy (1-5) *Dowdle, Waggener*

FOR M 563 Graduate Studies in Forest Mensuration (1-5) *Rustagi*

FOR M 565 Graduate Studies in Forest Management (1-5) *Bare, Schreuder, Waggener*

FOR M 566 Graduate Studies in Forest Photogrammetry (1-5) *Schreuder*

FOR M 568 Graduate Studies in Forest Economics (1-5) *Dowdle, Schreuder, Waggener*

FOR M 569 Graduate Studies in Forest Sociology (1-5) AWSpS *Lee*

Physical Sciences

Students taking undergraduate and graduate courses, structured or unstructured, that require field trips, special laboratory supplies, or special material duplications are required to pay appropriate amounts to cover such expenses. If a student fails to pay, the transcript may be withheld and the degree may not be conferred.

Courses for Undergraduates

FOR P 102 Introduction to Pulp and Paper Manufacture (3) *Hrutfiord* Technology of production of pulp and manufacture of paper. Laboratory study of papermaking.

FOR P 205 Pulp and Paper Processes Analysis (3) *Sarkanen* Inorganic chemistry of pulping and bleaching inclusive of sulfur, chlorine, and oxygen-based chemicals, reactivities, and chemical analysis. Wood raw material and conversion to mechanical pulps. Material balances on mechanical separation processes.

FOR P 243 Mechanics in Forestry (4) *Greulich* Principles of statics with application in forestry. Basic concepts, parallelogram law, Newton's laws, equilibrium diagrams and analysis. Treatment of structural systems and systems with friction. Prerequisite: MATH 125 or Q SCI 292, which may be taken concurrently.

FOR P 300 Timber Harvesting Management (3) A *Greulich* Timber harvesting methods and planning procedures. Logging costs and production. Safety and environmental considerations. For forest managers and other nonengineering majors.

FOR P 302 Pulp and Paper Technology (4) *Hrutfiord* Sources of pulpwood. Mechanical and chemical pulping processes. Conversion of pulp to paper. Laboratory study of raw material, mechanical pulping and paper making. (No credit given if 102 has been taken for credit.)

FOR P 303 Wood in Art and Decoration (2) Types of uses of wood in the field of art and decoration and the purposes wood serves. Structure and identifying characteristics of wood, kinds of wood used, and wood properties relevant to uses in musical instruments, carvings and sculpture, furniture, architecture, and interior decoration. Effects of finishes on appearance and performance of wood. Credit in both 303 and 304 may not be received.

FOR P 304 Wood Properties and Products (3) *Smith* Description of wood as a fibrous material, its properties and variability as influenced by species differences and growth conditions. Physical properties important to common uses. Nature of forest products industries and manufactured products. Present trends and developments in wood conversion. For non-wood science and utilization majors.

FOR P 305 Wood Properties and Products Laboratories (1) *Smith* Laboratory experience in topics presented on wood properties and products. Prerequisite: 304, which may be taken concurrently.

FOR P 309 Creativity and Innovation (2) *Allan* Understanding creativity and creative thinking; its challenges and dynamics through knowledge, judgment, planning, and observation. Techniques of creative thinking. Design and development of creative games. Computer-aided creative thinking. Creation, protection, and exploitation of a useful idea, including bargaining and negotiations. Offered jointly with CH E 309. Prerequisite: junior standing or permission of instructor.

FOR P 340 Forest Surveying and Drafting (5) *Schiess* Plane surveying techniques; forest boundary line surveys; GLO corners; traversing; use of transit; compass and tape; contour maps. Drafting techniques; use of drafting machines and lettering guides; map drawing; plotting of surveys; road plan and profiles; blueprints. Taught at Pack Forest only.

FOR P 341 Forest Harvesting (4) *Greulich* Timber harvesting methods and planning procedures. Logging cost and production control. Environmental considerations as related to logging and road construction. Prerequisites: 340, FOR B 320, FOR M 360.

FOR P 342 Forest Road Engineering (4) *Burke* Reconnaissance, preliminary, and location surveys for forest roads. Horizontal and vertical alignment computations. Earthwork computations. Design of forest roads. Prerequisite: CIVE 213.

FOR P 343 Introductory Soil Mechanics (3) *Schiess* Provides necessary soil mechanics background required in logging road design and harvest unit layout courses in forest engineering; various soil classification systems and their applications and limitations; basic laboratory and field testing procedures to predict soil mechanical conditions. Prerequisites: FOR B 310, GEOL 205.

FOR P 344 Hydraulics for Forest Roads (3) Elements of incompressible fluids. Open-channel gravity flow. Analysis and design of drainage ditches, ditch relief structures, and stream-crossing structures. Prerequisites: 10 credits in physics, 8 credits in mathematics.

FOR P 374 Wood Utilization (3) *Bryant* Nature of the forest products industries from a global and national perspective; major processing steps in manufacturing lumber, plywood, composition boards, pulp and paper; present trends and future possibilities of converting all forest growth into useful products; secondary forest products industries. Prerequisite: junior standing in forest resources.

FOR P 375 Wood Utilization Laboratory (2) *Briggs, Smith* Familiarization with the processing and economic environment of the forest products industries through field studies in local plants. Emphasis on small-log utilization in general and on the lumber industry in particular. Prerequisite: 374.

FOR P 377 Materials Science in Forestry (4) Introduction to the concepts of stress, deformation, and strain in solid materials, including the unique properties of wood. Development of those equations that relate these variables in structures. Laboratory session emphasizes theory. Prerequisite: 243 or ENGR 210.

FOR P 400 Wood and Fiber Structure (5) *Briggs, Leney* Woody plants. Growth of the tree stem. Development of the woody cell and the structure of coniferous woods, including fiber characteristics. Structure of hardwoods, including fibery relationship of wood structure to its total physical properties. Natural defects in wood and fiber. Prerequisites: forest resources major standing and permission of instructor. Entry card required.

FOR P 401 The Physics of Wood and Fiber Composites (4) *Smith* Equilibrium physical properties of composite systems. Structure and models, mass density, equilibrium moisture properties and equilibrium thermal properties. Stress, strain, Hooke's law for orthotropic materials. Electrical polarization, axial and bending stress, dielectric heating. Prerequisites: MATH 126, PHYS 116. Entry card required.

FOR P 402 The Physics of Wood and Fiber Composites (4) *Smith* Equilibrium properties, mass and energy transport, time-dependent electrical behavior, inelastic behavior and vibration. Prerequisite: 401. (Offered alternate years.)

FOR P 403 Fibrous Structure and Rheology I (3) *Allan* Review of the synthetic and natural fibers and their chemical, physical, microscopic, and submicroscopic properties. The bonding behavior of fibers in networks. Analysis of the structure of fiber networks with reference to nonwovens and paper.

FOR P 404 Fibrous Structure and Rheology II (3) *Allan* Behavior of fibers in fluid suspensions and properties of webs formed therefrom. Physics and chemistry of fiber-polymer interactions and adhesion. Fiber modification by physical and chemical processes and theory and design of fiber composite materials. Prerequisite: 403. (Offered alternate years.)

FOR P 405 Microtechnique (3) The technique of preparing, sectioning, staining, and mounting woody tissues and fibers for microscopic study. Entry card required.

FOR P 406 Wood Chemistry I (3) *Hrutfiord* Chemical and physical properties of cellulose, lignin, hemicellulose, and extractives. Wood as a raw material for the chemical industry.

FOR P 407 Wood Chemistry I Laboratory (2) *Hrutfiord* Laboratory to supplement 406.

FOR P 408 Wood Chemistry II (3) *Sarkanen* Formulation and structure of lignins. Role of quinone methides, carbonium, and carbanions in delignification processes. Acid and base catalyzed hydrolysis of polysaccharides. Biodegradation of biomass. Potential of biomass for conversion to valuable chemicals. Prerequisite: 406. (Offered even-numbered years.)

FOR P 409 Wood Extractives Chemistry (2) *Hrutfiord* Nature, origin, and occurrence of the extraneous components of wood, their influence on pulp and paper preparation, and their utilization.

FOR P 410 Energy From Wood (3) Explores principal characteristics of wood fuels and focuses upon major systems for recovering energy from them. Considers wood fuels from resource, technical, and economic points of view. Prerequisites: CHEM 101, 102.

FOR P 415 Applied Forest Hydrology (4) *Schiess, Wooldridge* Study of fundamental aspects of hydrology as influenced by silvicultural and timber harvest methods. Includes soil erosion, water quality, and manipulation of the forest stands for altered water yield. Prerequisite: senior standing.

FOR P 421 Quality and Production Control in Wood Processing (3) *Briggs* Application of wood science and technology to analysis of the effectiveness of wood-processing facilities. Production control and quality control related to materials and processes. Procurement control problems. Decision making with respect to product mix, equipment modification, analysis of inventory control, and material movement.

FOR P 422 Wood Process Models (3) *Briggs* Factors influencing feasibility judgments with respect to industrial development and factory design. Feasibility of new forest products manufacturing installations with reference to raw material supply, markets, transportation, and labor supply. Analysis of case histories of forest products manufacturing and facility development. Use of operations research methods in feasibility studies.

FOR P 440 Construction (4) *Burke* Design and construction of forest roads; earth-moving methods and costs, explosives, surfacing, drainage facilities. Laboratory: design of timber bridges. Prerequisite: 377.

FOR P 441 Forest Engineering (5) *Burke* Planning the logging operation: logging methods, route projection, selection of landings and settings, logging cost control. Prerequisite: 342.

FOR P 442 Mechanics in Logging and Construction (4) Examines both the major structural components of heavy equipment and the application of mechanical analysis and design to harvesting and construction activities in logging engineering. Prerequisite: 440.

FOR P 443 Safety Practices in Forest Industries (1) *Burke* Accident costs and frequency rates; accident investigations; safety inspection; safety organization and program. Prerequisite: forest engineering major.

FOR P 445 Management Science in Logging Engineering (4) Logging and roading process within a system's framework; use of management science methods in data collection, data analysis, and decision making, with special emphasis on logging engineering problems. Prerequisite: senior standing.

FOR P 446, 447, 448, 449 Senior Forest Engineering Field Studies (2,5,5,3) *Burke, Greulich* 446: route projection and logging planning. 447: reconnaissance and preliminary surveys. 448: road location and construction surveys. 449: cost estimates and reports. Development of a complete logging plan for a timber tract. Courses given consecutively in Spring Quarter. Prerequisite: 441.

FOR P 470 Forest Products Protection (3) *Driver, Smith* Wood- and fiber-destroying agencies, biological and physical, classification and manner of attack. Theory of toxicity and the important preservatives; pressure and nonpressure treatments. Fire retardant chemicals and treatments, coatings and impregnation.

FOR P 472 Gluing Process Technology (3) *Bryant* Theory of wood adhesion, chemical nature of wood adhesives, requirements of adhesives and binders relative to important wood and process variables. Prerequisites: 374, 377.

FOR P 473 Plywood and Board Processes (4) *Bryant* Familiarization with the technology of the modern lumber laminating, plywood, and composition board industries; product properties as related to process and species variables; uses and markets for these products. Prerequisite: 472.

FOR P 475 Wood Drying Technology (3) *Smith* Analysis of the wood-drying process; technology of reducing the moisture content of wood in the form of lumber, veneer, particles, and fiber. Relationship of moisture to wood and fiber as it affects the manufacturing process and end use. Prerequisite: senior or graduate standing in Wood and Paper Division.

FOR P 476 Pulping and Bleaching Processes (3) *Sarkanen* Conversion of wood to mechanical and chemical pulps. Kraft, sulfite, and semichemical pulping processes. Chemical recovery systems. Bleaching of mechanical and chemical pulps. Offered jointly with CH E 471.

FOR P 477 Papermaking Processes (3) *McKean* Fiber sources and properties. Secondary fibers. Stock preparation, sheet forming, water removal, finishing. Coating, lamination, and printing. Paper products. Offered jointly with CH E 472.

FOR P 478 Pulp and Paper Laboratory (2) *Sarkanen* Laboratory experiments in chemical and semichemical pulping of wood. Bleaching of chemical and high-yield pulps. Physical and chemical characteristics of pulp fibers. Offered jointly with CH E 473. Prerequisite: 476.

FOR P 479 Pulp and Paper Laboratory II (2) *McKean* Paper testing, paper additives, flocculation, drainage, retention, heat transfer, and fluid dynamics in papermaking. Sensing approaches and plated process control. Prerequisites: 476, 477, 478.

FOR P 480 Pulp and Paper Process Control (3) *Boyle* Control of pulp and paper processes. Sensors, actuators, interface equipment, and computer control strategies common to this industry. Prerequisites: 476, 477, which may be taken concurrently.

FOR P 481 Pulp and Paper Unit Operations (3) *Boyle* Unit operations of particular interest in the pulp and paper industry in addition to those covered in CH E 330 and 340. Prerequisite: CH E 340.

FOR P 482 Pulp and Paper, Process Design and Economics (3) *McKean* Analysis of industrial pulping, bleaching, papermaking, recovery, and steam and power operations, using systems analysis approach. Material and energy balances, process economics, process control, and design calculations. Prerequisites: 406, 476, 477, 481, or permission of instructor.

FOR P 483 Paper Coating and Converting (3) Coatings and their preparation, rheology, process equipment, drying, and product evaluation. Prerequisite: 477.

FOR P 485- Undergraduate Research (1-1-1) Undergraduate research or independent study project under the supervision of the faculty; usually one credit per quarter. Prerequisite: senior standing in Wood and Paper Division.

FOR P 487 Introduction to Wood Biochemistry (3) *Hrutfiord* Basic biochemical concepts; emphasis on the chemistry of photosynthesis, plant metabolism, and protein biosynthesis. (Offered alternate years.)

FOR P 488 Polymer Chemistry (3) *Allan* Fundamental review of synthetic and natural polymers, including kinetics of formation, molecular weight distributions, and solid-state and solution properties.

FOR P 489 Wood Biosynthesis (3) *Hrutfiord* Biosynthesis of carbohydrates, phenolic and terpenoid compounds in forest trees, and biochemistry of wood degradation. Prerequisite: 487 or BIOC 405. (Offered alternate years.)

FOR P 490, 491, 492 Undergraduate Studies (1-5, 1-5,1-5) Individual tutorial study of topics for which there is not sufficient demand to warrant the organization of regular classes. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Entry card required.

FOR P 497 Pulp and Paper Internship I (1) Technical and economic analysis of commercial pulp and paper installations. Structured visits to industrial operations to observe technical aspects of pulp and paper curriculum in practice. Preparation of visitation reports and analysis in seminar setting. Prerequisites: 406, 476, 477, 481.

FOR P 498 Pulp and Paper Internship II (1) Technical and economic analysis of commercial pulp and paper installations. Structured visits to industrial operations to observe technical aspects of pulp and paper curriculum in practice. Preparation of visitation reports and analysis in seminar setting. Continuation of 497. Prerequisite: 497.

Courses for Graduates Only

FOR P 501 Elasticity of Wood and Fiber Composites (4) The concept of stress, strain, and Hooke's law for the orthotropic continuum. Tensor transforms of stress, strain, and the elastic coefficients. The compliance and stiffness tensors. Strain energy. Distribution functions of descriptions of internal geometry of composites. Orthotropic elasticity of the fiber wall. Elasticity and two- and three-dimensional fiber networks. Elasticity of particle composite and laminates. Prerequisites: 401 and 402.

FOR P 502 Transport Processes in Composite Systems (2) Time-dependent and -independent diffusion of moisture and energy in composite materials. Coupled moisture and thermal diffusion. Mechanisms of moisture and thermal transport. Diffusion in particle composites. Solution of the diffusion equation by separation of variables and finite difference methods. Prerequisites: 401 and 402.

FOR P 541 Advanced Forest Engineering (5) Logging organization and management; logging cost analysis and budgeting.

FOR P 542 Advanced Logging Engineering (3) Detailed consideration of problems of logging planning and truck road engineering, including the preparation and field layout of logging plans; location, design, and construction of logging truck roads.

FOR P 571 Advanced Wood Preservation (3) Permeability of wood, theory and factors affecting penetration, liquid movement in wood, chemical effects on wood. Entry card required.

FOR P 572 Wood Chemistry and Analysis (3-5) *Hrutfiord* Application of instrumental methods of analysis to wood, wood products, and forest products processing effluents. Emphasis on separation systems, including gas and liquid chromatography, and on spectral analysis. Entry card required. (Offered alternate years.)

FOR P 573 Wood-Moisture Relations (3) *Smith* Theories and practice on relationships between wood and moisture over a range of moisture contents; effects of other polar and nonpolar compounds; capillarity, adsorption, and diffusion in wood. Entry card required.

FOR P 574 Wood-Resin Relations (3) *Bryant* Technology of synthetic resins as wood adhesives, wood impregnants, binders, overlays, and surface coatings. Entry card required.

FOR P 576 Photomicrography of Woody Tissues (3) Theory and method in microscopy and photomicrography of woody tissues. Entry card required.

clents. The compliance and stiffness tensors. Strain energy. Distribution functions of descriptions of internal geometry of composites. Orthotropic elasticity of the fiber wall. Elasticity and two- and three-dimensional fiber networks. Elasticity of particle composite and laminates. Prerequisites: 401 and 402.

FOR P 502 Transport Processes in Composite Systems (2) Time-dependent and -independent diffusion of moisture and energy in composite materials. Coupled moisture and thermal diffusion. Mechanisms of moisture and thermal transport. Diffusion in particle composites. Solution of the diffusion equation by separation of variables and finite difference methods. Prerequisites: 401 and 402.

FOR P 541 Advanced Forest Engineering (5) Logging organization and management; logging cost analysis and budgeting.

FOR P 542 Advanced Logging Engineering (3) Detailed consideration of problems of logging planning and truck road engineering, including the preparation and field layout of logging plans; location, design, and construction of logging truck roads.

FOR P 571 Advanced Wood Preservation (3) Permeability of wood, theory and factors affecting penetration, liquid movement in wood, chemical effects on wood. Entry card required.

FOR P 572 Wood Chemistry and Analysis (3-5) *Hrutfiord* Application of instrumental methods of analysis to wood, wood products, and forest products processing effluents. Emphasis on separation systems, including gas and liquid chromatography, and on spectral analysis. Entry card required. (Offered alternate years.)

FOR P 573 Wood-Moisture Relations (3) *Smith* Theories and practice on relationships between wood and moisture over a range of moisture contents; effects of other polar and nonpolar compounds; capillarity, adsorption, and diffusion in wood. Entry card required.

FOR P 574 Wood-Resin Relations (3) *Bryant* Technology of synthetic resins as wood adhesives, wood impregnants, binders, overlays, and surface coatings. Entry card required.

FOR P 576 Photomicrography of Woody Tissues (3) Theory and method in microscopy and photomicrography of woody tissues. Entry card required.

FOR P 577 Wood and Paper Science Seminar (1) Discussion of current topics in the science of wood and its various composites in the form of composition board, laminates, and paper. Offered on credit/no credit basis only.

FOR P 579 Forestry and Wood Utilization in the Economic and Social Environment (2) *Bryant* For graduate students in the College of Forest Resources with baccalaureate or master's degrees outside the forestry field (e.g., biology, chemistry, engineering). World view of the interrelationships of forestry and wood utilization in the economic and social environment as well as an opportunity to relate research interests to this framework. Prerequisite: permission for graduate students outside the College of Forest Resources.

FOR P 581 Pulping and Bleaching Technology and Process Engineering (4) W *McKean* Principles, process, and equipment configurations and products for chemical and mechanical pulping processes and associated bleaching processes. Review of reaction kinetics, description of solid and fluid transport and of process flows. Material and energy balance calculations and introduction to control approaches in pulping and bleaching processes. Prerequisites: 406, 476, 481.

FOR P 590 Graduate Studies (1-5) Study in fields for which there is not sufficient demand to warrant the organization of regular courses. Entry card required.

FOR P 600 Independent Study or Research (*)

FOR P 700 Master's Thesis (*)

FOR P 800 Doctoral Dissertation (*)

Tutorial Study

Tutorial study designed to meet individual requirements is available to graduate students in the graduate studies courses listed below. Such study may include literature review and field and laboratory work. The courses are offered in all quarters, and credits can vary from 1 to 5, and, with the permission of the instructor, each course may be repeated for credit. Credits are individually arranged for each course. Prerequisites include graduate standing and permission.

FOR P 540 Graduate Studies in Logging Engineering (1-5) *Burke, Greulich, Schless*

FOR P 570 Graduate Studies in Forest Products (1-5) *Allan, Bethel, Briggs, Bryant, Hrutfiord, Sarkanen, Smith*

Interdisciplinary Graduate Degree Programs

These programs are administered by interdisciplinary groups of the Graduate School. Certain courses carrying the particular program prefix appear below; other courses with the same prefix appear elsewhere as indicated. Other courses included in these programs are selected from many disciplines throughout the University and carry the prefix of the respective discipline.

Applied Mathematics

Frederic Y. M. Wan, Graduate Program Coordinator

The Applied Mathematics Program offers interdisciplinary graduate programs of study leading to the degrees of Doctor of Philosophy and Master of Science in Applied Mathematics, involving training in mathematics as well as significant study in at least one outside field. Graduate work in applied mathematics leading to M.S. and Ph.D. degrees encompasses (1) broad training in those mathematical techniques that have been found generally useful in applications, (2) in-depth exposure to at least one field of application, and (3) an opportunity to explore certain specialized aspects of applied mathematics.

Principal areas of study include applied linear algebra, real variable and operator theory, ordinary differential equations, complex variables, partial differential equations, special functions, numerical analysis, control and estimation theory, probability and statistics, combinatorics, optimization, and perturbation and approximation techniques. An extensive range of outside fields that has been identified includes all branches of engineering, the physical sciences, biological sciences, economics and management of science, and certain areas of medical science. Nontraditional fields of applications may be approved if appropriate.

Each individual program of study is designed by the student in consultation with, and with the approval of, a supervisory committee. Besides study of appropriate courses, close collaboration of student and faculty members in research is essential and each student will work under the supervision of a faculty member to develop the techniques and insight necessary for successful research.

Special Requirements

Entering students should hold an undergraduate degree in the physical, behavioral, earth, or life sciences, engineering or economics and management with a strong background in mathematics or mathematics with a concentration in at least one other field.

For the M.S. degree, either a thesis or nonthesis program may be selected. Admission to the Ph.D. program is contingent upon passing a qualifying examination. The program requires certification of a reading knowledge of one appropriate foreign language. Advancement to Candidate in Philosophy is contingent upon passing a General Examination specified by the Supervisory Committee. A dissertation presentation and defense (Final Examination) is required for the Doctor of Philosophy degree.

Financial Aid

Both research and teaching assistantships, awarded on the basis of merit, are available to full-time students.

Research Facilities

Support facilities are available in the form of libraries, laboratories, and a modern computing center.

Correspondence and Information

Chairperson
408 Guggenheim, FS-20

Faculty

Chairperson

Frederic Y. M. Wan

Professors

Baker, Marshall,*‡ (Physics), Ph.D., 1958, Harvard; theoretical physics.

Criminale, William O., Jr.,* (Oceanography, Geophysics), Ph.D., 1960, Johns Hopkins; fluid dynamics, mathematical physics.

Faaland, Bruce H.,*‡ (Finance, Business Economics, Quantitative Methods), Ph.D., 1971, Stanford; integer and combinational programming.

Finlayson, Bruce A.,* (Chemical Engineering), Ph.D., 1965, Minnesota; orthogonal collocation, finite elements, variational principles.

Ishimaru, Akira,*‡ (Electrical Engineering), Ph.D., 1958, Washington; wave propagation and scattering.

Kevorkian, Jirair,* (Aeronautics and Astronautics), Ph.D., 1961, California Institute of Technology; partial differential equations, perturbation theory.

Pearson, Carl E.,* (Aeronautics and Astronautics), Ph.D., 1949, Brown; fluid dynamics, numerical analysis.

Rockafellar, R. Tyrrell,* (Mathematics), Ph.D., 1963, Harvard; optimization, control theory, network programming.

Vagners, Juris,* (Aeronautics and Astronautics),† Ph.D., 1967, Stanford; optimal control and estimation theory.

Wan, Frederic Y. M.,* (Mathematics), Ph.D., 1965, Massachusetts Institute of Technology; mathematical modeling, asymptotic and numerical methods for differential equations.

Winter, Donald F.,* (Oceanography),† Ph.D., 1962, Harvard; physics and biological oceanography.

Associate Professor

Westwater, Michael J.,*‡ (Mathematics), Ph.D., 1967, Cambridge; quantum mechanics, mathematical physics.

Course Descriptions

AMATH 341 Computer Applications of Numerical Methods (3) AWSpS Development and application of numerical methods and algorithms to solve problems in engineering. Simultaneous equations, curve fitting, root-finding algorithms, Taylor series analysis, numerical integration, ordinary differential equations. Offered jointly with ENGR 341. Prerequisites: ENGR 141 or equivalent and MATH 238, which may be taken concurrently.

AMATH 351, 352 Quantitative Methods I, II (3,3) A,W Applications of mathematical techniques and basic principles of the natural sciences to major problems in engineering and oceanography. 351: ordinary differential equations. 352: approximate methods; curve fitting; Fourier series; introduction to partial differential equations; boundary-value problems. Offered jointly with OCEAN 351, 352. Prerequisites: one year of physics and MATH 126 for 351; 351 or MATH 238 for 352.

AMATH 381, 382, 383 Introduction to Mathematical Modeling (3,3,3) A,W,Sp Simple discrete and continuous models of diverse natural and social phenomena studied with particular reference to the unity of the tools of mathematical analysis useful in their study. 381: discrete methods; 383: continuous methods; 382: a mixture. Mathematical topics and phenomena. Offered jointly with MATH 381, 382, 383. Prerequisites: MATH 126 and 205 for 381 and 382; either AMATH 351 or MATH 238, and MATH 327 for 383.

AMATH 401 Methods in Applied Mathematics I (4) ASp Acquisition of technique and experience in application of areas of mathematics encountered in science and engineering; illustrated by case studies from many fields. Applications of vector differential calculus; line and surface integrals, integral theorems; complex variables; Taylor and Laurent series, contours integration. Offered jointly with ENGR 401. Prerequisites: MATH 205; MATH 327 or A A 370, and AMATH 351 or MATH 238 or permission of instructor.

AMATH 402 Methods in Applied Mathematics II (4) WS See 401. Applications of ordinary differential equations; phase plane, stability; systems of differential equations; power series solutions; Laplace and Fourier transforms; Fourier series. Offered jointly with ENGR 402. Prerequisite: 401 or permission of instructor.

AMATH 403 Methods in Applied Mathematics III (4) SpS See 401. Application of partial differential equations; special functions, probability and statistics. Offered jointly with ENGR 403. Prerequisites: 402 or permission of instructor.

AMATH 501 Seminar in Applied Mathematics (1, max. 6) AWSp Special topics and selected problems of current interest in applied mathematics. Offered on credit/no credit basis only.

AMATH 507, 508 Calculus of Variations I, II (3,3) A,W Necessary and sufficient conditions for a weak and strong extremum. Legendre transformation, Hamiltonian systems. Constraints and Lagrange multipliers. Space-time problems with examples from elasticity, electromagnetics, and fluid mechanics. Sturm-Liouville problems. Approximate methods. Offered jointly with MATH 507, 508. Prerequisites: 351 or MATH 238; MATH 327, 328, 329 for 507; 507 for 508; recommended: 402, 403, or MATH 428, 429.

AMATH 519 Tensor Analysis (3) A Cartesian tensors; motivation, manipulation, applications. Riemannian space; Christoffel symbols, geodesics, covariant differentiation. Curvature tensor, geodesic deviations, flat space. Special local coordinate systems. Applications to classical mechanics, continuum mechanisms, electromagnetism, relativity. Special topics. Offered jointly with MATH 519. Prerequisite: 401 or MATH 327, or permission of instructor.

AMATH 520 Mathematical Modeling (3) W Processes used in physical, biological, and economic sciences, as well as in engineering, for providing mathematical descriptions of various problems pertinent to these disciplines. Emphasis on the modeling rather than on the solution. Students must have an undergraduate background in one or more mentioned areas.

AMATH 563, 564 Methods of Partial Differential Equations II, III (3,3) A,W First-order partial differential equations: characteristics, conservation laws, shocks, applications to geometrical optics and Hamiltonian-Jacobi theory. Elliptic equations: fundamental solution, Green's functions, conformal mapping, boundary-value problems. Parabolic equations. Hyperbolic equations: characteristics, shocks, examples from fluid dynamics, approximate methods. Post-master's sequence. Prerequisite: 569. (Offered odd-numbered years.)

AMATH 567 Analysis in Engineering and Science I (3) A Complex variable and associated topics. Branch cuts, series and product expansions. Contour integration, numerical implications. Harmonic functions. Complex potential (and singularities) in physical problems. Conformal mapping; applications and examples. Grid generation. Fourier and Laplace transforms, inversions and asymptotics. Spectral decomposition, FFT method. Complex matrices. Offered jointly with A A 567.

AMATH 568 Analysis in Engineering and Science II (3) W Survey of properties and practical solution techniques for ordinary differential equations. Series expansions; eigenvalue problems; transforms and applications; variational methods; asymptotic expansions; perturbations, regular and singular; difference equations; numerical procedures. Offered jointly with A A 568. Recommended: 401 or equivalent.

AMATH 569 Partial Differential Equations (3) Sp Properties of diffusion, wave, and Laplace-type equations; initial and boundary-value problems; series expansions; transform methods; singularities, Green's functions; classification of second-order equations, theory and applications of method of characteristics. Offered jointly with A A 569 and MATH 569. Prerequisite: 403, 568 or MATH 428 or permission of instructor.

AMATH 577, 578 Perturbation Theory I, II (3,3) A,W Basic concepts of asymptotic expansions with applications to linear partial differential equations. Singular perturbations: matched asymptotic expansions, boundary layers, shock layers, uniformly valid solutions, the method of multiple scales, weakly nonlinear wave propagation problems and resonance phenomena, nonlinear wave propagation in fluid, solid and particle mechanics. Post-master's sequence. Prerequisites: 567, 568, 569, or equivalent. (Offered even-numbered years.)

AMATH 584 Applied Linear Algebra and Introductory Numerical Methods (3) A Applied linear algebra: matrix operations, linear systems, matrix factorization, eigenvalues, numerical methods, applications to optimization, circuits, differential equations. Survey of numerical methods: nonlinear systems, curve fitting, ordinary differential equations, quadrature, basic ideas in partial differential equations. Offered jointly with A A 584.

AMATH 585, 586 Approximate and Numerical Analysis II, III (3,3) W,Sp Advanced topics in numerical analysis. More detailed consideration of topics in 584. Emphasis on methods for partial differential equations, integral equations, finite elements, stability and accuracy, mesh generation, adaptive meshes, sparse matrices, variational methods. Post-master's sequence. Offered jointly with A A 585, 586. Prerequisites: 567, 584, 568, and 569, which may be taken concurrently. (Offered even-numbered years.)

AMATH 588, 589 Techniques of Applied Analysis II, III (3,3) Differential equations in the complex plane. Special functions. Asymptotic methods (saddle point, stationary phase, WKB). Fourier and related transforms. Radiation condition, signal propagation, singular inversions. Green's functions. Applications. Integral equations. Special techniques. Post-master's sequence. Prerequisites: 567, 568, 569 or equivalent; 568 and 569 may be taken concurrently.

AMATH 599 Special Studies in Applied Mathematics (*, max. 12) AWSpS Lectures and discussions of topics of current interest in applied mathematics. May not be offered every quarter; content may vary from one offering to another. Prerequisite: permission of instructor.

AMATH 600 Independent Research or Study (*) AWSpS Offered on credit/no credit basis only.

AMATH 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

AMATH 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Biology Teaching

Ingrith J. Deyrup-Olsen, Graduate Program Coordinator

The Graduate School Biology Teaching Group offers an interdisciplinary program that leads to the degree of Master of Arts for Teachers in the field of biological science. Designed specifically for biology teachers in secondary schools and community colleges, the program emphasizes broadening the student's understanding of the various fields of biological science, with improvement of the student's effectiveness as a teacher as the primary goal. The program offers opportunities for course work within the departments of the University in biological science and science education. Each student is asked to perform an in-depth study of a biological problem in the context of its relevance to the teaching of biological science. Facilities and guidance are provided by a sponsoring professor and advisory committee drawn from the Biology Teaching Group and the several biological science departments of the University.

Special Requirements

Prospective candidates for the degree must have a provisional or permanent certificate for teaching biology at the secondary level.

Assistantships and fellowships are not provided under the aegis of this program.

Correspondence and Information

Graduate Program Coordinator
Department of Zoology, NJ-15

Faculty

Chairperson

Ingrith J. Deyrup-Olsen

Professors

Deyrup-Olsen, Ingrith J.,* (Zoology), Ph.D., 1944, Columbia.

Edwards, John S.,* (Zoology), Ph.D., 1960, Cambridge (England).

Farner, Donald S.,* (Zoology), Ph.D., 1941, Wisconsin.

Gordon, Milton P.,* (Biochemistry), Ph.D., 1953, Illinois.

Kohn, Alan J.,* (Zoology), Ph.D., 1957, Yale.

Meeuse, Bastiaan J. D.,* (Botany), Ph.D., 1943, Delft (Holland).

Nester, Eugene W.,* (Microbiology and Immunology), Ph.D., 1959, Western Reserve.

Olstad, Roger G.,* (Education), Ph.D., 1963, Minnesota.

Stettler, Reinhard F.,* (Forest Resources), Ph.D., 1963, California (Berkeley).

Associate Professor

Halperin, Walter,* (Botany), Ph.D., 1965, Connecticut.

Biomathematics

The Biomathematics Group administers a graduate program leading to the Master of Science and Doctor of Philosophy degrees in quantitative methods applied to the medical, biological, and ecological sciences. Biology, medicine, and ecology are undergoing major changes in their development as quantitative sciences. As rapid technological advances find expression in new research tools, new theoretical concepts are being employed in the analysis of quantitative data. The techniques and viewpoints of mathematics and statistics, traditionally peripheral to biology, medicine, and ecology, are rapidly being woven into the fabric of the life sciences. The recent emergence of, and rapid growth of interest in, mathematical biology provide exciting new opportunities in research and teaching. The aim of this program is to stimulate interest in, and to produce researchers for, these interdisciplinary areas.

Many universities have instituted programs relating mathematics or statistics to one particular biological field. The aim of the program at this university is to give students the opportunity to bring together one or more branches of mathematics with selected fields of biology, medicine, health services, or ecology.

Admission Requirements

Students may enter the program from an undergraduate major in mathematics, statistics, or a biological field. Ideally, an applicant should have 30 or more credits in mathematics and statistics (to include a year of advanced calculus, one course in linear algebra, and one course in probability theory) and 15 or more credits in a biological field. In most cases, deficiencies may be made up after admission.

In addition to fulfilling graduate admission requirements, an applicant must submit three letters of recommendation from persons competent to evaluate the applicant's abilities, a narrative statement regarding the applicant's purpose and interest in entering the program, and an official Graduate Record Examination score report (only verbal and quantitative sections are required).

Recommendation for selection of candidates is made by a faculty admissions committee with review of applicants beginning in February for admission Autumn Quarter. Applications are accepted for other quarters as well. Closing dates are shown on the application form, although the admissions committee encourages applying as early as possible.

Master of Science Degree

The Master of Science degree program is designed for the Biostatistics Pathway and includes two options: Health Sciences Biology, and Quantitative Ecology and Resource Management. In exceptional situations, the degree is offered in the Individual Program Pathway.

The student must complete required course work, demonstrate competence in computer programming, write a thesis, and pass the first-year examination. This examination is offered after a student's first year, and, if a student does not pass at this time, it can be retaken the next year. A student also may receive a nonthesis Master of Science degree by successfully completing the first- and second-year qualifying examinations.

Doctor of Philosophy Degree

Students working for the Doctor of Philosophy degree follow either the Biostatistics or Individual Program Pathway. The Biostatistics Pathway includes two optional areas of emphasis: Health Sciences Biology, which develops the theory and application of statistics to the health sciences, and Quantitative Ecology and Resource Management, which applies statistics to ecological and natural resource problems.

Students in the Individual Program Pathway emphasize an area of biomathematics other than fundamental statistical approaches to ecology or health. Frequently the topic deals with applied mathematics and its use in mathematical biology. Applied mathematics areas include stochastic processes, differential equations, time series, numerical analysis, control theory, and decision theory. Mathematical biology areas include population genetics, population dynamics, automata theory, biophysics, optimal foraging theory, ecosystem simulation, bioengineering, and biochemical kinetics.

In addition to the course work, the program requires competence in computer programming, research experience, passing scores on all examinations (first- and second-year examinations, biology examination, and General Examination), and a dissertation.

Correspondence and Information

Chairperson, Biomathematics Group
Department of Biostatistics, SC-32

Faculty

Chairperson

Richard A. Kronmal

Professors

Bassingthwaighte, James B.,* (Bioengineering), Ph.D., 1964, Mayo Graduate School of Medicine; computer analysis of transport mechanisms in blood and tissues.

Bell, Charles B., Jr.,* (Biostatistics), Ph.D., 1953, Notre Dame; applications of stochastic processes to biomedical problems, nonparametrics.

Breslow, Norman E.,* (Biostatistics), Ph.D., 1967, Stanford; clinical trials, epidemiology, survival and categorical data.

Chapman, Douglas G. (Emeritus), (Fisheries, Mathematics), Ph.D., 1949, California (Berkeley); biometrics, population enumeration and population dynamics, quantitative ecology.

DeRouen, Timothy,* (Biostatistics), Ph.D., 1971, Virginia Polytechnic Institute; applications to the epidemiology of cardiovascular and sexually transmitted diseases.

Feigl, Polly,* (Biostatistics), Ph.D., 1961, Minnesota; application of statistics to biomedical studies and cancer patient data systems.

Fisher, Lloyd D.,* (Biostatistics), Ph.D., 1966, Dartmouth; cardiovascular data analysis, clinical trials, multivariate statistics, longitudinal data analysis.

Fletcher, Richard I.,* (Fisheries), Ph.D., 1973, Rhode Island; biophysics, fluid dynamics and population dynamics.

Gallucci, Vincent F.,* (Fisheries), Ph.D., 1971, North Carolina State; application of stochastic processes and differential equations to the biological sciences, population dynamics, and the management of harvested populations.

Goldstein, Allen A.,* (Mathematics, Applied Mathematics), Ph.D., 1954, Georgetown; optimization, approximation theory.

Hatheway, William H.,* (Forest Resources), Ph.D., 1956, Harvard; quantitative ecology, plant/water relations, and cold resistance in plants.

Hewitt, Edwin,* (Mathematics), Ph.D., 1942, Harvard; Fourier analysis, Fourier-Stieltjes transformations, measure theory, functional analysis.

King, Benjamin F.,* (Finance, Business Economics, Quantitative Methods), Ph.D., 1964, Chicago; sample surveys, problems of measurement, Bayesian methods.

Kronmal, Richard A.,* (Biostatistics), Ph.D., 1964, California (Los Angeles); nonparametric density estimation, computer algorithms, cardiovascular data analysis.

Martin, Donald C.,* (Biostatistics), Ph.D., 1968, Florida State; statistical computing, design of statistical systems, classification methods, approximations for probability functions, signal processing, randomization tests.

Martin, R. Douglas,* (Statistics), Ph.D., 1969, Princeton; robust inference, time series, data analysis.

Perlman, Michael D.,* (Statistics), Ph.D., 1967, Stanford; multivariate analysis, decision theory.

Perrin, Edward B.,* (Health Services), Ph.D., 1960, Stanford; design and use of health information systems, health services research, stochastic processes, clinical trials.

Prentice, Ross L.,* (Biostatistics), Ph.D., 1970, Toronto; survival analysis, case-control and cohort study methods, biostatistical consulting.

Pullum, Thomas W.,* (Sociology), Ph.D., 1971, Chicago; mathematical models in sociology and demography, particularly as related to human fertility and social mobility.

Pyke, Ronald,* (Mathematics), Ph.D., 1956, Washington; empirical processes.

Shorack, Galen R.,* (Statistics), Ph.D., 1965, Standord; empirical processes, robustness.

Thompson, Donovan J, (Emeritus), Ph.D., 1951, Iowa; sampling, community trials, community health surveys.

van Belle, Gerald,* (Biostatistics), Ph.D., 1967, Toronto; clinical trials, applied statistics screening, epidemiology.

Associate Professors

Bledsoe, Lewis J.* (Research), (Fisheries), Ph.D., 1974, Colorado State; systems ecology, applications of mathematical statistics and computer technology to analysis of environmental systems.

Conquest, Loveday,* (Fisheries), Ph.D., 1975, Washington; analysis of water pollution data and biological community measures, statistical analysis of aquatic ecosystems, experimental design, statistical methods in fisheries research, biometrics.

Crowley, John, * (Biostatistics), Ph.D., 1973, Washington; survival analysis, cancer clinical trials and carcinogenesis studies, statistical methods in epidemiology.

Davis, Kathryn,* (Biostatistics), Ph.D., 1974, Washington; density estimation, cardiovascular data analysis, clinical trials.

Diehr, Paula,* (Biostatistics), Ph.D., 1971, California (Los Angeles); application of statistics to health services research, multiple regression.

Farewell, Vernon T.,* (Biostatistics), Ph.D., 1977, Imperial College; analysis of survival data, case-control studies, statistics in cancer research.

Johnson, Dale E.,* (Bioengineering), Ph.D., 1971, Chicago; electron energy loss spectroscopy, image reconstruction.

Mathews, Stephen B.,* (Fisheries), Ph.D., 1967, Washington; quantitative fisheries management.

Peterson, Arthur V., Jr.,* (Biostatistics), Ph.D., 1975, Stanford; survival data methodology, competing risks, design of medical studies, random number generation.

Polissar, Lincoln* (Research), (Biostatistics), Ph.D., 1974, Princeton; cancer data analysis, epidemiologic methods, medical care.

Swartzmann, Gordon L.* (Research), (Fisheries), Ph.D., 1969, Michigan; optimization techniques applied to natural resource management, simulation models of ecosystems, stochastic processes, land-use planning.

Wahl, Patricia,* (Biostatistics), Ph.D., 1971, Washington; multivariate statistical techniques, especially regression analysis applied to cardiovascular data.

Assistant Professors

Benedetti, Jacqueline K.* (Research), (Biostatistics), Ph.D., 1974, Washington; clinical trials methodology, categorical data.

Guttorp, Peter,* (Statistics), Ph.D., 1980, California (Berkeley); point processes, stochastic modeling, statistical computing.

Kopecky, Kenneth,* (Biostatistics), Ph.D., 1977, Oregon; clinical trials design and analysis, survival data analysis, epidemiologic methodology, goodness of fit, biomedical and cancer-related applications.

McKnight, Barbara,* (Biostatistics), Ph.D., 1981, Wisconsin; survival analysis and competing risks, statistical applications, animal carcinogenesis testing, epidemiology, and diabetes research.

Temkin, Nancy R.,* (Biostatistics), Ph.D., 1976, State University of New York (Buffalo); clinical trials, recovery models, statistical modeling of epileptic phenomena, survival analysis.

Course Descriptions

Additional required courses are found under Statistics, Biostatistics, and Quantitative Science listings.

BMATH 554 Stochastic Processes in the Life Sciences (3) Modeling of various biomedical phenomena in terms of the basic stochastic processes—binomial, Poisson, and Gaussions. Extensions to include basic applications of random walk, compound, and nonhomogeneous Poisson processes, as well as Wiener processes and certain fundamental time series. Estimation, testing, and interval estimation for parameters in parametric models. Introduction to nonparametric stochastic processes and associated inference. Special emphasis in air-pollution models, water-pollution models, epileptic-seizure models, and cancer-related nutrition models. Prerequisites: basic course in each of statistical inference, probability, and biology.

BMATH 597 Seminar in Quantitative Ecology (1, max. 9) AWSp Lectures and discussions of current problems in quantitative ecology. Offered jointly with Q SCI 597. Prerequisite: permission of instructor.

BMATH 598 Special Topics in Quantitative Ecology (1-3, max. 12) AWSp Special topics in quantitative ecology, including population and community ecology, systems ecology, and physical processes in ecosystems. Prerequisite: permission of instructor.

BMATH 599 Research in Quantitative Ecology (1-5, max. 5) AWSp Special advanced topics in quantitative ecology. Topics can be of a theoretical nature or combined theory and experiment. Prerequisite: permission of instructor.

BMATH 600 Independent Study or Research (*)

BMATH 700 Master's Thesis (*)

BMATH 800 Doctoral Dissertation (*)

Health Services Administration

Douglas A. Conrad, Graduate Program Coordinator

The Health Services Administration group offers a two-year program of studies leading to the degree of Master of Health Administration. It provides preparation for careers in management, planning, and policy analysis, and similar roles in ambulatory-care organizations, hospitals, long-term-care facilities, mental-health-care organizations, government agencies, planning agencies, and other organizational settings in the health field. The curriculum is designed to be interdisciplinary, with a faculty drawn not only from the School of Public Health and Community Medicine, but also from the graduate schools of Business Administration and Public Affairs, School of Social Work, and the departments of Urban Planning, Economics, and Sociology. Each student's curriculum is drawn from these academic units according to distributional requirements set by the program. A student's program of studies may vary according to his or her concentration of study and career objectives. In addition to academic work, students are required to participate in an internship experience in a health facility or agency under the preceptorship of the administrator or director of that organization. Also, a year-long survey or research project of study under the supervision of a faculty adviser is required in the second year.

Course listings may be found under the School of Public Health and Community Medicine, Department of Health Services.

Special Requirements

Applicants must submit, in addition to Graduate School admission requirements, at last three letters of recommendation and scores from either the Graduate Record Examination or Graduate Management Admission Test. A narrative statement of objectives is also required, and interviews by members of the program faculty may be required. Relevant health field experience is preferred. In general, applicants are accepted only for Autumn Quarter of each year. The application deadline is March 31.

Financial Aid

A limited number of fellowships, assistantships, scholarships, and loans are available each year. However, students admitted should be prepared to utilize their own resources to finance their graduate education.

Research Facilities

In addition to utilizing University facilities, the program makes use of community health facilities and agencies for research and training.

Correspondence and Information

Graduate Program Coordinator
F361 Health Sciences, SC-37

Faculty

Director

Douglas A. Conrad

Professors

Amoss, Harold L. (Emeritus), (Urban Planning), Ph.D., 1951, California (Berkeley); community organization and development, planned social change.

Bice, Thomas W.,* (Health Services), Ph.D., 1969, Purdue; regulation in the health-care industry (federal and state).

French, Wendell L. (Emeritus), (Management and Organization), D.Ed., 1956, Harvard; organizational behavior, personnel management, organization development.

Gross, Edward,* (Sociology), Ph.D., 1949, Chicago; formal organizational, industrial sociology.

Horn, Barbara J.,* (Nursing), Ph.D., 1971, Michigan.

Morrill, Richard L.,* (Geography), Ph.D., 1959, Washington; social and economic geography, theory and quantitative methods.

Page, Alfred N.,* (Finance, Business Economics, and Quantitative Methods), Ph.D., 1964.

Phillips, Theodore J., (Medicine), M.D., 1959, Johns Hopkins; family medicine.

Richardson, William C.,* (Health Services), Ph.D., 1971, Chicago; health services utilization behavior, professional referral patterns, reimbursement mechanisms.

Rosenzweig, James E.,* (Business Administration), Ph.D., 1956, Illinois; administrative theory and business policy.

Saxberg, Borje O.,* (Business Administration), Ph.D., 1958, Illinois; administrative theory and organizational behavior.

Williams, Walter,* (Public Affairs), Ph.D., 1960, Indiana; public policy research and analysis, manpower.

Associate Professors

Conrad, Douglas A.,* (Health Services), (Community Dentistry; Finance, Business Economics, and Quantitative Methods),† Ph.D., 1978, Chicago; economic regulation in hospitals, health-care finance, cost effectiveness of dental treatment.

LoGerfo, James P.,* (Health Services), M.D., 1968, Rochester.

Lyden, Fremont J.,* (Public Affairs), Ph.D., 1960, Washington; public management, social theory and the public policy process, administration of medical programs.

Miller, Donald H.,* (Urban Planning), Ph.D., 1973, California (Berkeley); urban planning, planning theory, urban spatial structure, planning evaluation, public service planning.

Patti, Rino J.,* (Social Work), D.S.W., 1967, Southern California; social welfare policy, community and organizational development.

Schneider, Jerry B.,* (Civil Engineering, Urban Planning), Ph.D., 1966, Pennsylvania; metropolitan area and regional planning, transportation and other urban models.

Trivedi, Vandan M.,* (Health Services), Ph.D., 1974, Michigan; operations research models for hospitals and health-care systems.

Watts, Carolyn A.,* (Health Services), Ph.D., 1974, Johns Hopkins; regulation, insurance, health policy.

Assistant Professor

Michnich, Marie E.,* (Health Services), Dr.P.H., 1978, California (Los Angeles); management and organization, health promotion and disease prevention.

Nutritional Sciences

Bonnie S. Worthington-Roberts, Graduate Program Coordinator

The Nutritional Sciences Program offers an interdisciplinary graduate program leading to the Master of Science degree in Nutritional Sciences. Training is provided in advanced nutrition, foods, and application of these sciences to the field of clinical dietetics through both didactic and clinical experiences. Three types of students are best served by this program: (1) the individual with a strong science background who wishes to pursue advanced training in nutritional sciences; (2) the individual with an undergraduate background in nutrition, dietetics, and foods who wishes to pursue additional training in nutritional sciences while obtaining the supervised clinical experience applicable to meeting requirements for registration in the American Dietetic Association; and (3) the individual who already has become a registered dietitian but wishes to pursue advanced training in nutritional sciences with or without participation in a supervised clinical experience leading to specialization.

Principal areas of study include clinical nutrition, community nutrition, maternal and child nutrition, Nutritional biochemistry, and experimental foods. Supportive course work in related fields is provided through the schools of Medicine, Public Health, Pharmacy, and Nursing and the Department of Food Science in the College of Ocean and Fishery Sciences. Relevant courses are also provided by the departments of Anthropology, Genetics, Psychology, and Zoology in the College of Arts and Sciences.

Each individual program of study is designed by the student in consultation with, and with the approval of, a supervisory committee. Not only will appropriate course work be carefully defined, but collaboration between student and faculty in appropriate thesis research will begin as early in the graduate experience as possible. Those students receiving supervised clinical experience will work closely with the coordinator of clinical activities, so an individual program of clinical experiences can be designed to fit with the career goals of the student.

Admission Requirements

Students may enter the program from an undergraduate major in the biological sciences; background in human physiology and biochemistry is especially desirable. Those students who wish to pursue supervised clinical experience must have undergraduate experience in nutrition, foods, and dietetics. Applicants who are *not* registered dietitians but wish to gain clinical experience must provide evidence that the Plan 4 requirements of the American Dietetic Association have been met.

Research Facilities

Support facilities are available in the form of libraries, laboratories, a nutrient data base, computer facilities, a human metabolic unit, a vivarium, and a sensory evaluation complex. Clinical facilities available for supervised clinical experience include University Hospital, Harborview Medical Center, Fred Hutchinson Cancer Research Center, Northwest Kidney Center, Children's Orthopedic Hospital, Pacific Medical Center, Veterans Administration Hospital, Child Development and Mental Retardation Center, L. C. Foss Nursing Home, and a variety of other, smaller units.

Correspondence and Information

Chairperson
305D Raitt, DL-10

Faculty

Chairperson

Bonnie S. Worthington-Roberts

Professors

Bierman, Edwin L., (Medicine), M.D., 1955, Cornell; metabolism and endocrinology, clinical nutrition.

Brunzell, John D., (Medicine), M.D., 1963, Washington; metabolism and endocrinology, clinical nutrition.

Emanuel, Irvin,* (Medicine), M.D., 1960, Rochester; child development and mental retardation.

Finch, Clement A., (Medicine), M.D., 1941, Rochester; hematology.

Halver, John E.,* (Fisheries), Ph.D., 1963, Washington; fish nutrition and comparative nutrition.

Knopp, Robert H., (Medicine), M.D., 1964, Cornell; obstetrics-gynecology, clinical nutrition.

Labbe, Robert F.,* (Laboratory Medicine), Ph.D., 1951, Oregon State; nutritional biochemistry.

Liston, John,* (Food Science), Ph.D., 1955, Aberdeen; food science, marine microbiology.

Monsen, Elaine R.,* (Medicine), Ph.D., 1961, California (Berkeley); nutrition, dietetics.

Peterson, Donald R.,* (Epidemiology), M.D., 1947, Oregon, M.P.H., 1958, California (Berkeley); maternal-child epidemiology.

Pigott, George M.,* (Food Science), Ph.D., 1963, Washington; food engineering.

Porte, Daniel, Jr., (Medicine), M.D., 1957, Chicago; metabolism and endocrinology.

Saunders, David R., (Medicine), M.D.C.M., 1957, McGill; gastroenterology.

Scott, C. Ronald, (Pediatrics), M.D., 1959, Washington; pediatric genetics.

Smith, Nathan J., (Pediatrics, Orthopedics), M.D., 1945, Wisconsin; pediatrics, sports medicine.

Whorton, James C.,* (Biomedical History), Ph.D., 1969, Wisconsin; history of American medicine, public health, alternative healing, pharmacy, biochemistry.

Woods, Stephen C.,* (Psychology), Ph.D., 1970, Washington; appetite regulation, obesity.

Worthington-Roberts, Bonnie S.,* (Epidemiology, Pediatrics), Ph.D., 1971, Washington; maternal and child nutrition.

Associate Professors

Benedetti, Thomas J., (Obstetrics and Gynecology), M.D., 1973, Washington; perinatal medicine.

Brown, Zane A., (Obstetrics and Gynecology), M.D., 1966, Temple; perinatal medicine.

Chait, Alan, (Medicine), M.D., 1974, Cape Town; metabolism and endocrinology, clinical nutrition.

Chen, Mei, (Medicine), M.D., 1968, Taiwan; internal medicine, gerontology.

Chesnut, Charles H. III, (Medicine), M.D., 1966, Florida; nuclear medicine.

Childs, Marian T.,* (Medicine), Ph.D., 1950, California (Berkeley); nutrition.

Dellinger, Patchen E., (Surgery), M.D., 1970, Harvard; general surgery.

Elmer, Gary W.,* (Pharmacy), Ph.D., 1970, Rutgers; pharmacognosy.

Kiyak, Asumer H.,* (Community Dentistry), Ph.D., 1977, Wayne State; geriatric dentistry, behavioral aspects of health care.

Lennard, E. Stan, (Surgery), M.D., 1968, Texas Southwestern, D.S.S., 1976, Cincinnati; general surgery.

Martinsen, Charlene S.,* (Psychology), Ph.D., 1974, Washington; foods, sensory evaluation.

Peterson, Malcolm L.,* (Community Dentistry), M.D., 1954, Washington, Ph.D., 1960, Rockefeller; community medicine.

Wood, Francis C., Jr., (Medicine), M.D., 1954, Harvard; metabolism and endocrinology.

Yamanaka, William K.,* (Epidemiology), Ph.D., 1974, California (Berkeley); nutrition.

Assistant Professors

Oreskovich, Michael R., (Surgery), M.D., 1974, Washington; general surgery.

Pearlman, Robert A., (Medicine), M.D., 1975, Boston; gerontology.

Schwartz, Robert S., (Medicine) M.D., 1974, Ohio State; internal medicine and geriatrics.

Lecturers

Faine, Mary, (Dentistry), M.S., 1975, Washington; nutrition.

Karkeck, Joan, M.S., 1970, Case Western Reserve; nutrition and dietetics.

Lucas, Betty L., (Parent and Child Nursing), M.P.H., 1969, California (Berkeley); maternal and child nutrition.

Mahan, L. Kathleen, (Pediatrics), M.S., 1973, Tulane; maternal and child nutrition.

O'Leary, Mary, (Pediatrics), M.S., 1979, Minnesota; neonatal nutrition.

Pipes, Peggy L., (Parent and Child Nursing), M.P.H., 1966, Michigan; maternal and child nutrition.

Rees, Jane M., (Pediatrics), M.S., 1972, Washington; maternal and child nutrition.

Trahms, Cristine M., (Pediatrics), M.S., 1972, Washington; maternal and child nutrition.

Course Descriptions

Courses for Undergraduates

NUTR 300 Nutrition for Today (3) Importance of food to the maintenance of health; nutritive values and human needs; ways of meeting requirements. For nonmajors. Offered jointly with FD SC 300.

NUTR 301 Nutrition and Nursing (3) Basic principles of nutrition and their relationship to health problems. Normal nutrition needs of individuals at various age levels; environmental influences on nutrition; assessment of nutritional status; nutritional values of foods; dietary modifications as appropriate in the nutritional component of medical treatment. Prerequisite: organic chemistry.

NUTR 421 Human Nutrition (5) Basic principles of normal human nutrition, emphasizing chemistry, metabolism, deficiency diseases, and requirements for proteins, lipids, carbohydrates, vitamins, and minerals. Consideration of energy metabolism, nutritional status, nutrition for the life cycle, nutritive value of foods and food additives. Prerequisites: general and organic chemistry, biochemistry, human physiology.

Courses for Graduates Only

NUTR 500 Graduate Seminar in Human Nutrition, Diet, and Foods (1, max. 3) Current literature and recent symposiums in the field of human nutrition, dietetics, and foods.

NUTR 520 Protein and Carbohydrate Nutrition (3) Metabolic and physiologic concepts related to protein and carbohydrate nutrition. Areas addressed include composition of foods, requirements through the life cycle, quality of protein, vegetarianism, protein deficiency, low carbohydrates, glycemic response to foods, carbohydrates and dental caries, inborn errors in carbohydrate and protein metabolism.

NUTR 521 Lipid Nutrition (3) Normal lipid components of animal fluids and tissues, with review of their metabolism and physiological functions. Effect of diet and the normal development during the life span on these lipids. Changes of lipids with various types of disease states and means of nutritional modification of these changes.

NUTR 522 Nutrition of the Biologically Essential Minerals (3) Special emphasis on trace minerals. Consideration of the intestinal absorption of metals, their transport, function, storage, and excretion; mineral competition and imbalance; dietary sources, including foods, food additives, and medications; dietary implications drawn and clinical application made.

NUTR 523 Vitamin Nutrition (3) Dietary compounds presently considered to be essential for humans and called vitamins. General topics are whether the vitamin is fat soluble or water soluble; reviewing basic material and seeking increasing depth of understanding; relation of vitamins to other nutrients and to varying physiological conditions.

NUTR 525 Evaluation of Nutritional Status (3) Dietary, clinical, and biochemical-biophysical components in the assessment of nutritional status. Interrelationships of nutrients and effects of varying levels of nutrient intake. Critical appraisal of nutritional status surveys. Experimental design and dietary methodology. Prerequisites: human nutrition and biochemistry.

NUTR 526 Maternal and Infant Nutrition (3) Influence of nutrition on fertility and on the course and outcome of pregnancy. Nutritional management of high-risk pregnancy. Nutritional needs during lactation and effect of maternal diet on milk composition. Breast-feeding *vs.* bottle-feeding; fundamentals of infant nutrition. Nutritional management of high-risk infants. Prerequisites: human nutrition and human physiology.

NUTR 527 Nutrition: Childhood Through Adolescence (3) Influence of nourishment on growth, development, and behavior of children, toddlers through adolescents. Critical evaluation of normative data, special problems, and intervention strategies. Prerequisites: human nutrition and human physiology.

NUTR 528 Nutrition in Aging (3) Physiological, psychological, social, cultural, and economic factors affecting nutrition in the middle and later years. Prerequisites: human nutrition and human physiology.

NUTR 530 Clinical Nutrition in Normal and Handicapping Conditions of Children (6) Application of principles of advanced nutrition to nutritional needs of infants, children, and adolescents, and nutrition and feeding problems of mentally retarded and multihandicapped children. Participation in clinics conducted by interdisciplinary teams, in preclinic and postclinic conferences in clinical and developmental feeding assessment. Under supervision, each student is assigned responsibility for nutrition care of selected patients.

NUTR 531 National and International Nutrition (3) Survey of nutritional problems in the United States, surveillance strategies and nutrition programs designed to improve status of high-risk populations. Review of major nutritional problems in developing countries, causes of malnutrition, international agencies on food and nutrition, prospects and probable solutions to major nutrition problems in developing countries.

NUTR 532 Fieldwork in Public Health Nutrition (2-12, max. 12) Observation and participation in community agency nutrition programs.

NUTR 539 Seminar in Nutrition (1-3, max. 9) Library research and seminar on selected topics in recent developments in the field of nutrition. Prerequisite: 421.

NUTR 540 Recent Developments in Foods (3) Development of new technology in food production and product development. Design of low-sodium, caffeine-free, and low-calorie food products and other special types. A review of government regulations concerning new developments in foods, including food contamination and food additives. Prerequisites: basic foods and nutrition.

NUTR 541 Experimental Foods (3) Study of sensory evaluation techniques, including threshold tests, difference tests, and descriptive tests. Techniques of food product development and an evaluation of rheological properties of foods. Updates on performance of lipids, carbohydrates, and proteins in foods. Prerequisites: organic chemistry, basic course work in foods or food science.

NUTR 560 Practicum in Dietetic Education (1-5) AWSpS Supervised instructional experiences for dietetic education in both classroom and clinical situations. Individually arranged.

NUTR 561 Advanced Clinical Nutrition Fieldwork (1-3, max. 4) Participation in a health-care team assessing nutrition status and needs, designing care plans to optimize nutritional support of patients, and establishing appropriate criteria for the evaluation of the nutrition care provided. Supervised clinical experiences provided in a variety of local health-care institutions. Prerequisite: permission of instructor.

NUTR 562 Advanced Clinical Nutrition I (4) Assessment of the nutritional demands and hypermetabolic responses of trauma, surgery, acute and neoplastic diseases; determination of the appropriate amounts and sources of nutrients supplied through enteral and/or parenteral routes. Prerequisite: diet therapy.

NUTR 563 Advanced Clinical Nutrition II (4) Epidemiology and pathophysiology of acute and chronic diseases related to nutrition (e.g., cardiovascular, endocrinologic, and hematologic diseases). Nutritional interventions and their relationship to medical, surgical, and pharmacologic treatment. Prerequisite: diet therapy.

NUTR 564 Nutrition Support Management (3) Administrative processes affecting health care, specific focus on management of nutritional support. Includes productivity and cost effectiveness of nutrition care, establishing and achieving quality of care, peer review, budgeting, working with other health-care professionals and varying health-care systems. For clinical nutritionists working in standard health-care systems.

NUTR 600 Independent Study or Research (*)

NUTR 700 Master's Thesis (*)

Physiology-Psychology

Moncrieff H. Smith, Graduate Program Coordinator

This interdisciplinary Doctor of Philosophy degree program administered by the Physiology-Psychology Group of the Graduate School was initiated in 1959 and provides intensive training in the overlapping areas of behavioral and physiological sciences. Graduates of the program are employed in University departments of Psychology, Physiology, and Zoology, and in various School of Medicine departments.

The program is small, accepting only one or two students a year. Financial assistance to those requesting it is offered in the form of a National Institutes of Health predoctoral traineeship and teaching or research assistantships. A dual set of course requirements makes four years of postbaccalaureate work a minimum for the Ph.D. degree. A master's degree program is not offered.

Training is research oriented, and students are expected to undertake individual research projects in their first year of graduate study. Research in both of the parent departments is strongly encouraged. Each student spends approximately a year in course work in each discipline, then engages in seminars in either discipline, elective relevant course work in other University departments, and doctoral research.

Because physiological psychology and neurophysiology are strongly developed at the University, the graduate student finds the latest in instrumentation and research techniques in both fields. In addition to the research facilities of the two parent departments, students have the opportunity of working with laboratory primates at the Regional Primate Center located on campus. The center has facilities for a wide variety of behavioral and physiological studies of a number of primate species and is a valuable adjunct to the resources of the training program.

Correspondence and Information

Graduate Program Coordinator
333A Guthrie, NI-25

Faculty

Chairperson

Moncrieff H. Smith

Professors

Bolles, Robert C.,* (Psychology), Ph.D., 1956, California (Berkeley); motivation.

Crill, Wayne E.,* (Physiology and Biophysics, Medicine), M.D., 1962, Washington; excitable properties of mammalian central nervous system neurons.

Fetz, Eberhard E.,* (Physiology and Biophysics), Ph.D., 1967, Massachusetts Institute of Technology; neurophysiology.

Simpson, John B.,* (Psychology), Ph.D., 1973, Northwestern; behavioral endocrinology.

Smith, Moncrieff H.,* (Psychology), Ph.D., 1947, Stanford; memory.

Smith, Orville A., Jr.,* (Physiology and Biophysics), Ph.D., 1953, Michigan State; central nervous control of autonomic function.

Towe, Arnold L.,* (Physiology and Biophysics), Ph.D., 1953, Washington; neurophysiology of somatic sensation.

Woods, Stephen C.,* (Psychology), Ph.D., 1970, Washington; neural control of endocrine systems.

Associate Professors

Kenney, Nancy J.,* (Psychology), Ph.D., 1974, Virginia; neuroendocrine basis of regulatory behavior.

Rose, Richard M.,* (Psychology), Ph.D., 1964, Princeton; mathematical psychology, psychophysics.

Steiner, Robert A.,* (Physiology and Biophysics, Obstetrics and Gynecology, Zoology), Ph.D., 1975, Oregon; reproductive neuroendocrinology.

Course Description

P PSY 800 Doctoral Dissertation (*)

Radiological Sciences

Kenneth L. Jackson, Graduate Program Coordinator
E179 Health Sciences

Master of Science in Radiological Sciences Degree

The program leading to the degree of Master of Science in Radiological Sciences is offered by the Radiological Sciences Group of the Graduate School. Study for this degree is open to students with a baccalaureate degree in a physical or biological science or in engineering, depending on the option selected. Several curriculum options are offered to satisfy different requirements and interests of biological scientists, physical scientists, or engineers. The various options described below prepare students for careers in health physics, radiological health, radiological physics, or radiation biology.

Thesis topics include studies in radiation biology, radioecology, nuclear medicine, radiochemistry, radiation physics, or nuclear engineering. The above program options also are offered at the Joint Center for Graduate Study in Richland, making available for thesis research the extensive government laboratories there. Research facilities on campus include radioisotope and radiochemistry laboratories, a research reactor, a cyclotron, a large cobalt-60 irradiation facility, neutron beam, x-ray generator, an 8-MeV electron accelerator, and a cesium-137 source.

A student with a deficiency in one area of the prerequisites may be accepted for the program, provided the deficiency is removed during the first year of graduate study. Credit toward the degree is not ordinarily granted for a course used to remove a deficiency.

Physical Science Option

Prerequisites for this option include a baccalaureate degree in a physical science or in engineering, and a year of general biology at the college level.

COURSES		CREDITS
NUC E 484	Introduction to Nuclear Engineering	4
NUC E 485	Nuclear Instruments	3
PHYS 431, 433	Atomic and Nuclear Physics Laboratory	3, 3
RAD S 501, 502	Biological Effects of Ionizing Radiation	2, 2
RAD S 503, 504	Laboratory in Radiation Biology	1, 1
RAD S 507	Radiation Hazards Analysis and Control	1
RAD S 508	Physical Aspects of Medical Imaging	2
	or	
NUC E 486	Nuclear Power Plants	3
RAD S 520	Radiological Sciences Seminar	1, 1
RAD S 540, 541	Health Physics I, II	3, 3
RAD S 542	Environmental Impact of Radioactivity	3
RAD S 700	Thesis	9

Biological Science Option

Prerequisites for this option include a baccalaureate degree in a biological science, courses in mathematics through differential and integral calculus and statistics, and chemistry through quantitative analysis and organic chemistry.

COURSES		CREDITS
CHEM 350, 351	Elementary Physical Chemistry	3, 3
	Graduate-level biology course	3
NUC E 485	Nuclear Instruments	3
PHYS 225	Modern Physics	3
PHYS 327	Introduction to Nuclear Physics	3
RAD S 501, 502	Biological Effects of Ionizing Radiation	2, 2
RAD S 503, 504	Laboratory in Radiation Biology	1, 1
RAD S 507	Radiation Hazards Analysis and Control	1
RAD S 520	Radiological Sciences Seminar	1, 1
RAD S 540, 541	Health Physics I, II	3, 3
RAD S 542	Environmental Impact of Radioactivity	3
RAD S 700	Thesis	9

Environmental Science Option

An applicant with a baccalaureate degree in a physical science or engineering and a year of general biology at the college level generally is prepared to pursue this curriculum.

COURSES		CREDITS
CEWA 434	Ecological Effects of Wastewater	3 or 5
CEWA 461	Air Pollution Control	3
NUC E 484	Introduction to Nuclear Engineering	4
NUC E 485	Nuclear Instruments	3
NUC E 486	Nuclear Power Plants	3
RAD S 501, 502	Biological Effects of Ionizing Radiation	2, 2
RAD S 503, 504	Laboratory in Radiation Biology	1, 1
RAD S 507	Radiation Hazards Analysis and Control	1
RAD S 520	Radiological Sciences Seminar	1, 1
RAD S 540, 541	Health Physics I, II	3, 3
RAD S 542	Environmental Impact of Radioactivity	3
RAD S 700	Thesis	9

Correspondence and Information

Graduate Program Coordinator
E179 Health Sciences, SB-75

Faculty

Chairperson

Kenneth L. Jackson

Professors

Bodansky, David,* (Physics), Ph.D., 1950, Harvard; experimental nuclear physics.

Fairhall, Arthur W. (Emeritus), (Chemistry), Ph.D., 1952, Massachusetts Institute of Technology; radiochemistry, radionuclide dating.

Figley, Melvin M.,* (Radiology, Medicine), M.D., 1944, Harvard; radiology.

Gordon, Milton P.,* (Biochemistry, Microbiology and Immunology), Ph.D., 1953, Illinois; virus nucleic acids, structure of tobacco mosaic virus and biochemistry of infected cells, metabolism of methylated purines.

Jackson, Kenneth L.,* (Environmental Health, Radiology), Ph.D., 1954, California (Berkeley); physiological and biochemical mechanisms in radiation biology.

Lee, John A. H.,* (Epidemiology), M.D., 1955, Edinburgh; epidemiology of neoplastic disease.

Moulton, R. Wells (Emeritus), (Chemical Engineering), Ph.D., 1938, Washington; chemical engineering.

Nelp, Wil B.,* (Radiology, Medicine), M.D., 1955, Johns Hopkins; nuclear medicine.

Robkin, Maurice A.,* (Environmental Health, Nuclear Engineering), Ph.D., 1961, Massachusetts Institute of Technology; nuclear engineering, neutron activation analysis, neutron radiography, radiation dosimetry.

Stadler, David R.,* (Genetics), Ph.D., 1952, Princeton; mutation in *neurospora* and DNA repair mechanisms.

Stoebe, Thomas G.,* (Materials Science and Engineering), Ph.D., 1965, Stanford; physics of solids, diffusion in solids, mechanical behavior of ionic solids, thermoluminescent dosimetry.

Woodruff, Gene L.,* (Nuclear Engineering), Ph.D., 1966, Massachusetts Institute of Technology; reactor theory, fusion engineering, neutron spectroscopy.

Wootton, Peter,* (Radiation Oncology), B.Sc. (Hon.), 1944, Birmingham (England); medical radiation physics, radiation dosimetry.

Associate Professors

Eenmaa, Juri,* (Radiation Oncology), Ph.D., 1972, Washington; medical radiation physics, neutron therapy dosimetry.

Geraci, Joseph P.,* (Environmental Health), Ph.D., 1972, Washington; neutron radiobiology, biochemical mechanisms of radiation injury.

Nevissi, Ahmad E.* (Research), (Fisheries, Environmental Health), Ph.D., 1973, Arkansas; environmental radioactivity and radiochemistry.

Wolf, Norman S.,* (Pathology), Ph.D., 1960, Northwestern; hematopoietic stem cell dynamics and transplantation in radiation biology.

Assistant Professors

Hanson, James A., (Radiology), Ph.D., 1979, Wisconsin; quantitative computed tomography, Compton scatter, densitometry, digital radiography.

Sibley, Thomas* (Research), (Fisheries), Ph.D., 1976, California (Davis); biogeochemical cycling of radionuclides.

Lecturer

O'Brien, Michael J., (Environmental Health), M.S., 1973, Pittsburgh; operational radiation safety, internal radiation dosimetry, instrument calibration.

Course Descriptions

RAD S 501, 502 Biological Effects of Ionizing Radiation (2,2) A,W *Jackson* Effects of ionizing radiation at the molecular, cellular, organ, and organism levels with emphasis on mammalian systems. Prerequisite: permission of instructor.

RAD S 503, 504 Laboratory in Radiation Biology (1,1) A,W *Geraci* Laboratory study of the biological effects of ionizing radiation. Prerequisite: permission of instructor.

RAD S 505, 506 Radiological Physics I, II (3,3) *Wootton* Application of physical concepts, methodology and instrumentation in the study, production, and mensuration of ionizing radiations and their interactions with biological materials. Offered jointly with R ONC 505, 506. Prerequisite: permission of instructor.

RAD S 507 Radiation Hazards Analysis and Control (1) Sp *O'Brien* Emphasizes methods and procedures rather than facility or equipment design.

RAD S 508 Physical Aspects of Medical Imaging (2) A *Hanson* Quantitative physical principles of medical imaging are presented for electromagnetic and sonic radiation. X-ray imaging; sources, image formation, and information extraction, for CT as well as conventional systems; theory of ultrasound and resonance imaging. Offered jointly with RADGY 508. Prerequisites: 505, 506.

RAD S 510 Special Topics in Radiation Biology (2) Sp Detailed study of current research of special significance to the development of radiation biology. Prerequisite: permission of instructor.

RAD S 515 Chemical Mechanisms in Radiation Biology (2) Discussion of radiation-induced chemical reactions and their contribution to biological radiation damage, including alterations in enzymes, viruses, bacteria, and mammalian cells. Prerequisite: permission of instructor.

RAD S 517 Radiation Dosimetry (3) *Wootton, Staff* Examines the interactions of ionizing radiations with matter and the physical principles involved in their measurement in greater depth than does 505. For students contemplating a career in research concerned with ionizing radiation; assumes a sound background in physics. Offered jointly with R ONC 517. Prerequisite: permission of instructor.

RAD S 520 Radiological Sciences Seminar (1, max. 6) W

RAD S 540, 541 Health Physics I, II (3,3) W,Sp *Robkin* Physical basis of the quantification of the exposure to ionizing radiation. Includes the mathematics and physics of sources, interactions, spectrometry, and dosimetry of ionizing radiation. Offered jointly with NUC E 540, 541.

RAD S 542 Environmental Impact of Radioactivity (3) *Robkin* Dispersion, fate, and environmental significance of radionuclides released into environment. Includes dispersion, deposition, environmental transport, uptake, biological effects, protection from, and regulations relating to, radionuclides released into environment. Examples taken from academic, research, and industrial sources with emphasis on central station nuclear power plants. Offered jointly with NUC E 542.

RAD S 550 Field Practice in Radiological Health (*, max. 6) S Student rotates through laboratories engaged in radiological health and radiation safety work to gain experience in the problems encountered in practice. Prerequisite: permission of instructor.

RAD S 600 Independent Study or Research (*) AWSpS

RAD S 700 Master's Thesis (*) AWSpS

Interschool or Intercollege Programs

Bioengineering

309 Harris Hydraulics Laboratory

Bioengineering applies the concepts and techniques of engineering to problems of biology and medicine, and is jointly administered by the College of Engineering and the School of Medicine.

Undergraduate Program

Programs of study for engineering students are individually tailored to career objectives and may be accomplished by either of two pathways: (1) adherence to a traditional engineering department program using electives to cover bioengineering and health sciences courses; (2) adherence to a Bachelor of Science in Engineering degree program providing wider latitude in course requirements as approved by the Interdisciplinary Engineering Studies Group and the student's advisory committee.

Graduate Program

In the College of Engineering and the Graduate School there are options for study and research leading to master's and doctoral degrees with different levels of specialization in bioengineering.

Within the College of Engineering, two master's degree program pathways are offered in bioengineering. The Master of Science in Engineering degree pathway provides essential training in the life sciences that allows students with sound engineering backgrounds to prepare for careers in academic, industrial, or hospital environments. The Master of Science degree pathway provides essential training in the engineering sciences allowing students with strong biological backgrounds to prepare for careers in research and development in either basic medical sciences or clinical investigations.

For the student who wishes to pursue the Ph.D. degree in bioengineering, two options are available. A Ph.D. degree may be obtained through one of the traditional departments, which includes both course work and a research topic related to bioengineering. A proposal for a Doctor of Philosophy degree program currently is under review by the Graduate School. The thesis is supervised by a collaborative team composed of faculty members from the College of Engineering and the School of Medicine. Exceptional students whose goals do not match those of the traditional departments, and who are also highly motivated to pursue interdisciplinary studies, may, after admission to the Graduate School, apply for admission to an individual Ph.D. program based upon specialized study and research in bioengineering.

Offices and laboratories are located in the College of Engineering and the School of Medicine, which are mutually adjacent on the University campus. Students have access to the University Hospital, vivarium, primate center, computer center, and libraries, as well as to all engineering and health science departments and facilities. Excellent machine and electronics shops are available in the Center for Bioengineering.

Applicants for the M.S.E. degree should have a baccalaureate degree in engineering or the equivalent; applicants for the M.S. degree should have a baccalaureate degree in a science or the equivalent. One year each of calculus, physics, and chemistry is required.

Financial aid is available to qualified graduate students in the form of traineeships, fellowships, and assistantships. Funding is derived from federal research and training programs, the Graduate School Research Fund, and programs sponsored by private agencies. Information concerning these fellowships is available from the Center for Bioengineering.

Faculty

Director

Lee L. Huntsman

Professors

Auth, David C.,*‡ (Electrical Engineering), Ph.D., 1969, Georgetown; optics, bioengineering, lasers, instrumentation.

Bassingthwaighte, James B.,* M.D., 1955, Toronto, Ph.D., 1964, Minnesota; cardiovascular mass transport and ion exchanges, simulation analysis of integrated systems.

Guy, Arthur W.,*(Rehabilitation Medicine),† Ph.D., 1966, Washington; biological effects and medical applications of electromagnetic fields.

Hoffman, Allan S.,* (Chemical Engineering),† Sc.D., 1957, Massachusetts Institute of Technology; synthesis, characterization, and biological interaction of biomaterials, mechanics of natural tissues, applied polymers.

Huntsman, Lee L.,* Ph.D., 1968, Pennsylvania; mechanics of heart and heart muscle, cardiovascular system assessment, new measurement techniques.

Pollack, Gerald H.,* (Anesthesiology),† Ph.D., 1968, Pennsylvania; cardiac dynamics, pacemaking, muscular contraction.

Rushmer, Robert F.,* M.D., 1939, Chicago; biomedical instrumentation, health-care systems.

Associate Professors

Afromowitz, Martin A.*‡ (Research), (Electrical Engineering), Ph.D., 1969, Columbia; chemical sensors and biomedical instrumentation.

Bruckner, Adam P.*‡ (Research), (Aeronautics and Astronautics), Ph.D., 1972, Princeton; scattering of ultrashort light pulses in dense biological media, laser effects on biological tissue, ocular holography.

Chou, Chung-Kwang* (Research), (Rehabilitation Medicine),† Ph.D., 1975, Washington; bioeffects of microwaves and hyperthermia in cancer therapy.

Foster, David M.,* Ph.D., 1969, British Columbia; biomathematics and modeling methodology, simulation analysis, lipid and lipoprotein metabolism, gluconeogenesis.

Halbert, Sheridan A.,* (Biological Structure),† Ph.D., 1972, Washington; reproductive biology.

Holloway, G. Allen, Jr.* (Research), M.D., 1964, Harvard; microcirculation, instrumentation.

Horbett, Thomas A.* (Research), (Chemical Engineering),† Ph.D., 1970, Washington; interactions of cells and proteins with foreign materials, insulin-delivery devices.

Johnson, Dale E.,* Ph.D.,1971, Chicago; elemental microanalysis of biological systems, electron energy loss spectrometry.

MacKenzie, Alan P.* (Research), (Biological Structure),† Ph.D., 1957, London; physical and biochemical cryobiology, biotechnological applications of freezing and freezing-related procedures.

Martin, Roy W. (Research), (Anesthesiology),† Ph.D., 1975, Washington; bioinstrumentation, ultrasonic Doppler, echo, tissue characterization, signal processing.

Pearlman, Alan S.,* (Cardiology),† M.D., 1970, Harvard; echocardiography, assessment of cardiac anatomy, dynamics and blood flow.

Ratner, Buddy D.* (Research), (Chemical Engineering),† Ph.D., 1972, Polytechnic Institute of Brooklyn; synthesis and characterization of polymeric biomaterials for cardiovascular, ophthalmologic, and drug-delivery applications, surface analysis by ESCA, drug-delivery systems.

Reynolds, Larry O.*‡ (Research), (Nuclear Engineering), Ph.D., 1975, Washington; electromagnetic wave propagation and scattering in biological tissue, tissue characterization.

Spelman, Francis A.* (Research), Ph.D., 1975, Washington; local control of peripheral circulation, biophysics of the implanted cochlea, bioinstrumentation for primate research.

Verdugo, Pedro J.,* (Biological Structure),† M.D., 1965, State University of Chile; microrheology and control of ciliary and flagellar motion, biomechanics of cervical and respiratory mucus, instrumentation in laser scattering.

Assistant Professors

Bashein, Gerard,‡ M.D., 1974, New Mexico; Ph.D., 1969, Carnegie-Mellon; automation techniques in anesthesia, transesophageal ultrasonic cardiac assessment for operating-room monitoring.

Beach, Kirk W.‡ (Research), Ph.D., 1971, California (Berkeley), M.D., 1976, Washington; diagnosis and treatment of vascular diseases.

Forster, Fred K.*‡ (Research), (Mechanical Engineering), Ph.D. 1972, Stanford; ultrasonics, acoustics, and cardiovascular dynamics.

Phillips, David J.‡ (Research), Ph.D., 1975, Duke; clinical applications of biomedical instrumentation.

Soma, Mani,* (Electrical Engineering), Ph.D., 1980, Stanford; integrated circuits, bioelectronics.

Course Descriptions

Courses for Undergraduates

BIOEN 299 Introduction to Bioengineering (1) ASp Lectures, discussions, and reading assignments on the various aspects of bioengineering; orientation in bioengineering studies and practice. Offered on credit/no credit basis only.

BIOEN 401 Engineering Analysis of Cell Function (3) A *Verdugo* For engineers with no previous experience in the biological sciences, this course introduces the fundamentals of cell biology in an engineering-oriented framework. Includes structure, energetics, information processing, transduction, biological engines.

BIOEN 436 Medical Instrumentation (4) Sp *Spelman* Introduction to the application of instrumentation to medicine. Topics include transducers, signal-conditioning amplifiers, electrodes and electrochemistry, ultrasound systems, electric safety, and the design of clinical electronics. Laboratory included. For juniors, seniors, and first-year graduate students who are preparing for careers in bioengineering, both research and industrial. Prerequisite: some knowledge of human physiology and electronics or instrumentation or permission of instructor. Recommended: 535, E E 433. Entry card required.

BIOEN 490 Engineering Materials for Biomedical Applications (3) W *Hoffman* Combined application of the principles of physical chemistry, biochemistry, materials engineering, mass transfer, and fluid mechanics to biomedical problems. Case studies include considerations of the selection of materials, design, and the operation of instruments, components of, or entire, artificial organs (heart, kidney, lung) and artificial structural elements (bone, teeth, skin), all for use in contact with body fluids. Offered jointly with CH E 490. Prerequisite: organic chemistry or permission of instructor. (Offered even-numbered years.)

BIOEN 491 Controlled Release Systems—Principles and Applications (3) W *Hoffman* Mechanisms for controlled release of active agents and the development of useful systems for this purpose. Release mechanisms include diffusive, convective, or erosive driving forces. Applications to the biomedical, agricultural, forestry, and oceanography fields. Some special case studies covered in detail. Offered jointly with CH E 491. Prerequisite: permission of instructor. (Offered odd-numbered years.)

BIOEN 499 Special Projects (2-6, max. 6) AWSpS Individual undergraduate bioengineering projects under the supervision of an instructor. In addition, classes on selected topics of current interests as announced. Prerequisite: permission of instructor. Entry card required.

Courses for Graduates Only

BIOEN 510 Bioengineering Seminars (1) Topics of current bioengineering interests presented by resident and visiting faculty and students. Graduate students actively involved in bioengineering research are eligible to enroll for credit and can be expected to attend regularly, participate in discussions, and make presentations.

BIOEN 515 Introduction to Clinical Medicine for Engineers (3) *Holloway* Introduction to concepts and methods used in clinical medicine for students with engineering and physical science backgrounds. How and where engineering principles and methodologies can be applied to health-care problems. Prerequisite: basic physiology or permission of instructor.

BIOEN 516 Biomedical Industry (3) Product conception, evaluation, management, and marketing in biomedical industry. Role of research, market studies, government regulations, and clinical testing in product development. Taught by faculty members in collaboration with industrial professionals.

BIOEN 531, 532, 533 Electron Microscopy (1-5,1-5,1-5) A,W,Sp *Johnson, Luft* Theoretical and applied aspects of microscopy in biology, including newer methods. Light microscopy and electron optics, the electron microscope in detail, and methods for preparation of biological specimens. Offered jointly with B STR 531, 532, 533. Offered on credit/no credit basis only. Prerequisite: permission of instructor. (Offered alternate years, beginning with even-numbered Autumn quarters.)

BIOEN 535 Introduction to Biomedical Instrumentation (4) W *Johnson* Instrumentation systems (power supplies, transducers, amplifiers, recording and display devices); techniques of signal/noise enhancement (grounding, shielding, averaging); digital logic and instrumentation; A/D and D/A conversion; use of laboratory computers and laboratory experience in these areas. Biomedical applications. Prerequisite: permission of instructor.

BIOEN 540 Problem Solving in Bioengineering (3) Introduction to techniques of mathematical modeling. How to use computer methods to solve selected bioengineering problems in data analysis and modeling, and use models to test hypotheses. Hands-on computer experience. Prerequisite: permission of instructor. (Offered even-numbered years.)

BIOEN 547 Engineering Aspects of the Fluid Mechanics of the Human Body (3) W *Oates* Engineering background to the many flow regimes existing in the human body. Specific examples of flow problems such as cardiovascular, bronchial, microcapillary, urethral, etc. Offered jointly with A A 547. Offered on credit/no credit basis only. Prerequisite: permission of instructor. (Offered odd-numbered years.)

BIOEN 550 Mass Transport and Exchange in Biological Systems (3) W *Bassingthwaighte* Review of basic mechanisms of transport; transport through vascular system and blood-tissue exchange processes in organs; integrated systems analysis of closed systems and applications to physiological regulation, medical imaging, and pharmacokinetics. Prerequisites: calculus, introduction to differential equations; cardiovascular physiology; EE network analysis or systems analysis, chemical engineering transport.

BIOEN 558 Waves in Bioengineering (3) A *Lee* Properties and propagation of electromagnetic and acoustic waves in biological media. Reflection, absorption, scattering, refraction, diffraction, and the biological effects of ultrasound, microwaves, and lasers. Analogous relationships among these waves and limitations of such relationships. Prerequisite: E E 381 or equivalent.

BIOEN 560 Ultrasound in Bioengineering (3) Fundamentals of ultrasonic generation, formation, reception, and treatment of absorption, scattering, and transmission. Conventional and new methodology. (A, B, T-M mode, imaging, Doppler, tissue characterization, and nonlinear effects.) Offered on credit/no credit basis only. Prerequisite: 558 or equivalent or M E 525 or E E 525 for non-bioengineering students or permission of instructor.

BIOEN 561 Biomedical Optics (3) W Advanced theories of optical and spectroscopic measurement with emphasis on biomedical laser applications. Laser principles, instrumentation, and current practice in various biomedical uses, covering such areas as medicine, surgery, and biology. Prerequisites: E E 383 and 468 or 558.

BIOEN 562 Bioelectromagnetics (3) *Chou, Guy* Interaction of radio-frequency electromagnetic fields with biological systems: history, quantities and units, theoretical analysis, instrumentation and measurements, biological effects, medical applications, including cancer detection and therapy, major energy sources, public controversies, public and occupational health protection, international and national safety standards. Prerequisite: 558, E E 381, or permission of instructor. (Offered Spring Quarter, even-numbered years.)

BIOEN 599 Special Topics in Bioengineering (2-6, max. 15) AWSpS Offered at a graduate level periodically by faculty members within the Center for Bioengineering; concerns areas of research activities with current and topical interest to bioengineers. Prerequisites: undergraduate or graduate courses (or equivalent) determined individually for each special topic. Entry card required.

BIOEN 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

BIOEN 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

Quantitative Science

Administered by the College of Ocean and Fishery Sciences and the College of Forest Resources.

The center offers a broad spectrum of courses designed for both the undergraduate and graduate student. At the present time, courses are grouped in five areas: computer programming, quantitative ecology/resource management, operations research, statistical methods, and applied analysis. The Quantitative Ecology and Resource Management option of the Biomathematics Group also is located at the center.

Faculty

Acting Director

Vincent F. Gallucci

Professors

Bare, B. Bruce,* (Forest Resources), Ph.D., 1969, Purdue; systems analysis, operations research, computer modeling, forest land management, forest valuation and taxation.

Bevan, Donald E.,* (Fisheries), Ph.D., 1959, Washington; resource management, computer simulation.

Chapman, Douglas G. (Emeritus), (Fisheries), Ph.D., 1949, California (Berkeley); biometrics, population dynamics.

Dowdle, Barney,* (Forest Resources), Ph.D., 1962, Yale; growth and development of forest products industries, public forest land management.

Fletcher, R. Ian,* (Fisheries), Ph.D., 1973, Rhode Island; population dynamics.

Gallucci, Vincent F.,* (Fisheries), Ph.D., 1973, North Carolina State; biomathematics and population dynamics.

Hatheway, William H.,* (Forest Resources), Ph.D., 1956, Harvard; tropical forest ecology, biometrics, dendrology and model building, cold hardiness.

Mathews, Stephen B.,* (Fisheries), Ph.D., 1967, Washington; quantitative fishery management.

Schreuder, Gerald F.,* (Forest Resources), Ph.D., 1968, Yale; photogrammetry and management of economics and statistics.

Associate Professors

Bledsoe, Lewis J.* (Research), (Fisheries), Ph.D., 1976, Colorado; systems ecology.

Conquest, Loveday L.,* (Fisheries), Ph.D., 1975, Washington; statistical analysis of water pollution and community ecology data, aquatic ecosystems, biostatistics.

Greulich, Frances E., (Forest Resources), Ph.D., 1976, California (Berkeley); logging engineering.

Rustagi, Krishna P.,* (Forest Resources), Ph.D., 1973, Yale; operations research application to problems of forest management planning.

Swartzman, Gordon L.* (Research), (Fisheries), Ph.D., 1969, Michigan; ecological modeling, quantitative natural resource management.

Assistant Professor

Briggs, David G.,* (Forest Resources), Ph.D., 1980, Washington; wood utilization, computer applications in wood processing

Course Descriptions

Courses for Undergraduates

Q SCI 291, 292 Analysis for Biologists (4,4) AW,WSp Differentiation; integration, including multiple integrals and partial derivatives. Numerical and computing techniques in analysis. Emphasis on biological problems, particularly in ecology. Prerequisites: MATH 105 for 291; 291 or MATH 124 for 292.

Q SCI 340 Application of Digital Computers to Biological Problems (5) AS *Bevan, Geiszler* Methods and procedures for processing biological and natural resource data by means of digital computers; interactive computing, file manipulation, problem analysis, elementary FORTRAN programming, use of data base and statistical packages, interfacing of programs and software packages. Offered jointly with FISH 340. May not be taken for credit if FISH 340 has been taken. Prerequisite: 381 or equivalent.

Q SCI 366 Quantitative Methods in Forest Resource Management (3) A *Rustagi* Survey, discussion, and critique of the application of quantitative methods to forest resource management, planning, and decision making. Methods utilized in management science and in econometric and computer science that are currently used by resource planners. Introduction to systems analysis, linear programming, computer simulation, goal programming, forecasting, statistical techniques, and computer information systems. Offered jointly with FOR M 366. Prerequisites: 381, FOR M 250.

Q SCI 376 Operations Research in Resource Utilization I (3) A *Bare, Rustagi* Introduction to some of the tools of operations research and the application of these in examining, defining, analyzing, and solving complex problems of resource management and of resource product manufacturing. Emphasis on networks and graphs, principally PERT analysis, and on linear programming and its extensions, such as the transportation assignment and transshipments model. Sensitivity analysis and duality also are presented. Prerequisite: 391, which may be taken concurrently.

Q SCI 381 Introduction to Probability and Statistics (5) AWSpS Elementary concepts of probability. Sample space set theory, random variables, expectations, variances, covariance; multinomial, normal, hypergeometric, Poisson, negative-binomial, geometric, uniform normal, chi square, "t" and "F" distributions. Point and interval estimation, basic concepts of hypothesis testing; applications to biological problems. Prerequisite: MATH 105 or equivalent.

Q SCI 391 Introduction to Matrices and Their Applications (3) Sp Elementary concepts of matrices and matrix operations; use of computer in inverting matrices, solving systems of equations and other matrix operations; applications in operations research and biology. Prerequisites: 381, MATH 125; ENGR 141 or FISH 340 or equivalent course in computer use, or permission of instructor.

Q SCI 392 Techniques of Applied Mathematics in Biology I (3) A *Fletcher* Ordinary differential equations—linear and nonlinear; systems of differential equations; approximation techniques, numerical solution techniques; applications to biological processes. Prerequisite: 292 or MATH 126, or permission of instructor.

Q SCI 393 Techniques of Applied Mathematics in Biology II (3) W *Fletcher* Applications of advanced ordinary differential equations, special functions, and partial differential equations to descriptions of biological phenomena. Particular emphasis on transport in biological systems, including diffusion and fluid flow. Prerequisite: 392 or permission of instructor.

Q SCI 450 Linear Ecological Models (4) A *Bledsoe, Swartzman* Introduction to mathematical techniques and applications of systems analysis to ecological modeling. Techniques include matrix eigenanalysis, differential and difference equations, Markov chains, and model stochasticization and sensitivity analysis. Applications to species succession models, carbon, energy and nutrient cycling, food chains, and population life-cycle models. Students review selected papers in ecological modeling literature and develop, run, and analyze models on computer. Prerequisites: 292, 340, or permission. (Offered odd-numbered years.)

Q SCI 451, 452 Ecosystem Dynamics (3,3) W,Sp *Bledspe, Swartzman* Unified overview of the physical and biological processes that make up natural and man-managed ecosystems. Facets of the physical environment, production, consumption, decomposition, nutrient cycling, and exploitation by man are discussed as interrelated aspects of a whole ecosystem. Mathematical techniques for representing the interrelationships are emphasized; examples are drawn from aquatic, terrestrial, and marine systems of the biotic provinces of North America (biomes). Prerequisites: 292, 340, 450, or permission of instructor for 451; 451 for 452. (Offered even-numbered years.)

Q SCI 456 Mathematical Models in Population Biology (4) A *Gallucci* Definition and role of mathematical models in population biology; types of models; population processes and population growth; use of computer in model building; sampling and other methods of estimation of population parameters. Prerequisites: 381, 292, FISH 425 or BIOL 210 or permission of instructor.

Q SCI 457 Management of Exploited Animal Populations I (4) W *Mathews* Equilibrium yield model; spawner-recruit models, management methods; use of catch-effort statistics in estimation and management, computer simulation in management decisions. Offered jointly with FISH 457. Prerequisites: 381, 292; BIOL 210 or FISH 425, or permission of instructor.

Q SCI 458 Management of Exploited Animal Populations II (4) Sp *Gallucci, Mathews* Continuation of 457. Estimating catch and effort and analyzing catch-per-effort statistics. Standardizing effort, gear selectivity, recruitment, models of exploited fishery populations with management applications. Introduction to simulation of fish and wildlife populations with emphasis on applications using current data from fishery and game organizations. Offered jointly with FISH 458.

Q SCI 480 Sampling Theory for Biologists (3) Sp *Gallucci* Theory and applications of sampling finite populations including: simple random sampling, stratified random sampling, ratio estimates, regression estimates, systematic sampling, cluster sampling, sample size determinations, applications in fisheries and forestry. Other topics include sampling plant and animal populations, sampling distributions, estimation of parameters and statistical treatment of data. Offered jointly with STAT 480. Prerequisites: 482, 483, or permission of instructor. (Offered even-numbered years.)

Q SCI 482, 483 Statistical Inference in Applied Research (5,5) AW,WSp Analysis of variance and covariance; chi square tests; multiple and curvilinear regression; sampling theory; discrete distributions; experimental design and power of tests. Application to biological problems. Use of computer programs in standard statistical problems. Prerequisites: 381, MATH 124 or Q SCI 291 or permission of instructor for 482; 482 for 483.

Q SCI 486 Experimental Design (3) Sp *Conquest* Topics in analysis of variance and experimental designs: choice of designs, comparison of efficiency, power, sample size, use of computer for standard analyses. Offered jointly with STAT 486. Prerequisite: 483 or equivalent. (Offered odd-numbered years.)

Q SCI 499 Undergraduate Research (1-5, max. 5) AWSpS Special studies in quantitative ecology and resource management for which there is not sufficient demand to warrant the organization of regular courses. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

Courses for Graduates Only

Q SCI 502 Statistical Consulting for the Life Sciences (1-4) AWSp *Conquest, Gallucci* Consulting experience in data analysis, applied statistics, experimental design, parameter estimation, and sampling. For graduate students in the Center for Quantitative Science and Biomathematics. Student provides consultation services to students and faculty. Students spend one classroom hour per week under faculty supervision discussing problems encountered. Prerequisites: 482, 483, STAT 341, 342, or BIOST 571, 572, 573, or equivalents, and permission of instructor.

Q SCI 540 Topics in Fisheries Computing (3) Sp *Clark* Students gain experience and insights into complex computer algorithms in fisheries by doing projects typical of research in natural resource management. Students need at least an introductory programming course and background in the subject areas covered. Prerequisites: 340 or equivalent, 292 or equivalent, and permission of instructor. (Offered odd-numbered years.)

Q SCI 576 Multi-Objective Programming (3) W *Rustagi* Concepts and philosophy of goal programming as a tool in the evaluation of resource allocation among multiple, conflicting, often incommensurate objectives (goals). L.P. and G.P. computer programs are used to study impact of changes in relative importance of difficult goals. Goal programming applications in natural resource areas are discussed. Offered jointly with FOR M 576. Prerequisites: familiarity with linear programming and permission of instructor.

Q SCI 597 Seminar in Quantitative Ecology (1, max. 9) AWSp Lectures and discussions of current problems in quantitative ecology. Offered jointly with BMATH 597. Prerequisite: permission of instructor.

Q SCI 598 Special Topics in Quantitative Resource Management (1-3, max. 12) AWSpS Population and community ecology, systems ecology, and physical processes in ecosystems. Prerequisite: permission of instructor.

Quaternary Research Center

19 Johnson

Quaternary studies focus on the processes that presently shape the natural environment and have operated over approximately the past two million years (Quaternary Period). A knowledge of Quaternary events facilitates an understanding of earth history in relation to the modern environment and has predictive value with regard to present-day and future environmental changes.

Quaternary research is typically interdisciplinary, and thus it commonly involves related interests of two or more academic units. The Quaternary Research Center was established in 1967 to foster such interdisciplinary studies on a cooperative basis.

The Quaternary Research Center has as goals: (1) to understand environments and climate changes of the past two million years in the context of modern surface processes. These include historical changes, prehistoric postglacial environments, and Ice Age events; (2) to serve as an effective catalyst in fostering interdisciplinary studies in the fields of atmospheric sciences, archaeology/anthropology, botany, engineering, fisheries, forestry, geology, geophysics, oceanography, pedology, and zoology; (3) to provide a scientific perspective on the scale of modern and man-made environmental changes, including those of climate, in the context of recent earth history; (4) to conduct a curriculum jointly with other disciplines in the training of graduate students in Quaternary-oriented studies; and (5) to seek applications of Quaternary studies to modern environmental problems that will help predict consequences of policy decisions.

Graduate Program

Students associated with the center obtain their degrees through cooperating departments. Students interested in graduate work at the center should apply to the department of their choice but plan to do their research in a Quaternary-related subject.

Research Facilities

The research laboratories of the center provide an array of modern facilities for investigation of Quaternary problems:

Quaternary Isotope Laboratory. The work emphasizes use of carbon and oxygen isotopes to study various aspects of the carbon and hydrological cycles. A major interest is also in radiocarbon dating as applied to time-scale calibration and the study of climate change.

Periglacial Laboratory. The laboratory contains a series of cold rooms equipped for manipulating and studying the freezing and thawing of soils, rocks, and building materials, and a large and unique tilt table for soils permits their study under controlled conditions of slope, temperature, and moisture. Research stress is on frost action in periglacial environments.

Quaternary Palynology and Paleoecology Laboratories. These facilities foster studies of the biotic environment through detailed stratigraphic studies of plant and animal remains in Quaternary sediments. Studies of vegetational changes are supported by an extensive collection of modern reference pollen types from Asia and the Americas.

Tephrochronology Laboratory. Volcanic ash deposits of unknown origin are characterized petrographically and are identified by being matched against tephra of known source and composition. A reference collection of tephra from source areas around the world is being developed.

Correspondence and Information

Director
Quaternary Research Center, AK-60

Faculty

Director

Stephen C. Porter

Professors

Dunne, Thomas,*‡ (Geological Sciences), Ph.D., 1969, Johns Hopkins; geomorphology and hydrology.

Dunnell, Robert C.,*‡ (Anthropology), Ph.D., 1967, Yale; theoretical archaeology.

Edmondson, W. Thomas,*‡ (Zoology), Ph.D., 1942, Yale; limnology.

Leopold, Estella B.,*‡ (Botany, Forest Resources), Ph.D., 1955, Yale; paleobotany and palynology.

Porter, Stephen C.,* (Geological Sciences), Ph.D., 1962, Yale; Alpine glacial geology and geomorphology, Quaternary stratigraphy and chronology, volcanology, Pleistocene glaciation (southern Andes, Cascade Range, central Asia), Holocene glacier variations (Italian Alps, southern Alaska, Cascade Range), tephrochronology (Cascades, southern Andes, Hawaii).

Raymond, Charles F.,‡ (Geophysics), Ph.D., 1969, California Institute of Technology; glaciology.

Sherif, Mehmet A.,*‡ (Civil Engineering), Ph.D., 1964, Princeton; soils and sediment mechanics.

Stuiver, Minze,* (Geological Sciences),† Ph.D., 1958, Groningen (Netherlands); isotope research and radiometric dating, oxygen isotope analysis of ice cores, ocean-water analysis, solar variability and climatic change, isotopic carbon with special reference to geochronometrical applications.

Tsukada, Matsuo,*‡ (Botany), D.Sci., 1961, Osaka City (Japan); palynology and paleoecology.

Ugolini, Fiorenzo D.,*‡ (Forest Resources), Ph.D., 1960, Rutgers; soil genesis.

Washburn, A. Lincoln (Emeritus), (Geological Sciences), Ph.D., 1942, Yale; periglacial studies, geomorphology of cold environments, glacial geology.

Associate Professors

Brubaker, Linda B.,‡ (Forest Resources), Ph.D., 1973, Michigan; dendrochronology and dendroclimatology.

Emerson, Steven R.,*‡ (Oceanography), Ph.D., 1974, Columbia; marine geochemistry.

Hallet, Bernard,* (Geological Sciences),† Ph.D., 1975, California (Los Angeles); glacial and periglacial geology with emphasis on fundamental physiochemical processes, and environmental and engineering geology.

Hedges, John I.,‡ (Oceanography), Ph.D., 1975, Texas; origin and fate of organic compounds in aquatic environments.

Hartmann, Dennis L.,*‡ (Atmospheric Sciences), Ph.D., 1976, Princeton; climate diagnostics and theory.

Richey, Jeffrey E.*‡ (Research), (Fisheries), Ph.D., 1973, California (Davis); aquatic biogeochemistry and ecology.

Assistant Professors

Grootes, Pieter M. (Research), (Geological Sciences), Ph.D., 1977, Groningen; ^{18}O isotope studies, ^{14}C and ^{10}Be accelerator dating.

Quay, Paul D. (Research), (Geological Sciences, Oceanography), Ph.D., 1977, Columbia; C isotope studies of rivers, lakes, and oceans.

Spaulding, W. Geoffrey (Research), (Botany), Ph.D., 1981, Arizona; desert paleoecology and paleoclimatology.

Stein, Julie K.,*‡ (Anthropology), Ph.D., 1980, Minnesota; geologic archaeology.

Warren, Stephen G.,*‡ (Atmospheric Sciences, Geophysics), Ph.D., 1973, Harvard; radiation processes in climatology.

Course Descriptions

QUAT 417 The Late Cenozoic Glacial Ages (3) Sp *Porter* Physical and biological evidence, both terrestrial and marine, for cyclic climatic change during the late Cenozoic, emphasizing regional stratigraphic patterns, dating, and correlation. Growth and dissipation of Quaternary ice sheets and alpine glaciers and change in distribution of fauna and flora, as indicated by the geologic record. Use of this data to evaluate theories on causes of glacial ages and potential for predicting future climatic variations. Offered jointly with GEOL 417. Prerequisite: introductory course in earth science and biological science.

QUAT 453 Concepts and Methods in Paleoecology (4) A *Brubaker, Leopold, Tsukada* Biological fossils as key evidence in reconstruction of past environments. Conceptual framework and methods of study for interpretation of fossils in sediments, tree rings, sedimentary/geochemical evidence. Past dynamic changes in plant communities and species history evaluated in context of modern ecological theory. Offered jointly with BOT 453 and FOR B 453. Prerequisite: BOT 354 or FOR B 320.

QUAT 501 Seminar in Quaternary Environments (1, max. 6) WSp Interdisciplinary seminar in the changing natural environments of the Quaternary Period, with emphasis on climatic changes and their effects. Speakers from the University and elsewhere present lectures on their specialties, followed by discussion. Offered on credit/no credit basis only.

QUAT 502 Interdisciplinary Quaternary Investigations (2, max. 6) WSp Research course for interdisciplinary investigation of Quaternary problems. Student attends sessions of 501 and pursues a problem-oriented case study concurrently under faculty direction. Required paper on case study. Offered on credit/no credit basis only. Prerequisite: graduate standing.

QUAT 504 Special Topics in Quaternary Sciences (1-3) Environments and climate changes of past two million years (Quaternary Period) in context of modern surface processes, including historical changes, prehistorical environments of postglacial period, and Ice Age events. Provides scientific perspective on scale of modern and man-made environmental changes, including those of climate in context of recent earth history. Offered on credit/no credit basis only. Prerequisites: background courses in earth sciences and ecology.

University Conjoint Courses

Each of the following courses is administered by two or more schools or colleges within the University. No degree program is offered.

Courses for Undergraduates

UCONJ 100 Introduction to Health Professions (1) AWSp *Becker, Behrens, Haley, Hatlen* Opportunities in health professions. Roles of members of the health-care team. Lectures, discussions, and patient case presentations illustrate opportunities available and the respective professions' contributions.

UCONJ 411 Psychology of Aging (3) W *Kiyak* Focuses on developing the skills necessary for critically evaluating current psychological theories of aging, research findings in this area, and the implications of findings on the aging person. Special consideration given to the effects of socioeconomic, sex, and ethnic differences in the psychology of aging. Open to upper-division undergraduates and beginning graduate students interested in the field of gerontology.

UCONJ 420 Biological Safety Practices (1) A *Kenny* General introduction to appropriate laboratory procedures used for handling potentially hazardous biological agents. Particular focus on laboratory safety and appropriate protocols that should be employed by those engaged in infectious disease and recombinant DNA research. Offered on credit/no credit basis only.

UCONJ 422 Sexually Transmitted Diseases: An Overview (2) A *Elmer, Holmes* Clinically oriented course designed to train upper-class health science students to the point they are stimulated and qualified to participate effectively in community outreach programs for the prevention of venereal diseases. Lecture-discussion session each week with emphasis on the nature of the prevalent sexually transmitted diseases. Field experience includes visits to venereal disease clinics and possible speaking engagements. Offered cooperatively by the departments of Pharmaceutical Sciences, Medicine, and Epidemiology and International Health. Department of Pharmaceutical Sciences responsible for administration of course. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

UCONJ 440 Biological Aspects of Aging (3) A Introductory course on aspects of the biology of human aging and of functional changes associated with normal aging and with those illnesses that may be present in the elderly. Focus on the relationship between changes in physical function, environment, and quality of life. Includes theoretical perspective on aging as well as the aging process in specific physiological systems. Designed for upper-level undergraduate students with an interest in aging. Prerequisite: introductory course in biology or permission of instructor.

UCONJ 442 Social and Cultural Aspects of Aging (3) Sp *Amoss* Involves faculty from the various social science fields examining the range and variation of relationships among age-linked attitudes and cultural values related to aging; the social and economic factors that influence the elderly in contamporary society; the effects of ethnic and sex differences in sociocultural aging. Open to upper-division undergraduates and beginning graduate students interested in gerentology. Entry card required.

UCONJ 460 Introduction to Oral Biology and Related Therapeutics (2) W *J. Plein, Siegel* Oral biology and therapeutics designed for health profession students not in dental or dental hygiene programs. Includes structure and function of the teeth and oral soft tissues; pathobiology, signs, prevention, and treatment of oral disease; patient counseling on use of drugs and oral hygiene measures for the prevention and treatment of diseases of the mouth. Open to undergraduate students in last professional year and to graduate students. Prerequisite: permission of instructor.

UCONJ 490 Social Sensitivity in Health Care (3) AWSp Multidisciplinary course for students in the health professions to sensitize them to the life situation of the poverty and minority groups as it relates to the community's health-care system. Focuses particularly on the social, cultural, and physical barriers that these groups encounter when they seek solutions to their health problems. Stimulates student to define more clearly his professional role in the health-care problems of these groups. Since the primary input of information for this course is experiential, students are involved in field experiences with persons in minority groups and poverty situations to furnish students with the firsthand personal involvement with the life styles and experiences of these persons. The faculty is selected from the involved schools, as well as from members of the cultural groups being surveyed. Enrollment is limited to twenty students. An attempt is made to achieve a balance of students from the various departments. Offered cooperatively by School of Nursing, School of Dentistry, School of Social Work, School of Medicine, School of Pharmacy, and School of Public Health and Community Medicine. Prerequisite: permission of instructor.

UCONJ 492 The Developmentally Disabled Child: Selected Interdisciplinary Topics (1-10, max. 10) AWSp Elective interdisciplinary series of minicourses designed to offer specific information and foster the development of specific skills in areas critical for effective professional functioning with the developmentally disabled child. Each minicourse provides an intensive examination of one major topic represented within the basic components of an interdisciplinary training program. These basic components include: normal growth and development, exceptional growth and development, interdisciplinary theory, assessment devices and strategies, intervention strategies, information-exchange skills, and community functioning. Faculty members from dentistry, education, medicine, nursing, nutrition, occupational therapy, physical therapy, psychology, social work, and communication disorders are involved. The minicourses have been especially developed for trainees in the Child Development and Mental Retardation Center. Offered on credit/no credit basis only. Prerequisite: permission of the course coordinator.

UCONJ 493 Interdisciplinary Health Team in Primary Care I (*, max. 5) W *Anderson, Carnevali, Eaton, Pittman, Smith, Truelove* Dentistry, medicine, nursing, pharmacy, and social work students are assigned to interdisciplinary teams representing each discipline. Classes are conducted in didactic and seminar mode. Family history and professional socialization experiences form the point of departure for movement into study of team development and maintenance skills for health-care delivery teams. Self-instruction on baseline assessment skills in other discipline areas prepares students for team-delivered care in 494. Students observe role behavior in selected clinical teams and begin to function as a team in a selected primary-care site. Prerequisite: permission of instructor. Limit: six students from each discipline.

UCONJ 494 Interdisciplinary Health Team in Primary Care II (*, max. 4) Sp *Anderson, Carnevali, Eaton, Pittman, Smith, Truelove* Multidisciplinary student teams (dentistry, medicine, nursing, pharmacy, social work) are provided a clinical experience with model faculty teams in selected primary-care sites. Students continue to examine and conceptualize the multidisciplinary process in primary care in seminars and conferences. Variable credit is based on clinical hours taken for credit. Prerequisites: 493 and permission of instructor.

UCONJ 497 Health Care in a Rural Community (3) Sp *Hall, Schodde* Critical analysis built upon concepts relative to interdisciplinary health-care delivery in a rural community. Students develop an organizational model for rural health care and study innovative ways of mobilizing community resources and support for a comprehensive rural health-care system. Pharmacy students, nurses, and other health professionals study application of theory in an appropriate clinical setting within the conceptual framework of each student's professional field.

Courses for Graduates Only

UCONJ 510 Seminar in Neurobiology (0) AWSpS Weekly seminars organized each quarter by one of the four participating departments: biological structure, physiology and biophysics, psychology, or zoology. Required of graduate students supported by the Systems and Integrative Biology Training Program. Offered on credit/no credit basis only.

UCONJ 512 Hypertension (2 or 3) Analysis and synthesis of knowledge required to identify and manage hypertension in all age groups while functioning as a member of an interdisciplinary health-care team. Lecture stresses analysis of information regarding the etiology, pathophysiology, epidemiology, and psychological and behavioral correlates of hypertension and its complications. Optional seminar focuses on clinical application of this information.

UCONJ 513 Dynamics of Patient Management: Diabetes Mellitus (2) Sp Analysis of advanced knowledge related to interdisciplinary management of diabetes. Commonalities and differences in provider approaches, recent research and its effect on management practices, collaborative communication, knowledge application. Brief interactive presentations, decision-making opportunities, discussion. Prerequisites: graduate standing in pharmacy, dietetics, nursing; third- or fourth-year medical student; or permission of instructor.

UCONJ 584 Plant Tumors (1, max. 9) *M. Gordon* Discussion of the literature of plant tumors and current research work being carried on in this area at the University. Offered cooperatively by the departments of Biochemistry, Botany, and Microbiology and Immunology. Offered on credit/no credit basis only. Prerequisite: offered only to persons actively pursuing work in this area.

UCONJ 585 Seminar in Molecular and Cellular Biology (1, max. 15) AWSp *Gordon, Staff* For students enrolled in the Molecular and Cellular Biology Training Program. Participants present the background and current progress in their thesis research. Offered on credit/no credit basis only. Prerequisites: enrollment in doctoral degree program in biological science and in graduate research.

School of Law

Dean

John R. Price
326 Condon

Associate Deans

Robert L. Fletcher
338 Condon

John O. Haley
304 Condon

Assistant Dean

Helen Halpert
306 Condon

Established in 1889, the School of Law is a member of the Association of American Law Schools and is on the American Bar Association's list of approved law schools. Graduates of the school are prepared to practice law anywhere in the United States. Additional information about the school is contained in the current University bulletin *School of Law*.

Facilities and Services

The School of Law is housed in Condon Hall, adjacent to the University's main campus. It is equipped with classroom, library, lounge, and office facilities.

The Marian Gould Gallagher Library at the School of Law contains some 328,000 bound volumes and 38,000 microform equivalent volumes. It includes decisions of all English and American courts of last resort, in addition to an excellent collection of Japanese and other Asian law material.

Juris Doctor Program

Juris Doctor Degree

The Juris Doctor degree is conferred upon a student who has met the residence requirements, consisting of nine quarters of at least 12

credits each, and has earned at least 135 credits satisfactory to the School of Law.

As in most law schools of the United States, the first-year courses are required and are designed to introduce students to basic legal skills, foundational subject matter, and the variety of public and private processes with which the profession is concerned. Those courses deal with contracts, torts, property, civil procedure, criminal law, administrative law, and basic legal skills.

Except for a required course in professional responsibility and an analytical writing requirement, courses in the second and third years are elective. Therefore, a student may choose a program designed to suit his or her interests and needs.

Admission

New students may enter the School of Law only in Autumn Quarter. Instruction begins for first-year students a few days earlier than the time set for upper-class students. Beginning students must have received a baccalaureate degree from an accredited college or university prior to commencing the study of law.

All applicants are required to take the Law School Admission Test (LSAT) and to register for the Law School Data Assembly Service (LSDAS). Registration material for both appears in the *Law School Admission Bulletin and LSAT Study Guide.*

No specific prelaw course is required or recommended, and the School of Law subscribes to the remarks set forth on prelaw preparation in the *Prelaw Handbook—Annual Official Guide to ABA-Approved Law Schools. Personal interviews are neither required nor encouraged. Applications for admission to the next entering class must be postmarked or delivered by February 1. To be assured of consideration for admission, an applicant must cause complete credentials, including the LSDAS report, to be filed in the School of Law by March 1. An application fee (at this writing, $35) also is required.*

Transfer Applicants

Students who have completed at least one year at a member school of the Association of American Law Schools may apply to this school for admission with advanced standing with credit for no more than one year of such work. A student who has completed or expects to complete at least two years of work at a member school of the Association of American Law Schools and who expects to graduate from that member school may apply to this school for admission as a non-degree candidate.

Applicants should request application forms and instructions from the admissions officer in time to permit filing of the application by July 15. To be assured of consideration, the applicant must complete his or her application file by August 1.

Students are accepted only to the extent that vacancies exist. Selection of the applicants is based on evidence either (1) that the candidate can produce acceptable work at this law school and that only by transferring to this law school will the candidate alleviate serious hardship, or (2) that the candidate can produce above-average work at this law school. Minority transfer applicants are considered under criteria applicable to first-year admissions.

Students working on law degrees to be conferred by the University have priority over non-degree candidates in the selection of courses. This policy is in accordance with the general University policy on the registration of nonmatriculated students.

Inquiries

A more detailed statement on admission policy and application procedure is available in the School of Law. Requests for application materials and the University law school bulletin should be addressed to the University of Washington, School of Law, Admissions Officer, JB-20, Seattle, Washington 98105.

Graduate Program

William T. Burke, Graduate Program Coordinator

The law faculty offers, in addition to the professional law program leading to the Juris Doctor degree, graduate programs leading to the Master of Law (LL.M.), and the Doctor of Philosophy (Ph.D.) degrees. Two areas of specialization in the law programs are: Asian Law, and Law and Marine Affairs.

Programs with specialization in Asian Law lead to the LL.M. and Ph.D. degrees as follows:

LL.M.—A person who has received a first degree in law, is competent in English and either the Chinese, Korean, or Japanese language, and has a record of superior academic achievement can become a prospective candidate for an LL.M. degree in a program that emphasizes East Asian law (particularly Japanese). For the master's degree, 36 credits of course, seminar, and research are required. Of the required credits, 12 must be acquired in a major research project in lieu of a thesis.

Ph.D.—An exceptional scholar-lawyer who is bilingual (either in Chinese, Korean, or Japanese, as well as in English) and who evidences an interest in law teaching or government service in his country of origin can become a candidate for a Doctor of Philosophy degree in the field of Asian Law. The Ph.D. program requires a minimum of three years, at least two of them in residence.

The program with specialization in law and marine affairs also leads to the LL.M. degree. Students who have acquired the first degree in law can become prospective candidates for the LL.M. in this field. This program devotes particular attention to interdisciplinary aspects of marine affairs. A law school component of this program emphasizes study of coastal zone management and the international law of the sea. Courses integral to this program are offered in the Institute for Marine Studies, School of Fisheries, Graduate School of Public Affairs, College of Engineering, departments of Economics and Geography, and School of Oceanography. Requirement for the LL.M. degree with specialization in law and marine affairs is satisfactory completion of 40 credits of course and research credits, a minimum of 15 of which must be in the School of Law.

Financial Aid

The law school may have scholarship funds available for study in East Asian law. For programs in law and marine affairs, financial support for especially qualified students may be available in connection with noncredit research projects. Any request for support should be made by letter at the time of applying for admission to the program.

Correspondence and Information

Graduate Program Coordinator
712 Condon, JB-20

Faculty

Professors

Andersen, William R.,* LL.M., 1958, Yale; administrative law, regulated industries, urban government.

Armitage, Thomas C.,* J.D., 1969, California (Los Angeles); antitrust, consumer protection, government regulation of business.

Aronson, Robert H.,* J.D., 1973, Penn; evidence, criminal law, professional responsibility.

Burke, William T.,* J.S.D., 1959, Yale; marine law.

Chisum, Donald S.,* LL.B., 1968, Stanford; corporations, civil procedure, intellectual property, federal courts and jurisdiction.

Corker, Charles E.,* LL.B., 1956, Harvard; contracts, constitutional law.

Cosway, Richard,* J.D., 1942, Cincinnati; commercial transactions.

Cross, Harry M. (Emeritus), J.D., 1940, Washington; property.

Fletcher, Robert L.,* LL.B., 1947, Stanford; property.

Gallagher, Marian G. (Emeritus), LL.B., 1937, Washington; law librarianship.

Haley, John O.,* LL.M., 1971, Washington; comparative law (Japan).

Hardisty, James H.,* LL.B., 1966, Harvard; criminal law, law and psychiatry, juvenile courts.

Harsch, Alfred (Emeritus), LL.B., 1928, Washington; LL.M., 1940, Columbia; law.

Henderson, Dan F.,* LL.B., 1949, Harvard, Ph.D., 1955, California (Berkeley); U.S./Japanese business transactions, corporate relations, admiralty.

Hershman, Marc G.,* (Marine Studies),† LL.M., 1970, Miami; law coastal zone, legal legislation, coastal planning and management.

Hjorth, Roland L.,* LL.B., 1961, New York; transnational tax, Common Market, federal taxation.

Hume, Linda S.,* J.D., 1970, California (Los Angeles); commercial transactions, property, equal rights.

Hunt, Robert S.,* S.J.D, 1952, Wisconsin; land use, securities regulation, property.

Huston, John,* LL.M., 1955, New York; federal taxation.

Johnson, Ralph,* LL.B., 1949, Oregon; natural resources, legislation, Indian law.

Junker, John M.,* J.D, 1962, Chicago; criminal law and procedure.

Kummert, Richard O.,* LL.B., 1961, Stanford; business planning, corporations, federal tax.

Loh, Wallace D.,* 1974, Yale; contracts, criminal procedure, social science and the courts.

Meisenhlder, Robert,* S.J.D., 1942, Michigan; federal courts and federal systems, procedure.

Morris, Arval,* LL.M., 1958, Yale; constitutional law, jurisprudence.

Peck, Cornelius J.,* J.D., 1950, Harvard, administrative law, labor law.

Price, John R.,* LL.B., 1961, New York; estate planning, taxation, property.

Prosterman, Roy L.,* LL.B., 1958, Harvard; international transactions.

Rieke, Luvern V.,* J.D., 1949, Washington; contracts, domestic relations.

Roddis, Richard S. L.,* J.D., 1954, California (Berkeley); insurance.

Rodgers, William H., Jr.,* J.D., 1965, Columbia; legislation, environmental law, resource management.

Rombauer, Marjorie D.,* J.D., 1960, Washington; creditor and debtor, personal property.

Schatzki, George,* LL.M., 1965, Harvard; labor relations and arbitration, professional responsibility.

Shattuck, Warren L. (Emeritus), LL.B., 1934, Washington, J.S.d., 1936, Yale; law.

Smith, Charles Z. (Emeritus), LL.B., 1955, Washington; evidence, judicial administration.

Stoebuck, William B.,* S.J.D., 1973, Harvard; property, land use, legal history.

Taylor, George E. (Emeritus), D.Litt., 1957, Birmingham (England); law.

Trautman, Philip A.,* J.D., 1954, Washington; conflict of laws, procedure.

Tunks, Lehan K.,* J.S.D., 1947, Yale; associations, taxation, administrative law.

Associate Professors

Hartman, John, J.D., 1975, Harvard, Dip.L., 1980, Oxford; federal courts, contracts.

Jay, Stewart M.,* J.D., 1976, Harvard; civil procedure, theories of justice, constitutional law.

Assistant Professor

Stein, Ted L.,* J.D., 1977, Harvard; civil procedure, international law.

Lecturers

Halpert, Helen H., J.D., 1977, Davis; negotiations.

Sullivan, John J., LL.B., 1949, Washington; trial practice.

Course Descriptions

Courses for Undergraduates

LAW 442 Land Law and the Urban Environment (3) Examination of the major legal tools available to shape the urban environment by controlling the use of land. Considers zoning, subdivision controls, urban renewal, private land-use restrictions, and the rules of nuisance law. Offered on credit/no credit basis only. For nonlaw students only; must be graduate or upper-division undergraduate. (Not offered every year.)

LAW 443 The Legal Process (5) Designed for, and limited to, graduate students and upper-division undergraduates. Intended to present the system of law and its functions rather than to teach substantive law pertaining to any particular subject or discipline. Offered on credit/no credit basis only. (Not offered every year.)

LAW 444 Constitutional Freedom and American Education (3-6, max. 6) Examines the relationships between the Constitution of the United States and the American system of public education, excluding higher education, in areas of constitutional freedom and legal controls, racial desegregation, and equal educational opportunity, including equal financing of the public schools. Offered jointly with EDEPS 444. (Not offered every year.)

LAW 449 The System of Military Justice (3) Exploration of the system of criminal law under the Uniform Code of Military Justice. Emphasis on procedures and the operation of the system rather than upon substantive crimes. Discussion and lecture involve case studies. Prerequisite: junior standing or permission of instructor. (Not offered every year.)

LAW 495 Law and Social Science (4) Policy-oriented, interdisciplinary study of uses and limits of social science in the lawmaking process on appeal and fact-finding process at trial. Critical perspectives on roles of social science, especially social psychology, in adjudication. Offered jointly with PSYCH 495. Open to upper-division undergraduates and graduate students only.

First-Year Courses

The courses below are intended for law students; other students are admitted only rarely with special permission of the Dean. Only the course titles are given. For complete course descriptions, see the School of Law Bulletin.

LAW A 500 Administrative Law (4)

LAW A 501- Contracts ((2-8)-, max. 8)

LAW A 502- Civil Procedure I ((2-6)-, max. 6)

LAW A 503- Property I ((2-8)-, max. 8)

LAW A 504- Torts ((2-8)-, max. 8)

LAW A 505- Criminal Law ((2-5)-, max. 5)

LAW A 506- Basic Legal Skills ((1-6)-, max. 6)

Second- and Third-Year Courses

LAW A 508 Negotiable Instruments (3)

LAW A 509- Corporations VI ((2-6)-, max. 6)

LAW A 510 Sales (3)

LAW A 511- Commercial Transactions ((2-6)-, max. 6)

LAW A 512 Personal Property Security (3)

LAW A 513- Creditor-Debtor Law ((2-3)-, max. 5)

LAW A 514 Corporations (3 or 4)

LAW A 515 Associations (3)

LAW A 516 Legal Accounting (4)

LAW A 517 Securities Regulations (3) A

LAW A 518 Financial Management (4)

LAW A 519 Consumer Protection (3)

LAW A 520- Property II ((2-8)-, max. 8)

LAW A 521 Community Property (3)

LAW A 522 Land-Use Controls (3)

LAW A 523 Real Property Security (3)

LAW A 524 Private Land Development (3)

LAW A 525 Water Law (3)

LAW A 527 Environmental Law: Pollution Control (3)

LAW A 528 Natural Resources: Energy (3)

LAW A 529 Public Land Law (3)

LAW A 530 Basic Income Tax (5)

LAW A 531 Death and Gift Taxation (2-5)

LAW A 532 Federal Income Taxation of Business Enterprise (5)

LAW A 534 Federal Tax Procedure (3)

LAW A 535 Problems of Federal Taxation (4)

LAW A 536 Deferred Compensation (3)

LAW A 537- Business Planning ((2-6)-, max. 6)

LAW A 538 Estate Planning Workshop (3)

LAW A 539- Federal Tax Policy ((1-3)-, max. 3)

LAW A 540 Land Use Planning (3)

LAW A 541 Transnational Tax (5)

LAW A 542 Oil and Gas Law (3)

LAW A 547 Government Regulation of Information (3)

LAW A 548 Civil Rights (3)

LAW A 550- Constitutional Law ((2-8)-, max. 8)

LAW A 551 Constitutional Freedom and American Education (4)

LAW A 552- Antitrust ((2-5)-, max. 5)

LAW A 554- Labor Relations and the Law ((3-2)-, max. 5)

LAW A 555 Labor Relations in the Public Sector (3)

LAW A 556- Employment Discrimination ((2-4)-, max. 4)

LAW A 557 Equal Rights (3)

LAW A 558- Jurisprudence and Legal Philosophy ((2-4)-, max. 4)

LAW A 559 Legal Method (3)

LAW A 560 Income Maintenance Legislation (3)

LAW A 563 Urban Government (4)

LAW A 564 Legal History (3)

LAW A 565 American Indian Law (3)

LAW A 566- Theories of Justice ((2-4)-, max. 4)

LAW A 568 Collective Bargaining and Labor Arbitration (4)

LAW A 569 Social Science and the Courts (4) Sp

LAW A 570 Legal Problems of Economic Development (3)

LAW A 571 International Legal Organizations (3)

LAW A 572 International Legal Order (3)

LAW A 573 Arms Control and Disarmament: The Legal Perspective (3)

LAW A 574 International Legal Process (2-4, max. 4)

LAW A 575 United States Legal History (3)

LAW A 579 Children and the Law (3)

LAW A 580 Domestic Relations (3)

LAW A 583 Insurance I (3)

LAW A 584 Insurance II (3)

LAW A 585 Admiralty (3)

LAW B 500 Civil Procedure II (4) Sp

LAW B 501 Criminal Procedure IV (4)

LAW B 502- Criminal Procedure VI ((2-6)-, max. 6)

LAW B 503- Evidence ((2-6)-, max. 6)

LAW B 505 Rules of Evidence in the Courtroom (3)

LAW B 506- Conflicts of Laws ((2-5)-, max. 5) W

LAW B 507 Federal Courts and the Federal System (3 or 4)

LAW B 508 Equitable Remedies (3)

LAW B 510 Problems of Professional Responsibility (3)

LAW B 512 Rights of Prisoners in Washington (3)

LAW B 513- Problems in Evidence ((2-6)-, max. 6)

LAW B 520- Trial Advocacy ((2-6)-, max. 6)

LAW B 521- Appellate Advocacy ((1-3)-, max. 3)

LAW B 523 Negotiation: Dispute Settlement and Planning (3)

LAW B 530- Judicial Externship ((1-15)-, max. 15)

LAW B 532- Supervised Analytic Writing ((1-3)-, max. 3)

LAW B 533 Interviewing and Counseling for Lawyers (2)

LAW B 535- Legislative Externship ((1-15)-, max. 15)

LAW B 536 Introduction to Legal Drafting (3)

LAW B 538 Agency Externships (1-8, max. 10)

Asian and Comparative Law

LAW B 540 Law in East Asia: Japan (3)

LAW B 541 Law in East Asia: China (3)

LAW B 542 Law in East Asia: Korea and Southeast Asia (3)

LAW B 543 Islamic Literature on Jurisprudence and Law in English (3) Offered jointly with N E 432.

LAW B 544 Justiciability Under the Civil Law and the Common Law (4)

LAW B 545- United States-Japanese Contract and Sales Problems ((2-4)-, max. 4)

LAW B 546 United States-Japanese Corporate Relations (4)

LAW B 547 United States-Japanese Tax Problems (3 or 4)

LAW B 548 Japanese Administrative Law (3)

LAW B 549 Government Regulation of Business in Japan (3)

LAW B 550- Legal Analysis and Research for Students Not Trained in the Common-Law System ((1-4)-, max. 4)

LAW B 551- Comparative Law Seminar ((2-6)-, max. 6)

LAW B 552- Tutorial in Comparative Law ((1-4)-, max. 4)

LAW B 553 Chinese Legal Tradition (3) Offered jointly with SISEA 553.

Law and Marine Affairs

LAW B 560 Coastal Zone: Legal Regulation of Onshore Activities (2) Offered jointly with IMS 510.

LAW B 561 International Law of the Sea (4) Offered jointly with IMS 506.

LAW B 563-564 Ocean Policy and Resources Seminar (3-3) Offered jointly with IMS 562-563.

LAW B 565 U.S. Law and the Marine Environment (3) Offered jointly with IMS 515.

Seminars

LAW B 573- Federal Tax Policy Seminar ((1-6)-, max. 6)

LAW B 575- The Supreme Court and the Constitution ((2-6)-, max. 6)

LAW B 576- Selected Problems on Environmental Protection Seminar ((2-6)-, max. 6)

LAW B 578- International Legal Order Seminar ((2-6)-, max. 6)

LAW B 579- Federal Tax Seminar ((2-6)-, max. 6)

LAW B 583- Eminent Domain ((1-3)-, max. 3)

LAW B 584- Indian Law Seminar ((2-6)-, max. 6)

LAW B 585- Information Law Seminar ((2-2-2)-, max. 6)

LAW B 588- Issues in Discrimination ((2-6)-, max. 6)

LAW B 587- Problems in Labor Law Seminar ((1-4)-, max. 4)

LAW B 589- Intellectual Property Law Seminar ((1-4)-, max. 4)

LAW B 590- Social Security Act Seminar ((1-3)-, max. 3)

LAW B 591- Issues in Labor Law Seminar ((1-6)-, max. 6)

LAW B 592- Seminar on the Legal Rights of Handicapped Persons ((1-4)-, max. 4)

LAW 600 Independent Study or Research (*)

LAW 800 Doctoral Dissertation (*)

Graduate School of Library and Information Science

Director

Margaret E. Chisholm
133 Suzzallo

Graduate Program

A 63-credit course of study leads to the Master of Librarianship degree, which prepares graduates for professional positions in information management in libraries and a variety of other environments. The school's curriculum incorporates a significant number of courses in the organization, storage, retrieval, and management of information through the use of diverse technologies. The foundation courses, LIBR 500 (Society, Users, and Libraries) and LIBR 501 (Bibliographic Control), which provide the theoretical base for further study, are offered in Autumn Quarter. Advanced and skill courses are organized around five areas of concentration: managerial tools, organization of resources, information resources and retrieval, design and provision of information services, and environments of information service.

The law librarianship program requires a J.D. degree for admission and may be completed in one calendar year. It prepares lawyers to serve as law librarians in courts, federal and state units of government, and schools of law. These students take the foundation courses, additional courses that deal specifically with law librarianship, and a selection of other courses in the librarianship curriculum.

Special Research Facilities

The school's computer laboratory provides a dedicated facility for online access to the University's CDC Cyber and VAX computers, as well as to off-campus bibliographic utilities and information networks, for the use of graduate students and faculty in research and instruction. The basic instruction is provided for on-line data-base search, networking design, on-line cataloging, and microcomputers.

Admission

The following criteria are examined as evidence of the applicant's ability to progress satisfactorily in a graduate program: (1) application for admission; (2) a baccalaureate degree from a college or university of recognized rank, and evidence of above-average scholastic ability, usually shown by a 3.00 minimum grade-point average for the junior and senior years; (3) an official score from the Graduate Record Examination, general aptitude section, taken within five years of the year of expected enrollment; (4) three letters of reference; and (5) a statement of educational and personal objectives. In addition, an applicant from a non-English-speaking country must demonstrate a satisfactory command of English by submitting a recent score from the Test of English as a Foreign Language examination. Completed applications for admission must be received by May 1. International students, however, are advised to complete their applications by March 1.

In addition to the above requirements, an applicant for the law librarianship program must hold a degree from an accredited American law school or from a law school in one of the common-law countries.

While not required, it is recommended that applicants have completed some formal study of modern foreign language. Familiarity with computer programming, statistics, or college algebra is helpful in many areas of librarianship.

Assistantships, Fellowships, Traineeship Opportunities

The school has funding available each year for one research assistantship and several student assistantships. In addition, a limited number of federal fellowships are awarded, and fellowships from the Cobb and the Henry endowment funds and a multiethnic fellowship are awarded each year. The amount of assistance and number of awards varies from year to year. Other fellowships are described in *Financial Assistance for Library Education*, available from the American Library Association, 50 East Huron Street, Chicago, Illinois 60611.

Correspondence and Information

Director
Graduate School of Library and Information Science, FM-30

Faculty

Director

Margaret E. Chisholm

Professors

Ahlers, Eleanor E. (Emeritus), M.A., 1957, Washington; librarianship.

Benne, Mae M.,* M.S., 1955, Illinois; children's literature, public library services for children.

Chisholm, Margaret E.,* Ph.D., 1966, Washington; school library media programs, organization and administration, special literatures, and library education.

Hiatt, Peter,* Ph.D., 1963, Rutgers; library and information services, planning and evaluation of services and materials for special populations, continuing education and staff development, library education.

Lieberman, Irving (Emeritus), Ed.D., 1955, Columbia; librarianship.

Shaw, Spencer G.,* B.L.S., 1941, Wisconsin; children's materials and services, storytelling and folklore, multiethnic materials for children and young adults, materials and services for special populations, directed fieldwork program.

Associate Professors

Mignon, Edmond,* Ph.D., 1976, California (Berkeley); information retrieval, bibliographic organization, information studies, methods of research.

Skelly, Grant T.,* Ph.D., 1968, California (Berkeley); bibliography and reference, subject literature/history of the book.

Turner, Mabel A. (Emeritus), M.S.L.S., 1959, Columbia; librarianship.

Assistant Professors

Fidel, Raya,* Ph.D., 1982, Maryland; information storage and retrieval systems, system analysis and automation, research methods.

Nelson, Jerold A.,* Ph.D, 1971, California (Berkeley); interpersonal relations in libraries, intellectual freedom.

Soper, Mary E.,* Ph.D., 1972, Illinois; technical services, organization of library materials, cataloging, abstracting, indexing.

Course Descriptions

LIBR 450 Survey of Children's Literature (3) *Benne, Shaw* Designed for educators, librarians, and others interested in the selection and utilization of children's books for family, school, and library enrichment. Not open to librarianship majors. Prerequisite: junior or higher standing.

LIBR 451 Literature for Young Adults (3) Reading and appraisal of literature appropriate to the needs, interests, and abilities of young adults. For the general student as well as the teacher. Not open to librarianship majors. Prerequisite: junior or higher standing.

LIBR 470 History of the Book (3) *Skelley* Survey of the development of the book from hieroglyphics and clay tablets to the present, with emphasis on the printed book in the Western world since Gutenberg. The book as a physical object and the processes and materials of its production, viewed in the context of changing technologies and various cultural, esthetic, economic, and trade influences. Includes aspects of book collecting. Offered on credit/no credit basis only. Prerequisite: junior or higher standing.

LIBR 471 Storytelling: Art and Techniques (3) *Shaw* Storytelling, past and present, noting its development as an art form. Reading and analyzing storytelling materials (folk literature and literary forms) used by storytellers throughout historical periods. Learning essential techniques necessary to maintain this artistic skill in a professional field. Planning storytelling programs for various age and interest groups and situations, utilizing folk, classic, and contemporary literature. Not open to librarianship majors. Prerequisite: junior or higher standing.

LIBR 499 Study Projects in Library Development (1-5) Individual or group study projects, workshops, or seminars on the improvement of library services. Offered on credit/no credit basis only. Prerequisite: junior or higher standing.

LIBR 500 Society, Users, and Libraries (6) Introduction to librarianship. Society's information processes, ways in which individuals use information in their environments, and the role of libraries and librarians. Students develop skills basic to other courses, establish personal agenda for study in the remainder of the program, learn the literature of the field, and become acquainted with the intellectual context of librarianship as a service profession. Prerequisite: major standing.

LIBR 501 Bibliographic Control (6) Survey of the major types of instruments for the bibliographic control of the various kinds of library materials and of the conventions used in describing them. Basic concepts, historical background, and theoretical and practical aspects of bibliographic control; evaluation and methodology. Prerequisite: major standing.

LIBR 502 Introduction to Information Science (3) *Fidel* Theory, understandings, and perspectives for the analysis of design and operation of information retrieval systems. Systems analysis applied to the process of information transfer. Consideration of user needs assessment, performance evaluation, and control of terminology. Prerequisites: 500, 501, or permission of instructor.

LIBR 510 Management for Librarians (3) Management concepts critical to provision of library services. The planning process applied to library problems and opportunities. Communications awareness and skills in the professional environment. Organizational concerns, including personnel, budgeting, control techniques, theories of management, and evaluation of effectiveness. Prerequisites: 500, 501, or permission of instructor.

LIBR 511 Library Administration Skills (3) Provides practice in the administrative skills related to personnel selection, supervision, and management, and to planning and budgeting processes in the library setting. Topics include work specification, performance evaluation, personnel policy formulation, budget types, and budget preparation and control. Prerequisite: 510 or permission of instructor.

LIBR 512 Community Analysis and Library Change (3) Review of the concepts, strategies, and tools for study of the community, response to community change, and promotion of desired library change. Includes experiential exercises, analysis of case studies, and investigation of the literature of relevant fields. Prerequisites: 500, 501, or permission of instructor.

LIBR 520 Organization of Library Materials: Introduction (3) *Soper* Introduction to principles and techniques of standard methods of organizing library materials for use. Includes fundamentals of descriptive cataloging, primary systems of subject analysis, and developments in technical services. Prerequisites: 500, 501, or permission of instructor.

LIBR 522 Descriptive Cataloging (3) *Soper* Continuation of 520, with emphasis on rules of descriptive cataloging for monographic print materials of all kinds and nonbook materials. Includes applications of automation to bibliographic control of library materials. Prerequisite: 520 or permission of instructor.

LIBR 523 Subject Analysis of Library Materials (3) *Soper* Continuation of 520, with emphasis on subject analysis of library materials. Includes work with Library of Congress and Dewey decimal classifications, Sears and Library of Congress subject headings, and other systems used in libraries today. Prerequisite: 520 or permission of instructor.

LIBR 525 Organization and Use of Serials (3) *Soper* Management of serials, including acquisition and replacement, control, subject access, preservation, and use of all types in all kinds of libraries. Includes application of new technology and international developments as they affect serials. Prerequisite: 522 or permission of instructor.

LIBR 526 Indexing and Abstracting (3) *Fidel* Techniques of vocabulary control and thesaurus construction as applied to indexing and abstracting processes. Design, selection, and evaluation of indexing systems. Computerized methods for free text, full text, and controlled vocabulary procedures. Application of methods to information retrieval systems. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 528 Literature Searching (3) *Mignon* Survey of concepts and techniques of professional literature searching. Organization of computerized bibliographic files. Analysis and evaluation of data bases. Management and planning of library searching services. Specialized procedures in user interviewing and request analysis. Experience in design and on-line execution of literature searches, using a variety of standard searching languages, including the Dialog and Orbit systems. Prerequisites: 500, 501, or permission of instructor.

LIBR 531 Organization of Retrieval Systems (3) *Fidel* Designing and evaluating retrieval systems. Concepts such as authority lists, data schema, structure, and format. Basic concepts and methods, complemented by practical work in data-base design and thesaurus construction. Prerequisite: 502 or permission of instructor.

LIBR 540 Materials for General Information Needs (3) *Nelson* Consideration of the individual in the generalized information environment. Interdisciplinary sources for the selection of library materials. Forms of materials for nonspecialized information retrieval and referral. Development of skills in question negotiation and search strategy. Prerequisites: 500, 501, or permission of instructor.

LIBR 541 Information Access in the Humanities (3) *Nelson, Skelley* Description and analysis of information problems and information sources in the humanities. Fields considered are philosophy, religion, visual arts, performing arts, language, and literature. Prerequisites: 500, 501, or permission of instructor.

LIBR 542 Information Access in the Social Sciences (3) *Skelley* Description and analysis of information problems and information sources in the social sciences. Fields considered are anthropology, business economics, education, geography, history, political science, psychology, and sociology. Prerequisite: 528 or permission of instructor.

LIBR 543 Information Access in Science and Technology (3) Covers the following topics as they apply in the literature of the natural sciences and engineering: nature of information transfer; characteristics and organization of bibliographic and reference sources; information retrieval from manual and computer on-line sources; search strategy; practice with specific data bases and manual sources. Prerequisite: 528 or permission of instructor.

LIBR 544 Legal Bibliography (3) Introduction to legal bibliography and law librarianship. A comprehensive introduction to methods of legal research and explores current issues in law librarianship. Prerequisites: 500, 501, or permission of instructor.

LIBR 545 Government Publications (3) *Nelson* Government publications of the United States and foreign countries, their acquisition, organization, and use. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 547 Evaluation and Selection of Audiovisual Materials (3) Develops competency in applying criteria to the evaluation, selection, and use of audiovisual materials and their accompanying technologies. Focuses on previewing the full range of audiovisual formats found in all types of libraries. Prerequisites: 500, 501, or permission of instructor.

LIBR 549 Children's Materials: Evaluation and Use (3) *Benne, Shaw* Study of library materials for children with emphasis on literature in its various forms. Attention also given to criteria used in evaluation, issues in selection, and use of materials with children. Prerequisites: 500, 501, or permission of instructor.

LIBR 550 Children's Materials: Bibliography and Resources (3) *Benne, Shaw* Study and evaluation of bibliography and selection aids necessary to develop collections for public, school, and academic libraries. Attention is given to the standard works of literary criticism; contemporary and historical studies, and texts dealing with the use of literature with children; and publications of organizations, both United States and foreign, role of the publisher, the needs of the selector and the scholar. Prerequisites: 500, 501, or permission of instructor.

LIBR 551 Literature for Young Adults (3) Reading, evaluation, and sharing of literature currently appropriate to the needs, interests, and abilities of young adults, ages twelve through twenty. Application of criteria to the assessment of young adult reading materials and consideration of the uses of these materials with young people. Prerequisites: 500, 501, or permission of instructor.

LIBR 553 Information Access in Health Sciences (3) *Mignon* Characteristics of users of biomedical literature. Survey of information resources in health sciences and health-care planning. Use of information retrieval systems, emphasizing services of the National Library of Medicine. Organization of medical and hospital libraries. Problems of information policy, professional standards, and certification. Prerequisite: 543 or permission of instructor.

LIBR 555 Socioeconomic Data Resources (3) *Mignon* Utilization of public data bases of economic and demographic statistics for information retrieval, special attention to services of Bureau of the Census. Application of on-line data files to library reference services. Offered on credit/no credit basis only. Prerequisites: 528 and 599 or course in inferential statistics, or permission of instructor.

LIBR 557 Advanced Legal Bibliography (2) Bibliographical data and use of federal and state law reports and statutes; quasi-legal and commissioners' reports of the states; bar association records, legal periodicals, indexes and digests, and cooperative bibliographies of law collections. Offered on credit/no credit basis only. Prerequisite: law librarianship major or permission of instructor.

LIBR 558 Selection and Processing of Law Library Materials (4) Aids to selection, processing, microphotography of legal material, etc. Offered on credit/no credit basis only. Prerequisite: law librarianship major or permission of instructor.

LIBR 560 Information Needs, Uses, and Users (3) *Nelson* Study of the factors and influences, both individual and social, associated with human beings needing, using, and acting on information. Information theory, human information processing, information flow among social and occupational groups, and research on information needs and uses. Prerequisites: 500, 501, or permission of instructor.

LIBR 561 Serving Individual Information Needs (3) *Nelson* Training in awareness and skills for perceiving and responding to the information requests of users. Effective strategies for meeting information needs are learned through use of simulations, role playing, experiential exercises, discussion, and practice. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 562 Planning for Library and Information Services (3) *Hiatt* Principles underlying library and information services, and the selection and design of services to meet user needs in all types of libraries and information centers. Emphasis on adult clientele in academic, public, and special libraries, but attention given to school library media centers and all age levels. Prerequisites: 500, 501, or permission of instructor.

LIBR 563 Library Services for Special Populations (3) *Hiatt* Acquaints students with the library and information needs of the aging, handicapped, and institutionalized; what libraries are doing to meet these needs; and what skills, insights, and attitudes are needed by librarians working with these target groups. Some emphasis on the institutionalized and the institution environment. Prerequisites: 500, 501, or permission of instructor.

LIBR 567 Public Library Services for Children (3) *Benne, Shaw* Administration of children's departments in public libraries; planning and promoting programs and services; evaluation of library collections; community and professional roles of the children's librarian. Prerequisite: 549 or permission of instructor.

LIBR 568 Administration of the School Library Media Program (3) Develops competency in administering materials, equipment, and services of the library media program as an integral part of the educational process of the school. Focuses on developing skills in acquiring, organizing, and managing the full range of learning resources for access and use and communicating the program to users. Required for school library media specialists. Prerequisites: 500, 501, or permission of instructor.

LIBR 571 Storytelling: Art and Techniques (3) *Shaw* Study of storytelling, past and present, noting its development as an art form. Reading and analyzing storytelling materials (folk literature and literary forms) used by storytellers throughout historical periods. Learning essential techniques necessary to maintain this artistic skill in a professional field. Planning storytelling programs for various age and interest groups and situations, utilizing folk, classic, and contemporary literature. Prerequisites: 500, 501, or permission of instructor.

LIBR 572 Archival and Manuscript Services (3) Selection, organization, and uses of archival and manuscript collections. Emphasis on the principles and techniques; some attention to the administration of state archival and historical institutions' collections. Lecture, demonstration, and laboratory. Prerequisites: 500, 501, or permission of instructor.

LIBR 577 Law Library Administration (5) Staff, patrons and public relations, circulation, architecture, book arrangements, equipment, rules, publicity, publications, budgets, reports, professional societies, regional service. Offered on credit/no credit basis only. Prerequisite: law librarianship major or permission of instructor.

LIBR 581 Intellectual Freedom in Libraries (3) *Nelson* Analysis of issues related to intellectual freedom, with particular attention to implications for libraries and librarians. Topics include consideration of the current legal climate, conformity vs. freedom in the modern world, the librarian as censor, social responsibility and individual freedom, the intellectual freedom of children, prospects for the future. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 583 Cooperative Information Systems (3) Analysis of cooperative information systems found among all types of libraries and information centers. Emphasis on developments in the United States and also treatment of foreign and multinational systems, with assessment of their contributions. Prerequisites: 500, 501, or permission of instructor.

LIBR 590 Directed Fieldwork (4) *Shaw* Six weeks of professionally supervised fieldwork in various types of libraries. Offered on credit/no credit basis only. Librarianship majors only. Prerequisites: 500, 501.

LIBR 592 Aspects of Publishing (3) *Skelley* Examination of selected topics and figures relating to book and periodical publishing, primarily from the Renaissance to the present. Focus on publishing practices, processes, and strategies considered in given economic, cultural, and social contexts. Does not cover the arts, crafts, materials, and technical means involved in producing the published product, but the combination of activities, entrepreneurial or otherwise, that constitute publishing. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 597 Directed Fieldwork Seminar (2) *Shaw* Research or in-depth study that leads to a consideration of problems, concerns, or issues of mutual interest that originated during field experiences. Offered on credit/no credit basis only. Prerequisites: 500, 501.

LIBR 598 Special Topics in Librarianship (3) Seminar dealing with various topics in librarianship. Offered by visitors or resident faculty. Topics are changed from quarter to quarter. May not be offered every quarter. May be repeated for credit. Offered on credit/no credit basis only. Prerequisites: 500, 501, or permission of instructor.

LIBR 599 Methods of Research in Librarianship (3) Introduction to research methods commonly used in library and information science. Emphasis on problem selection, study design, data interpretation, and dissemination of results. Prerequisites: 500, 501, or permission of instructor.

LIBR 600 Independent Study or Research (*) Offered on credit/no credit basis only.

LIBR 700 Master's Thesis (*) Offered on credit/no credit basis only.

School of Medicine

Dean

David C. Dale
A300 Health Sciences

Associate Deans

Benjamin H. Belknap
David R. Morris
John M. Neff
Theodore J. Phillips
Marvin Turck
Loren C. Winterscheid

Assistant Deans

D. Daniel Hunt
David M. Irby
Barbara D. Kirby
Paul H. Rockey
Werner Samson
Ronald J. Adkins, Washington State University
Guy R. Anderson, University of Idaho,
Stephen Guggenheim, Montana State University
Wayne Myers, University of Alaska

WAMI Program

Established in 1946, the School of Medicine is the only medical school directly serving the states of Washington, Alaska, Montana, and Idaho. Located in the Warren G. Magnuson Health Sciences Building, the school operates a decentralized program of medical education (WAMI) via a network of teaching affiliates throughout the Pacific Northwest.

The school's basic-science departments provide educational opportunities for students from all schools and colleges within the University. Clinical teaching programs are conducted at the University Hospital, Harborview Medical Center, Children's Orthopedic Hospital and Medical Center, Seattle Veterans Administration Hospital, and Pacific Medical Center, as well as at other clinical affiliates in Seattle and throughout the WAMI states.

The school currently admits 175 medical students to its first-year class and has a total enrollment of seven hundred students pursuing the Doctor of Medicine degree. The full-time faculty numbers more than one thousand members. The affiliated University residency training network enrolls approximately six hundred house officers. Enrollment in the graduate programs in the basic sciences exceeds two hundred students, and approximately four hundred postdoctoral fellows are enrolled in various advanced training programs. The school has baccalaureate and graduate programs in occupational therapy, physical therapy, prosthetics and orthotics, and medical technology. It participates in training a broad spectrum of other allied health professionals.

Academic Program

Doctor of Medicine Degree

Upon completion of the curriculum of the School of Medicine, the M.D. degree is awarded to those candidates who (1) have given evidence of good moral character, (2) have satisfactorily completed the requirements of the curriculum, (3) have fulfilled all special requirements, and (4) have discharged all indebtedness to the University.

Bachelor of Science Degree

Programs leading to a baccalaureate degree with a major in microbiology are offered through the College of Arts and Sciences. Those programs are described in the College of Arts and Sciences section of this catalog.

Bachelor of Science in Medical Technology Degree

The medical technology curriculum is designed to train young men and women to be professional employees in hospital, clinic, public health, and medical research laboratories. The prescribed preparatory program consists of two years of University study in which an emphasis is placed upon courses in chemistry and biology. This is followed by a two-year period of full-time instruction and training in medical technology. Information concerning the curriculum and admission to the program in medical technology appears under Laboratory Medicine in this catalog.

Bachelor of Science in Physical Therapy Degree

A curriculum in physical therapy is offered by the Department of Rehabilitation Medicine in the School of Medicine. It provides professional training in the basic sciences and in the clinical use of accepted physical therapy modalities and procedures. Information concerning admission to physical therapy appears under Rehabilitation Medicine in this catalog.

Bachelor of Science in Prosthetics and Orthotics Degree

A curriculum in prosthetics and orthotics leading to the degree of Bachelor of Science is offered by the Department of Rehabilitation Medicine. It provides professional training in the basic sciences and the clinical application, design, and fabrication of prostheses and orthoses. Information concerning admission to the curriculum in prosthetics and orthotics may be found under Rehabilitation Medicine in this catalog.

Bachelor of Science in Occupational Therapy Degree

A curriculum in occupational therapy is offered by the Department of Rehabilitation Medicine in the School of Medicine. It provides professional training in the basic sciences and, in the clinical use of occupational therapy, appears under Rehabilitation Medicine in this catalog.

Master of Science and Doctor of Philosophy Degrees

Work leading to master's and doctoral degrees is offered, in accordance with the requirements of the Graduate School, in the departments of Biochemistry, Biological Structure, Microbiology and Immunology, Pathology, Pharmacology, and Physiology and Biophysics. Master's degree programs are offered by the departments of Biomedical History, Rehabilitation Medicine, and Laboratory Medicine.

Students may work toward these degrees concurrently with the M.D. degree, usually taking additional years beyond the typical four-year medical curriculum. To expedite the training of physicians who wish to specialize in public health and community medicine, the school has available a program that leads simultaneously to the degrees of Doctor of Medicine and Master of Public Health. The program usually requires the addition of a fifth year to the medical education process. The quarters of the fifth year may be taken sequentially or interspersed with medical training in a variable pattern, subject to appropriate academic approval. Students may elect concentration in any of three departments of the School of Public Health and Community Medicine: Environmental Health, Epidemiology, or Health Services.

Concurrent degrees are possible in many other departments and colleges of the University. Recent graduates have pursued concurrent degrees in education and engineering, as well as in the basic sciences of medicine and the School of Public Health and Community Medicine. A student who intends to work toward a graduate degree should confer with the Chairperson of the department in which graduate study is to be pursued and with the associate dean for academic affairs of the School of Medicine. Specific requirements for admission to work for advanced degrees appear in the Graduate School section of this catalog. Permission to pursue advanced degrees is granted to medical students only if they are progressing normally in the medical curriculum and show evidence of being able to take on this additional work load.

Medical Accreditation and Licensure

The University of Washington School of Medicine is a fully accredited institution, having received approval from the Liaison Committee on Medical Education representing the Association of American Medical Colleges and the American Medical Association.

Admission to the practice of medicine in any state is conditional upon meeting the requirements of that state's board of examiners. Admission to practice in the state of Washington is dependent on the candidate's having an M.D. degree, completing an internship, and passing the licensing examinations of the state. Washington accepts the National Board of Medical Examiners examination for this purpose. As of 1983, all states except Texas and Louisiana also accept this examination as well as the examination administered by the Federation of State Licensing Boards.

Additional information about licensure requirements may be obtained from the Washington State Division of Professional Licensing, Post Office Box 9649, Department 71175, Olympia, Washington 98504.

Postgraduate Medical Education

Internships and Residencies

Postgraduate clinical training programs are available at University-affiliated hospitals: University Hospital, Harborview Medical Center, Seattle Veterans Administration Hospital, Pacific Medical Center, Children's Orthopedic Hospital and Medical Center, Providence Hospital, Swedish Hospital, Group Health Cooperative of Puget Sound, and Boise Veterans Administration Hospital. All clinical departments cooperate with one or more of these institutions. A University network of affiliated family practice residencies includes training programs based in Seattle, Tacoma, Spokane, and Boise, Idaho, and in military programs at Madigan Army Medical Center and Bremerton Naval Medical Center. First-year training programs are available in the clinical fields of anesthesiology, family medicine, general surgery, laboratory medicine, medicine, neurology, neurological surgery, obstetrics and gynecology, ophthalmology, orthopedic surgery, pathology, pediatrics, psychiatry, radiation therapy, radiology, rehabilitation medicine, and urology. The residency programs vary in duration from three to five years and are integrated, providing for rotation through several of the University-affiliated hospitals during this period of training.

Postdoctoral Fellowships and Traineeships

Postdoctoral fellowships and traineeships are available in all departments. They are designed to provide additional research and teaching experience for advanced students who already have obtained the Ph.D. or M.D. degree.

Medical Curriculum

Basic Curriculum (122 Credits)

The first two years (six quarters) of the medical student curriculum is identified as the *Basic Curriculum*. It consists of three phases, or groups, of courses in the Human Biology series: pre-organ system courses in the sciences basic to medicine, organ systems taught by basic and clinical disciplines, and introduction to clinical medicine and health care. The first phase is designed to provide the background in basic disciplines required for the organ system courses. In the second phase, the student is concerned with learning the normal and pathophysiologic properties of the several human organ systems. Emphasis is placed upon correlating these properties with clinical methods of data collection and problem formulation. Students pursue the Introduction to Clinical Medicine course throughout all six quarters, learning to interview patients, obtain a medical history, and perform physical examinations. In the course Medicine, Health, and Society, they also study the health-care system and problems of providing medical care to populations.

Students are expected to pursue the Basic Curriculum during their first six quarters in the School of Medicine. The academic demands of the Basic Curriculum are scaled so that most students also will be able to take elective courses. Electives may be used to make up educational deficiencies, to broaden the student's background, or to begin the fulfillment of the Independent Study in Medical Sciences requirement. No student is expected to undertake work in excess of 24 credits per quarter. In fact, assumption of an academic load in excess of this requires special permission.

FIRST QUARTER (AUTUMN)

HUBIO 510P	Microscopic Anatomy (Histology)
HUBIO 511P	Gross Anatomy Embryology
HUBIO 512P	Mechanism in Cell Physiology
HUBIO 513P	Introduction to Clinical Medicine
HUBIO 514P	Biochemistry
HUBIO 515P	Ages of Man
HUBIO 516P	Cell Biology

SECOND QUARTER (WINTER)

HUBIO 520P	Cell and Tissue Response to Injury
HUBIO 521P	National History of Infectious Disease and Chemotherapy
HUBIO 522P	Introduction to Clinical Medicine
HUBIO 524P	Biochemistry
HUBIO 525P	Gross Anatomy and Embryology

THIRD QUARTER (SPRING)

HUBIO 530P	Epidemiology
HUBIO 531P	Head, Neck, Ear, Nose, and Throat
HUBIO 532P	Nervous System
HUBIO 533P	System of Human Behavior I
HUBIO 535P	Introduction to Clinical Medicine

FOURTH QUARTER (AUTUMN)

HUBIO 540P	Cardiovascular Respiratory System
HUBIO 542P	Introduction to Clinical Medicine
HUBIO 543P	Principles of Pharmacology I
HUBIO 544P	Endocrine System
HUBIO 545P	Reproductive Biology

FIFTH QUARTER (WINTER)

HUBIO 550P	Introduction to Clinical Medicine
HUBIO 551P	Gastrointestinal System
HUBIO 553P	Musculoskeletal System
HUBIO 554P	Genetics
HUBIO 555P	Medicine, Health, and Society
HUBIO 556P	Skin System

SIXTH QUARTER (SPRING)

HUBIO 560P	Introduction to Clinical Medicine
HUBIO 561P	Hematology
HUBIO 562P	Urinary System
HUBIO 563P	System of Human Behavior II
HUBIO 564P	Principles of Pharmacology II
HUBIO 566P	Systematic Pathology

Clinical Curriculum (120 Credits)

The clinical curriculum is pursued predominantly in the third and fourth years of medical school. It includes three elements: prescribed clerkships to be completed by all students (72 credits or thirty-six weeks in medicine, obstetrics and gynecology, pediatrics, psychiatry, surgery); a clinical selective series requiring a minimum number of credits (20) in three clinical areas (family medicine, rehabilitation medicine/chronic care, and emergency care/trauma); and 28 credits of clinical clerkships elected by the student.

Education in the clinical curriculum utilizes the case-study method. Students gain a clinical knowledge base and gradually increase their clinical problem-solving abilities while working as junior members (clerks) of a medical-care team. Each such team is headed by a faculty clinician working in one of the medical school-affiliated hospitals or practice units.

Independent Study in Medical Science (10 Credits)

In addition to the Basic and clinical curricula, the school has required since 1968 that each student complete a prescribed number of credits in one or more of the sciences basic to medicine. Beginning in 1982, this requirement is for 10 credits and must be a planned program consistent with the student's interests and career goals. Its purpose is that each student gain an understanding of the philosophy and methods of science as it relates to his or her chosen field of medicine. The planned program should include investigation in the disciplines studied and must result in a written paper acceptable to the student's adviser and faculty committee supervising this phase of the curriculum.

WAMI Program (Decentralized Medical Education)

The WAMI Program was initiated in 1971 as an experiment in decentralized medical education to provide a broader range of educational opportunities for students. It is an integral part of the undergraduate medical curriculum and is a fully accredited program of the School of Medicine. The WAMI Program is named for the four states (Washington, Alaska, Montana, and Idaho) that share resources and responsibilities in the regional program. Funds appropriated to the WAMI Program by Alaska, Montana, and Idaho legislatures assure each state of positions in the freshman medical class each year for its students.

University Phase

In the University Phase of the WAMI Program, approximately forty percent of the students admitted to the University's School of Medicine receive the first year of the medical school training at Washington State University, University of Alaska, Montana State University, or the University of Idaho. While in one of these institutions, they enroll in basic science courses taught by the science faculty and are provided supplemental resources from this university's School of Medicine faculty. Preceptorships with community physicians are also offered first-year students at the WAMI-participating universities. These students join their classmates at the University's campus in Seattle for the second year of medical studies.

Clinical Phase

At the conclusion of the second year, students enter that portion of the curriculum that is predominantly clinical. As part of the clinical training, they may choose among clerkships at the University of Washington, at its affiliated hospitals, or at seventeen Community Clinical Units located in the four-state region. At these sites, physicians in private practice serve as School of Medicine clinical faculty members to provide supervised clinical training in five specialties: family medicine, obstetrics and gynecology, psychiatry, pediatrics, and internal medicine. The WAMI Community Clinical Units are also used for a portion of the residency training in the respective disciplines. Training experiences at the WAMI Community Clinical Units include outpatient contact at local physicians' private offices, hospital rounds, follow-through inpatient care, emergency room duty, service at local community special clinics, lectures, and didactic and participatory discussions. Clerkships in family medicine are offered at Pocatello, Idaho; Anchorage and Ketchikan, Alaska; Whitefish-Kalispell, Montana; and Anacortes, Spokane, and Omak, Washington. Clerkships in obstetrics and gynecology are offered at Spokane, Washington; Anchorage, Alaska; and Boise, Idaho. Psychiatric clerkships are offered at Anchorage. Pediatrics clerkships are available in Pocatello; Great Falls, Montana; and Spokane. Clerkships in internal medicine are offered at Billings and Missoula, Montana, and Wenatchee, Washington.

By capitalizing on the resources of neighboring state universities, the clinical expertise of community practitioners, and the medical center, the WAMI Program has been able to expand medical school admissions for students from all four states, to expand clinical training opportunities in the primary-care disciplines, and to expand continuing medical education programs offered health professionals in their local communities.

Admissions

(These procedures and policies described are subject to change. Information regarding changes is available at the School of Medicine Admissions Office.)

Requirements for Entrance

The New Medical College Admission Test (MCAT) is required and must be taken by autumn of the year preceding the proposed date of enrollment. All MCAT tests prior to April, 1977, do not meet the requirement and cannot be substituted. Minimum science course requirements are: biology (8 semester/12 quarter credits); chemistry (12 semester/18 quarter credits), including one year of organic chemistry (all lectures and laboratories within a sequence); and physics (8 semester/12 quarter credits). These courses should be completed by the time of application if possible; all must be completed prior to anticipated medical school matriculation. Proficiency also is required in English and basic mathematics. All candidates must demonstrate substantial academic ability in their major field and in the required science courses. A minimum of three years of college is required; however, ninety-nine to one hundred percent of entrants in recent years have had baccalaureate degrees. No particular major is preferred, but a broad educational background is encouraged. A knowledge of, and exposure to, the needs of individuals and society and an awareness of health-care delivery systems are desirable.

Candidates are urged to discuss undergraduate credentials and curriculum with premedical advisers at their undergraduate institutions.

New Medical College Admission Test

All applicants must provide the scores received on the New MCAT. Arrangements for this test may be made with the premedical adviser at the institution where premedical training is being taken. The New MCAT customarily is given in the spring and autumn of each year. As noted, the New MCAT must be taken by autumn of the year preceding the proposed date of enrollment. Additional information on the administration of this test may be obtained by writing to the American College Testing Program, Post Office Box 414, Iowa City, Iowa 52243, or telephoning (319) 337-1276. Early application for testing is advised. The deadline for registration is generally a month prior to the actual test date.

Variations in the type and amount of course work completed by the time of testing are considered in evaluation of MCAT results, particularly where retesting has been employed. All candidates are referred specifically to the section of the Association of American Medical Colleges' (AAMC) Medical School Admissions Requirements relating to the New Medical College Admission Test.

Application Process

The University is a participant in the American Medical College Application Service (AMCAS) Program. Application forms may be obtained from AMCAS offices, 1776 Massachusetts Avenue Northwest, Suite 301, Washington, D.C. 20036. Because the admissions committee begins examining applications a year prior to the time of entrance, early application is advisable. Deadline for receipt of application by AMCAS is November 1.

Candidates generally given serious consideration are persons who are legal residents of Washington, Alaska, Montana, and Idaho and, regardless of residence, M.D.-Ph.D. program candidates and Black Americans, American Indians, and Chicanos. Those considering application as nonresidents apart from the groups listed above should be aware that no such individuals gained admission to the last six entering classes. Applications from those who have failed to meet minimum standards in another medical school or a dental school cannot be considered.

The deadline for submitting additional application materials is February 1. These supplemental materials include: (1) A three-hundred-word autobiographical statement (can be written on the personal comment section of the AMCAS application or submitted separately) that should include a description of the origin and development of the candidate's motivation to become a physician and the reasons for desiring to attend this medical school. (2) A premedical committee evaluation or three individual letters submitted from instructors who have taught the candidate in a collegiate course (a mixture of evaluations from the sciences and humanities recommended; letters of recommendation should evaluate critically the difficulty of course work attempted and the candidate's academic ability, strengths, weaknesses, motivation for medicine, maturity, and special attributes and assets. (3) A supplemental information form supplied by the school during processing that requests information not given on the AMCAS application. (4) A $35 fee, which should be submitted, along with the blue fee coupon, in the envelope provided (may be waived in hardship cases). (5) Legal residence certification by the appropriate state certifying officer that is required for Alaska, Montana, and Idaho applicants, and may be required for some Washington applicants. (6) The Medical Scientist Training Program application within five weeks after receiving the form from the school by those candidates who wish to be considered for the M.D.-Ph.D. program; this application form is sent to all eligible applicants together with the acknowledgement of receipt of their medical school application. Transcripts for all course work subsequent to the AMCAS application must be filed directly with the school's Office of Admissions as soon as available. If the course of study, as outlined in the AMCAS application, changes, it is requested that this office be notified of these changes in writing, preferably using the format on the AMCAS application.

Interviews are by invitation only and, after careful review of completed applications, are granted to those candidates considered potentially competitive for the positions available.

Attempts are made to issue notices of acceptance about the middle of each month, starting in December. Successful applicants should respond in writing to the notice of acceptance within two weeks. Prior to matriculation, the comptroller's office will require a $50 deposit from those who expect to enter. This deposit is applied to the first quarter's tuition.

All students enrolled in the School of Medicine may, as part of the WAMI Program, receive a portion of training at sites away from the University campus. Those who enter as residents of Alaska, Montana, or Idaho are expected to spend their first year at the university site in their particular states. Offers of acceptance, therefore, are conditioned upon agreement to participate in the WAMI Program.

Inquiries, address changes, or other information regarding the application should be transmitted in writing and directed to the University of Washington; School of Medicine; Office of the Dean, SC-64; Committee on Admissions; Seattle, Washington 98195.

Residence Classification

Upon review of an application, the Committee on Admissions may request proof of legal residence of Washington candidates and will require proof of legal residence for Alaska, Montana, and Idaho candidates. Determination of state of legal residence is not made by the School of Medicine.

The University's Residence Classification Office handles determinations of Washington residency for University purposes. Application for such a determination can be obtained by writing: University of Washington; Residence Classification Office; 209 Schmitz, PD-10; Seattle, Washington 98195.

Certification of Alaska, Montana, and Idaho residency for University purposes is made by each state's WAMI certifying office. Alaska applicants should contact University of Alaska; Dr. Ray Bailey; WAMI Residency Committee; WAMI Medical Education Program; Fairbanks, Alaska 99701. Idaho applicants should contact University of Idaho; Judy McNevin, Associate Director of Admissions; Moscow, Idaho 83843. Montana applicants should contact Ms. Jacki Wrigg, Certifying Office for the WAMI Program, 33 South Last Chance Gulch, Helena, Montana 59601. Please note that these certifying offices do not have access to the AMCAS application. Candidates must supply data on residency directly to the certifying offices.

Medical Scientist Training Program (M.D.-Ph.D. Program)

A limited number of highly qualified candidates who wish to pursue both the M.D. and Ph.D. degrees are considered annually. Medical scientist trainees must be accepted by the School of Medicine for the M.D. degree and by the Graduate School for the Ph.D. degree. They are permitted a wide choice of research specializations from among numerous disciplines and interdisciplinary areas of biomedical sciences. The program emphasizes continuity of both clinical and basic sciences exposure. Among participating graduate departments and interdepartmental disciplines are biochemistry, bioengineering, biological structure, biomathematics and biostatistics, biomedical history, epidemiology, genetics, microbiology, pathobiology, psychology, and radiation biology.

Applicants should correspond directly with the Director of the Medical Scientist Training Program, 413 Health Sciences, SM-30, University of Washington, Seattle, Washington 98195, as well as proceed with the regular School of Medicine application.

Applicants who wish to be considered for the M.D.-Ph.D. Program must submit the Medical Scientist Training Program application within five weeks after receiving the form from the school. This application form is sent to all eligible applicants together with acknowledgment of receipt of their medical school application. Serious consideration is not given to applicants with a cumulative grade-point average of less than 3.50 and average MCAT scores of less than 10 on Science Problems, Skills Analysis: Reading, and Skills Analysis: Quantitative.

Transfer Students

Residents of Washington, Alaska, Montana, and Idaho who are attending other medical schools are eligible to apply for transfer for clinical training into the third-year class only. Students interested in transferring from other medical schools should direct their inquiries to the Admissions Office of the School of Medicine for the latest information. It should be noted that transfers can be accepted *only* if there are adequate clinical facilities to accommodate them, and this has been a severely limiting factor since the increase in class size over the past decade. No transfers have been accepted since 1978.

Financial Information

Fees and Other Charges

All fees and extra service charges are payable in United States dollars and due at the time specified for such fees and charges. The University reserves the right to change any of its fees and charges without notice. Resident tuition presently is $1,016 per quarter. Nonresident tuition presently is $2,576 per quarter. For medical students, the average annual cost for books, supplies, equipment, and examination fees is $950.

Financial Assistance

All financial aid is based on the demonstrated need of the student. All applicants for aid from the school must submit data for an analysis of need (FAF) by the College Scholarship Service. This requires full disclosure of resources available to the student from individual and family sources. The Guaranteed Student Loan Program, the National Direct Student Loan Program, the Auxiliary (PLUS) Loan Program, the Health Professions Loan Program, and the Health Education Assistance Loan Program are the primary sources of aid.

Partial scholarships are available through the School of Medicine Scholarship Fund. These awards are limited to students of exceptional financial need and require financial information from the student and his/her parents, regardless of dependency status.

Financial aid information is distributed to all accepted applicants. Application forms for financial aid may be obtained from the Office of Student Financial Aid, School of Medicine. In case of emergency or special need, an application for financial assistance may be made at any time. Special sources of financial aid are available to disadvantaged and minority students. The Minority Affairs Program is an additional resource for financial aid information.

Outside employment is discouraged.

Medical Student Research Training Program

Research opportunities are offered to UW medical students interested in gaining valuable experience from training in medical research. The purpose of the program is to actively encourage students to participate in a research project as part of their medical education. This

research is planned and carried out under the supervision of a faculty sponsor and may be undertaken during any quarter. Student trainees in the program receive a stipend supported largely by a special fund from the School of Medicine. A sufficiently challenging project may require a working schedule of forty hours per week.

Minority Affairs Program

The minority affairs program assists students from minority or disadvantaged backgrounds. The program attempts to nurture interest in medical careers among college and high school students and to assist them as needs arise in their premedical careers. These students are encouraged to contact the Minority Affairs Office. During the admissions application process the program communicates regularly with applicants and assists them with arrangements related to their visit to the campus.

The school offers a prematriculation summer program designed to teach students useful skills and to initiate their exposure to the medical school curriculum. Stipends are available to students who qualify. During the regular school year the program serves as a general information source for both academic and nonacademic needs. It attempts to make available to students the multiple resources available, both in the School of Medicine and the community.

Student Evaluation and Promotion

Award of the Doctor of Medicine degree is contingent upon satisfactory completion of academic and noncognitive requirements. The latter includes the acquisition of behavior patterns and attitudes consistent with the oath that all graduates take at the time of graduation. As such, student evaluation is based upon the faculty's observations of the student's behavior and conduct as well as upon papers and examinations. Periodic review of student progress is made by a faculty committee, and students are informed of their deficiencies and the remedial requirements for these deficiencies. Dismissal from the school may occur if the student fails to maintain an acceptable academic record, fails to follow academic directives provided by the committees of the school, or fails to develop attitudes and behavior patterns appropriate to a career in medicine. Opportunities to make up unsatisfactory work are allowed at the discretion of the Dean upon advice from the Academic Affairs and Executive committees of the School of Medicine. Once dismissal or withdrawal from school has occurred, readmission requires the approval of the Academic Affairs Committee. Readmission after dismissal will not be considered without substantial evidence that the problems causing dismissal have been resolved. Every student is required to pass Parts I and II of the national board examination and all University of Washington examinations before receiving the Doctor of Medicine degree.

Grading System

Grades awarded in each course in the M.D. curriculum are Satisfactory, Not Satisfactory, or Honors. The school's goal is to provide a curriculum that defines the competencies to be achieved by the student at each level. Therefore, grading signifies satisfactory or not-satisfactory accomplishment of these competencies at the end of each course. Honors may be awarded in a course based on predetermined criteria that usually involve additional work in the subject as selected by the student. This system precludes ranking of students in class standing by a grade-point average.

Honors

A charter as Alpha of Washington was granted to the School of Medicine in 1950 by Alpha Omega Alpha, the honorary medical fraternity. Members are elected by the membership of Alpha Omega Alpha on the basis of high scholarship and good moral character.

Medical Thesis Program

The medical thesis program of the School of Medicine is voluntary, and participation is initiated by the student. Often a student will develop a special interest in some particular field in medicine. This interest will create a desire to learn more about the field or to do special work in it. The thesis program is a means of fulfilling that desire. Prizes are awarded for the best theses submitted each year, and certain departments offer prizes for the best thesis written under that department's supervision. The preparation of a satisfactory thesis may carry with it honors at graduation. Additional information concerning the thesis program can be obtained from the chairperson of the Medical Thesis Committee or from the Office of the Dean.

Graduation With Honor

A degree of Doctor of Medicine with honor may be awarded to students with high achivement who, in addition, have demonstrated initiative and success in clinical and scholarly pursuits related to medicine. Evidence of such scholarly achievement may include, but is not limited to, a thesis of acceptable quality, a paper accepted for publication in a recognized journal, or scholarly analysis of a clinical subject comparable to review papers and case reports. Candidates for graduation with honors are nominated by the departments each year and are selected on the basis of an Honors and Awards Committee review of academic records.

Continuing Medical Education

Director

John N. Lein

The Division of Continuing Medical Education offers a variety of programs for physicians and health professionals at the School of Medicine and in Pacific Northwest and Alaska communities.

Programs at the School of Medicine include short courses and conferences, year-long review courses, workshops, visiting professorships, preceptorships, and teleconferences. Programs in the communities include guest lecturers and programs as requested by communities throughout the region.

All physicians are invited to participate in continuing medical education programs and in the regular hospital rounds and conferences scheduled at the University Hospital or its affiliated hospital clinics.

All programs sponsored by the Division of Continuing Medical Education are applicable to physician relicensure requirements of the Washington Board of Medical Examiners, Category I, or the Physician's Recognition Award of the American Medical Association, and the Accreditation Council for Continuing Medical Education. Prescribed credit from the American Academy of Family Physicians is requested for all applicable programs.

Descriptive brochures for short courses and conferences are published up to twelve weeks in advance of each program. Information concerning Continuing Medical Education programs may be obtained from: University of Washington; School of Medicine; Division of Continuing Medical Education, SC-50; Seattle, Washington 98195; telephone: (206) 543-1050. Information concerning hospital rounds should be requested from the various responsible departments.

Anesthesiology

BB1459 Health Sciences

The Department of Anesthesiology has responsibilities for the teaching of medical students during their years of undergraduate training. During the second year, faculty who also have joint appointments in physiology and pharmacology participate in the teaching of students in these areas. During the clinical years, students are taught basic principles of anesthesiology, including artificial respiration and resuscitation, through clinical clerkships. In addition, the department has an active training program for interns and residents in anesthesiology and affords experience in anesthesiology to dental interns and residents in surgery and obstetrics.

Faculty

Chairperson

Thomas F. Hornbein

Professors

Amory, David W.,* Ph.D., 1961, M.D., 1967, British Columbia.

Bonica, John J., M.D., 1942, Marquette.

Chapman, C. Richard,* (Psychiatry and Behavioral Sciences),† Ph.D., 1969, Denver; psychology, psychiatry, and behavior science.

Cheney, Frederick W., M.D., 1960, Tufts.

Cullen, Bruce F., M.D., 1966, California (Los Angeles).

Fink, B. Raymond (Emeritus), M.R.C.S., 1938, University College (London).

Freund, Felix G. (Emeritus), M.D., 1948, Buenos Aires.

Hornbein, Thomas F.,* (Physiology and Biophysics),† M.D., 1956, Washington (St. Louis); physiology, biophysics.

Murphy, Terence M., M.B., 1961, Liverpool (England).

Pollack, Gerald H.,* (Bioengineering),† Ph.D. 1968, Pennsylvania.

Townes, Brenda D.,*‡ (Psychiatry and Behavioral Sciences), Ph.D., 1970, Washington.

Ward, Richard J., M.D., 1949, St. Louis.

Associate Professors

Artru, Alan A., M.D., 1975, Wisconsin.

Benedetti, Costantino, M.D., 1972, Rome.

Bishop, Michael J., M.D., 1974, California (San Diego).

Buffington, Charles W., M.D., 1973, West Virginia.

Butler, Stephen H., M.D., 1966, Toronto.

Byers, Margaret R. (Research), Ph.D., 1969, Harvard; biological structure.

Colley, Peter S., M.D., 1967, Vermont.

Freund, Peter R., (Physiology and Biophysics), M.D., 1975, Columbia.

Haschke, Richard H.,* (Biochemistry), Ph.D., 1969, Illinois (Urbana).

Kenny, Margaret A.,*‡ (Laboratory Medicine), Ph.D., 1968, Illinois (Urbana).

Martin, Roy W. (Research), (Bioengineering),† Ph.D., 1975, Washington.

Pavlin, D. Janet, M.D., 1969, Manitoba.

Pavlin, Edward G., M.D., 1968, Manitoba.

Plumer, Michael H., M.D., 1970, Pritzker School of Medicine (Chicago).

Ready, L. Brian, M.D., 1967, Saskatchewan.

Sivarajan, Murali, M.B.B.S., 1967, Jawaharlal (India).

Su, Judy Y. (Research), Ph.D., 1968, Washington.

Assistant Professors

Bashein, Gerard, Ph.D., 1969, Carnegie-Mellon, M.D., 1974, New Mexico.

Bell, Larry E., M.D., 1976, Stanford.

Bowdle, T. Andrew, M.D., 1980, Ph.D., 1983, Washington.

Buckley, F. Peter, M.B., 1968, St. Batholomews Hospital (London).

Caplan, Robert A., M.D., 1977, Yale.

Chadwick, Heathcliff S., M.D., 1976, Oregon.

Chan, Kwan Y.,‡ Ph.D., 1976, California (Los Angeles).

Dong, Willie K. (Research), Ph.D., 1974, Davis.

Glauber, Dennis T., M.B., 1949, Witwatersrand (South Africa).

Krane, Elliot J., M.D., 1977, Tucson.

Lynn, Anne M., M.D., 1975, Stanford.

Martin, Richard F. (Research), Ph.D., 1978, Texas.

Morray, Jeffrey P.,* M.D., 1974, Rochester.

Slattery, John T.,*‡ (Pharmaceutics), Ph.D., 1978, State University of New York (Buffalo).

Tyler, Donald C., M.D., 1970, Pennsylvania.

Williams, Virginia, M.D., 1973, Tulane.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

ANEST 498 Undergraduate Thesis (*) AWSpS *Caplan* By special arrangement. Time and credit to be arranged.

ANEST 499 Undergraduate Research (*) AWSpS *Caplan* Specific research problems relating to pulmonary, cardiovascular, renal, obstetric, and central nervous system functions, and their alteration by anesthetic techniques and agents. (Six weeks, full time. Limit: two students.)

ANEST 680P Basic Anesthesia Clerkship (4) AWSpS *Caplan* Introduction to the principles of airway management and ventilatory support, use of local anesthetics, techniques of patient monitoring and fluid therapy. Skills taught include airway management, venipuncture, lumbar puncture and endotracheal intubation. Prerequisite: third- or fourth-year student. (Two weeks, full time. Limit: six students each two-week period.) All affiliated hospitals.

ANEST 681P Advanced Clerkship in Anesthesiology (8) AWSpS *Caplan* Clerkship for students interested in some facet of anesthesiology or desiring greater exposure to anesthesiology as a specialty. Individual programs can be arranged in the following areas: surgical anesthesia, obstetrical anesthesia, and pain clinic. Prerequisite: 680P or permission of instructor. (Four weeks, full time. Limit: one student per period.) All affiliated hospitals.

ANEST 697P Anesthesiology Special Electives (*, max. 24) AWSpS *Caplan* Special clerkships, externship, or research opportunities can at times be made available at institutions other than the University of Washington. Students wishing to elect this course should obtain a special assignment form from the Dean's office at least one month before advance registration. Prerequisite: permission of instructor. (Six to twelve weeks, full time.)

Animal Medicine

T142 Health Sciences

The Division of Animal Medicine provides education and research opportunities in laboratory animal medicine and comparative pathol-

ogy. Current educational programs include scheduled courses in zoonotic diseases and in the principles and techniques of animal experimentation (CONJ 407) for biomedical graduate students; training in laboratory animal medicine for veterinary students and veterinarians; and a Master of Science degree program in collaboration with the Department of Pathology. Areas of current research include bacteriological and viral diseases of laboratory animals, parasitic diseases, and animal models of human disease conditions.

Predoctoral Programs

These programs are designed to acquaint veterinary students with laboratory animal medicine as a veterinary specialty. Specific areas covered include the principal diseases, disease control and treatment, and principles of sound animal husbandry of the common laboratory animals, as well as the role of laboratory animals in biomedical research. Blocks of twelve weeks (offered in the summer to second- and third-year students) and four weeks (offered to fourth-year students year around) are available. Stipend support is normally provided.

Postdoctoral Program

Postdoctoral training in the areas of laboratory animal medicine and comparative pathology are offered to holders of the D.V.M. or equivalent degree. Training that consists of a combination of course work, residency experience, and research is normally completed in two years. The program prepares participants for specialty certification by the American College of Laboratory Animal Medicine or the American College of Veterinary Pathology. Stipend support is normally provided.

Master of Science Degree

Options are offered within the Master of Science degree program in pathology in the areas of comparative pathology and laboratory animal medicine. These may be added to the postdoctoral training described above. The degree options involve additional elective courses and the completion of a more involved research project, which usually extends the training period to three years.

Correspondence and Information

Academic Programs
T142 Health Sciences, SB-42

Faculty

Director

Gerald L. Van Hoosier, Jr.

Professors

Rausch, Robert L.,* (Pathobiology),† D.V.M., 1945, Ohio State, Ph.D., 1949, Michigan State; zoonotic disease, pathobiology of helminths, parasitology.

Van Hoosier, Gerald L., Jr.,* (Pathology),† D.V.M., 1957, Texas A&M; laboratory animal medicine.

Associate Professors

DiGiacomo, Ronald F.,* (Epidemiology), V.M.D., 1965, Pennsylvania; epizootiology.

Giddens, W. Ellis, Jr.,* (Pathology),† D.V.M., 1961, Iowa State, Ph.D., 1968, Michigan State; comparative pathology.

Thouless, Margaret E.,*‡ (Pathobiology), Ph.D., 1974, Birmingham (England); pathobiology.

Wolf, Norman S.,*‡ (Pathology), D.V.M., Ph.D., 1960, Northwestern; pathology.

Assistant Professors

Dennis, Melvin B., Jr., (Medicine), D.V.M., 1961, Washington State; comparative medicine.

Russell, Robert G., M.V.Sc., 1978, Melbourne (Australia), Ph.D., 1980, Saskatchewan (Canada); comparative pathology.

Lecturer

Morton, William R., V.M.D., 1967, Pennsylvania; primate clinical medicine.

Course Descriptions

CONJ 407 Principles of Animal Experimentation (3) W See Conjoint Courses.

ANMED 520, 521 Biology of Laboratory Animals (2,2) *Van Hoosier* Fundamentals of the morphological, functional, and applied aspects of anatomy, physiology, pharmacology, biochemistry, and immunology of the commonly used laboratory animal species, with emphasis on reproductive physiology. Similarities and differences within, and between, species, including man. Husbandry, genetics, behavior, and nutrition. (Offered alternate years.)

ANMED 526 Zoonotic Diseases (3) A *DiGiacomo, Rausch* Explores the public health aspects of zoonotic diseases, their epidemiology and current approaches to control. Focuses on the major viral, rickettsial, bacterial, protozoal, helminthic, and fungal diseases transmitted from wild and domesticated animals to humans in North America. Offered jointly with EPI 526. Prerequisites: graduate standing and permission of instructor.

CONJ 530, 531 Diseases of Laboratory Animals (2,2) A,W See Conjoint Courses.

CONJ 540 Animal Models (1) Sp See Conjoint Courses.

ANMED 590 Selected Topics in Laboratory Animal Medicine (2) *Dennis, Van Hoosier* Radiation biology, genetics, anesthesiology and experimental surgery, preventive medicine, and ethical aspects of use of animals in biomedical teaching and research. Specific topics vary from year to year, depending on the expertise of the annual visiting professor. (Offered alternate years.)

Biochemistry

J405 Health Sciences

Graduate Program Coordinator

Elton T. Young

The study of biochemistry involves the combined field of biology and chemistry. Specific research projects may entail study in such related fields as microbiology, genetics, organic chemistry, physiology, and pharmacology. Graduate students enrolled in the Department of Biochemistry engage in studies and research that prepare them for the challenging opportunities open to the professional biochemist in colleges and universities, research institutes, medical schools and hospitals, government laboratories, and the laboratories of chemical and pharmaceutical industries.

The course of advanced study is designed to give each student a firm foundation upon which to base further professional progress. In the first year of academic work, most students attend courses in biochemistry and in related fields such as advanced chemistry, genetics, and microbiology. In the second and succeeding years, an increasing amount of time is devoted to research and independent study. For the Ph.D. degree, each student is required to gain teaching experience, usually during the second year of the graduate program.

The basic requirements for admission for graduate study in biochemistry are one year of organic chemistry, one year of physical chemistry, and mathematics through integral calculus. Applicants must also meet the general admission requirements of the Graduate School.

Normally, all graduate students admitted to the Department of Biochemistry are provided with financial assistance.

Research facilities for the department are housed in the Biochemistry-Genetics Building, which provides approximately fifty-two thousand square feet of excellent research space, conference rooms, and a departmental library. In addition, approximately eleven thousand square feet of research space and conjoint facilities are shared with the Department of Genetics. The laboratories are equipped with the latest in research equipment and are supported extensively by external, centralized research facilities, which include a modern computer center, the Marine Biology Laboratory at Friday Harbor, and the Health Sciences Library. Close collaboration exists with investigators in other related departments, including chemistry, genetics, microbiology, and biological structure.

Correspondence and Information

Graduate Program Coordinator
Department of Biochemistry, SJ-70

Faculty

Chairperson

Earl W. Davie

Professors

Bornstein, Paul,* (Medicine),† M.D., 1958, New York; structure and function of connective tissue macromolecules and their role in morphogenesis and development, disordered macromolecular structure and function in hereditary and acquired connective-tissue disorders and the aging process.

Byers, Breck E.,*‡ (Genetics), Ph.D., 1967, Harvard; cell biology: mitosis and meiosis, mechanisms of nuclear division and crossing-over in yeast.

Davie, Earl W.,* Ph.D., 1954, Washington; protein synthesis in microbial systems, mechanism of blood clotting.

Fischer, Edmond H.,* Ph.D., 1947, Geneva; relationship of protein structure to enzyme activity, calcium and vitamin B-containing enzymes, control of carbohydrate metabolism in muscle.

Fujikawa, Kazuo (Research), Ph.D., 1965, Kyoto; mechanisms of blood clotting.

Glomset, John A.,*‡ (Medicine), M.D., 1960, Upsala; metabolism and endocrinology.

Gordon, Milton P.,* (Microbiology and Immunology), Ph.D., 1953, Illinois; virus nucleic acids, structure of tobacco mosaic virus and biochemistry of infected cells, metabolism of methylated purines, molecular basis of plant tumors.

Hall, Benjamin D.,*‡ (Genetics), Ph.D., 1958, Harvard; molecular genetics, analysis of eukaryotic gene structure in relation to function, gene expression in yeast.

Hauschka, Stephen D.,* (Zoology), Ph.D., 1966, Johns Hopkins; mechanisms of embryonic cellular interactions (especially the sequential biochemical changes accompanying muscle differentiation), cell culture and biochemical changes of neuronal specificity.

Jensen, Lyle H.,* (Biological Structure),† Ph.D., 1943, Washington; x-ray structure determination of biological molecules, protein crystallography.

Loeb, Lawrence A.,*‡ (Pathology), M.D., 1961, New York, Ph.D., 1967, California (Berkeley); tumor biology, environmental carcinogenesis, cellular aging.

Morris, David R.,* Ph.D., 1964, Illinois, biosynthesis and biological function of polyamines, regulation of growth of eukaryotic and prokaryotic cells.

Neurath, Hans (Emeritus), Ph.D., 1933, Vienna; structure and functions of proteins and zymogens, proteases and fertilization.

Palmiter, Richard D.,* Ph.D., 1968, Stanford; molecular endocrinology, regulation of metallothionein in gene expression.

Parson, William W.,* Ph.D., 1965, Western Reserve; bioenergetics, with particular emphasis on photosynthesis.

Petra, Philip H.,*‡ (Obstetrics and Gynecology), Ph.D., 1966, Tulane; reproductive biochemistry, structure and function of steroid-binding proteins.

Reid, Brian R.,* (Chemistry),† Ph.D., 1965, California (Berkeley); nucleic acid-protein recognition processes in the genetic code, analysis of transfer RNA structure, function, and dynamics using high-resolution nuclear magnetic resonance.

Ross, Russell,*‡ (Pathology), Ph.D., 1955, Washington; atherosclerosis, connective tissue pathology, wound healing.

Schmer, Gottfried,*‡ (Laboratory Medicine), M.D., 1956, Vienna; synthesis of artificial organs, molecular engineering of antitumor enzymes.

Shapiro, Bennett M.,* M.D., 1964, Jefferson Medical College; biochemistry of fertilization, bacterial membrane enzymes, membrane and cell division.

Teller, David C.,* Ph.D., 1965, California (Berkeley); physical chemistry of macromolecules, association reactions of proteins.

Titani, Koiti (Research), Ph.D., 1960, Tokyo; protein chemistry.

Walsh, Kenneth A.,* Ph.D., 1959, Toronto; structure and functions of proteins, and zymogens, proteases and fertilization.

Young, Elton T.,* (Genetics),† Ph.D., 1967, California Institute of Technology; regulation of gene activity in the yeast *Saccharomyces cerevisiae*.

Associate Professors

de Haen, Christoph* (Research), (Medicine),† Dr.Sc., 1969, Swiss Federal Institute of Technology; mechanisms of action of polypeptide hormones.

Eisenman, Robert N.* (Research), Ph.D., 1971, Chicago; retrovirus gene expression.

Haschke, Richard H.,*‡ (Anesthesiology), Ph.D., 1968, Illinois (Urbana); function and mechanism of axonal transport.

Herriott, Jon R.,* Ph.D., 1967, Johns Hopkins; x-ray crystallography of macromolecules, protein structure and function.

Kisiel, Walter (Research), Ph.D., 1971, North Dakota State; mechanisms of blood clotting.

Kurachi, Kotoku (Research), Ph.D., 1970, Kyushu; mechanisms of blood clotting.

Saari, John C.,*‡ (Ophthalmology), Ph.D., 1970, Washington; metabolism and transport of vitamin A, structure and function of photoreceptor membranes.

Assistant Professors

Chung, Dominic (Research), Ph.D., 1976, California (Los Angeles); mechanisms of blood clotting.

Schackmann, Robert (Research), Ph.D., 1976, Rice; biochemistry of fertilization.

Lecturer

Wade, Roger D., B.A., 1979, Central Washington State; physical biochemistry.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

BIOC 405, 406 Introduction to Biochemistry (3,3) W,Sp *Agabian, Petra, Saari, Teller* Basic principles of biochemistry, emphasizing broad understanding of chemical events in living systems in terms of metabolism and structure-function relationships of biologically important molecules. Does not fulfill advanced biochemistry prerequisites (see 440, 441, 442). Prerequisites: general biology and organic chemistry or permission of instructor for 405; 405 or permission of instructor for 406.

BIOC 426 Basic Techniques in Biochemistry (3) Sp *Haschke, Wade* Introduction to basic biochemistry experiments. Acquaints students with basic biochemical laboratory techniques and serves as a preparation for advanced biochemistry laboratory courses. Prerequisites: 405, 406 or 440, 441, 442, which may be taken concurrently.

BIOC 440, 441, 442 Molecular Biology (3,4,3) A,W,Sp *Parson, Walsh, Young* Interdisciplinary course in general biochemistry and molecular biology for undergraduate students in molecular and cellular biology and graduate students in other science departments. Prerequisites: 440 for 441 (one-hour quiz per week required in 441); 441 for 442; recommended: three quarters of organic chemistry.

BIOC 498 Undergraduate Thesis (*) AWSpS For senior medical students. Prerequisite: permission of instructor.

BIOC 499 Undergraduate Research (*) AWSpS Investigative work on enzymes, proteins, lipids, nucleic acids, protein biosynthesis, intermediary metabolism, physical biochemistry, and related fields. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 512P Medical Students' Laboratory (3) W When possible, the relationship of the biochemical techniques or experiments being performed to clinical or diagnostic medicine is demonstrated or discussed. For medical students and others by permission. Prerequisites: HUBIO 514P, 524P or equivalent, and permission of instructor.

BIOC 515P Biochemistry Review I (1) A Elective quiz section to clarify and amplify material presented in HUBIO 514P. Offered on credit/no credit basis only.

BIOC 520 Seminar (1) AWSp Seminar dealing with special topics in the field of biochemistry. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 525P Biochemistry Review II (1) Quiz section to clarify and amplify material presented in HUBIO 524P. Not required. Offered on credit/no credit basis only. Entry card required.

BIOC 530 Advanced Biochemistry (3) A Graduate-level discussion of the structure, function, and chemistry of proteins, control of enzymatic reactions. Prerequisites: a comprehensive course in biochemistry and permission.

BIOC 531 Advanced Biochemistry (3) W Graduate-level discussion of the action of hormones, membrane structure and function, electron transport, oxidative phosphorylation, photosynthesis. Prerequisites: a comprehensive course in biochemistry and permission of instructor.

BIOC 532 Advanced Biochemistry (3) Sp Graduate-level discussion of nucleic acid structure, viruses including oncogenic viruses, RNA biosynthesis, protein biosynthesis, and eukaryotic cell cycle. Prerequisites: a comprehensive course in biochemistry and permission of instructor.

BIOC 540, 541, 542 Literature Review (2,2,2) A,W,Sp Emphasizes critical evaluation of original articles in the literature. Coordinated with 530, 531, 532, and to be taken concurrently. For first-year graduate students in biochemistry and students of other science departments, with permission. For 540: numerical grade; for 541 and 542: offered on credit/no credit basis only. Entry cards required.

BIOC 555 Current Topics (1) Overview of current research in biochemistry. Topics include protein chemistry, enzymology, blood coagulation, cell surface proteins, fertilization, genetic engineering, control of transcription, serum lipoproteins, and photosynthesis. Offered on credit/no credit basis only. Prerequisite: first-year biochemistry graduate standing.

BIOC 560 Physical Biochemistry (3) W Specialized aspects of physical chemistry as applied to systems of biological interest. Particular emphasis on hydrodynamic and optical properties of macromolecules. Prerequisite: physical chemistry.

BIOC 570 Current Topics in RNA Tumor Virology (2) Sp *Eisenman, Lineal* Weekly lecture-discussion dealing with current research on the biology and biochemistry of RNA tumor viruses, with concentration on a critical evaluation of the literature. Offered on credit/no credit basis only. Prerequisites: 530 and 531, or equivalent, or permission of instructor. (Offered odd-numbered years.)

BIOC 574 The Biochemical Basis of Disease (3) Sp *Bornstein, Shapiro* Discussion of pathologic physiology and molecular basis of clinical disorders. An attempt is made to demonstrate the relevance of biochemical research to the understanding and the rational therapy of human disease. Scope limited to diseases in which new developments permit description in biochemical terms.

BIOC 581 Introduction to Biochemical Research (3, max. 6) WSp Student works with one of the research groups within the department for one quarter and then rotates to another laboratory for a second quarter. Offered on credit/no credit basis only. Prerequisite: graduate standing in biochemistry or permission of instructor. Entry card required.

BIOC 583 Advanced Techniques in Biochemistry (2) Laboratory course involving experiments concerning spectrophotometry, radioactive isotopes and ionic equilibria. For first-year graduate students in biochemistry and students of other science departments, with permission. Prerequisite: biochemistry graduate student standing or permission of instructor.

BIOC 585 Nucleic Acids in Biochemistry (1) AWSp *Agabian, Young* Weekly research conferences on the role of nucleic acid in biochemistry. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 587 Molecular Aspects of Differentiation (1) Weekly conferences on laboratory research in microbial development and/or molecular aspects of differentiation. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 588 Current Topics in Molecular and Cellular Biology (1) AWSpS *Agabian, Byers, Morris, Palmiter, Shapiro, Young* Critical evaluation of the biochemical literature in areas related to molecular and cellular biology. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 589 Connective Tissue Macromolecules (1) AWSpS *Bornstein* Seminars designed to discuss current knowledge of the biochemistry and pathophysiology of fibrous proteins and other structural macromolecules. Prerequisite: 442 or HUBIO 514P, 524P or permission of instructor.

BIOC 590 Proteins and Enzymes Seminar (1, max. 8) AWSpS *Neurath, Walsh* Weekly conferences on current research in proteins and enzymes. For graduate students in biochemistry. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 591 Seminar on Protein Structures (1, max. 20) AWSp *Adman, Herriott, Jensen, Sieker, Stenkamp, Watenpaugh* Weekly seminar discussion of current topics in research on molecular structure, usually emphasizing techniques of X-ray crystallography. Offered jointly with B STR 591. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 592 Topics in the Biochemistry of Regulation (1) AWSpS *Morris* Control of enzyme activity and gene expression related to biology of growth and function. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 593 Activation of Development (1) AWSpS *Shapiro* Weekly research conference. Concentrates on biochemical events at the time of fertilization and early development and on the role of membranes in metabolic control. May be repeated for credit. Offered on credit/no credit basis only. Prerequisites: 530, 531, 532, or equivalent, or permission of instructor.

BIOC 594 Glycogen Metabolism Seminar (1) AWSpS *Fischer* Weekly conferences on research in glycogen metabolism. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 595 Membranes, Bioenergetics (1) AWSpS *Shapiro* Weekly research conferences on biochemical processes that occur in membranes. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 596 Gene Expression (1) AWSpS *Palmiter* Weekly research conferences. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

BIOC 598 Seminar in Developmental Biology (1) AWSpS *Hauschka* Discussion covers recent advances in the field of developmental biology, especially those areas that are or can be analyzed by a biochemical approach. May be repeated for credit. Prerequisite: permission of instructor.

BIOC 600 Independent Study or Research (*) AWSpS

BIOC 700 Master's Thesis (*) AWSpS

BIOC 800 Doctoral Dissertation (*) AWSpS

Bioengineering

328 Aerospace and Engineering Research

The Center for Bioengineering provides a multidisciplinary program of collaborative research and training designed to accelerate the application of new engineering technologies to clinical practice and research. Major areas of current research involvement include biomaterials, biomathematics, biomechanics, controlled drug-release systems, fertility studies, health-care delivery systems, hearing, kinesiology, laser applications, microanalysis of subcellular structures, microcirculatory exchanges and blood flow, muscle, and ultrasonic instrumentation.

Faculty and students in the health sciences may engage in studies of mutual interest with faculty and students in the College of Engineering. Programs offered in the College of Engineering can lead to the interdepartmental undergraduate Bachelor of Science in Engineering and graduate Master of Science in Engineering and Master of Science degrees, and in both the College of Engineering and the School of Medicine a special individual Ph.D. program can be formulated. A Ph.D. degree program proposal is under review by the Graduate School. The Master of Science degree pathway provides essential training in the engineering sciences that helps students with strong biological backgrounds to prepare for careers in research and development in either basic medical sciences or clinical investigations. Information on bioengineering, faculty, and courses also appears in the Interschool or Intercollege Programs section of this catalog.

Biological Structure

G515 Health Sciences

Graduate Program Coordinator

John W. Prothero

The Department of Biological Structure offers graduate programs of study leading to the Master of Science and Doctor of Philosophy degrees. The department seeks to promote an understanding of biological processes through the study and analysis of structure. The structure-oriented approach, correlated with the study of function, forms the basis for exploring fundamental problems in biology.

The department's graduate program is directed toward the education of doctoral students who anticipate academic careers that will involve teaching and research in the biomedical sciences. Graduates from the program are expected to have a broad knowledge of biological structure at all levels, from the macromolecular to the gross anatomical, with major emphasis on the cellular level.

Graduate students are required to select research and teaching pathways in their program. The research pathways are designed to provide training for a student in one or two of the following areas: cell biology, developmental biology, neurobiology, reproductive biology, quantitative biology, cellular immunology, and macromolecular structure. The teaching pathways provide training to teach two or more of the anatomical subdisciplines: gross anatomy, neuroanatomy/neurobiology, histology, embryology/developmental biology, cell biology, and macromolecular structure.

After one to two years of course work, the student's effort is directed mainly toward research. The development of skills in teaching and communication is regarded as an important feature throughout the graduate program.

Special Requirements

Applicants must have completed an undergraduate major in any appropriate field such as biology, chemistry, physics, anthropology, zoology, or psychology.

Financial Aid

The department offers financial support through a limited number of teaching assistantships and training grant positions and from research funds when available.

Correspondence and Information

Prospective graduate students are invited to write to the Graduate Program Coordinator, SM-20, for a copy of the departmental brochure, which describes the graduate program in more detail.

Faculty

Chairperson

Cornelius Rosse

Professors

Blandau, Richard J. (Emeritus), Ph.D., 1939, Brown, M.D., 1948, Rochester; endocrinology, embryology, phase microscopy, reproductive physiology.

Gehrig, John D.,*‡ (Oral and Maxillofacial Surgery), D.D.S., 1946, M.S.D., 1951, Minnesota; oral surgery.

Hendrickson, Anita E.,* (Ophthalmology),† Ph.D., 1964, Washington; neuroanatomy, morphology, and development of primate visual system.

Holbrook, Karen A.,* Ph.D., 1972, Washington; fetal skin development and differentiation.

Jensen, Lyle H.,* (Biochemistry),† Ph.D., 1943, Washington; molecular structure, x-ray diffraction.

Koehler, James K.,* Ph.D., 1961, California (Berkeley); electron microscopy, cryobiology.

Luft, John H.,* M.D., 1953, Washington; cytology, light and electron microscopy.

Odland, George F., (Medicine),† M.D., 1946, Harvard; dermatology.

Roosen-Runge, Edward C. (Emeritus), M.D., 1936, Hamburg; histology.

Rosse, Cornelius,* M.D., D.Sc., 1964, Bristol; hemopoiesis, gross anatomy.

Tamarin, Arnold,*‡ (Oral Biology), M.S.D., 1961, Washington; histology and embryology.

Westrum, Lesnick E.,* (Neurosurgery),† M.D., 1963, Washington, Ph.D., 1966, London; neuroanatomy.

Associate Professors

Adman, Elinor T. (Research), Ph.D., 1967, Brandeis; crystallography.

Baskin, Denis G.,* (Research), (Endocrinology and Metabolism),† Ph.D., 1969, California (Bekeley); cell biology, endocrinology.

Bolender, Robert P.,* Ph.D., 1970, Harvard; cell structure and function employing stereological and biochemical techniques.

Byers, Margaret R.‡ (Research), (Anesthesiology), Ph.D., 1969, Harvard; neurocytology.

DeVito, June (Research), Ph.D., 1954, Washington; neuroanatomy.

Gaddum-Rosse, Penelope,* Ph.D., 1965, Liverpool; reproductive biology.

Graney, Daniel O.,* Ph.D., 1965, California (San Francisco); gross anatomy, electron microscopy, intestinal absorption.

Halbert, Sheridan A.,* (Bioengineering),† Ph.D., 1972, Washington; reproductive physiology.

Kashiwa, Herbert K.,* (Oral Biology), Ph.D., 1960, George Washington; gross anatomy, cytochemistry, calcium metabolism.

Landau, Barbara R. (Emeritus); (Physiology and Biophysics),† Ph.D., 1956, Wisconsin; anatomy.

MacKenzie, Alan P.* (Research), (Bioengineering),† Ph.D., 1958, London; physical cryobiology (pure and applied).

Nameroff, Mark A.,* M.D., 1965, Ph.D., 1966, Pennsylvania; cell differentiation.

Pollack, Sylvia B.* (Research), Ph.D., 1967, Pennsylvania; cellular immunology.

Prothero, John W.,* Ph.D., 1960, Western Ontario; model building, morphogenesis.

Sundsten, John W.,* Ph.D., 1961, California (Los Angeles); neuroanatomy, neurobiology.

Verdugo, Pedro J.,* (Bioengineering),† M.D., 1965, Chile; fertility studies.

Watanpaugh, Keith D. (Research), Ph.D., 1967, Montana State; crystallography.

Assistant Professors

Broderson, Stevan H.,* Ph.D., 1967, New York State (Buffalo); lipid histochemistry.

Ching, Lai-Ming, Ph.D., 1978, Auckland (New Zealand); lymphocyte differentiation.

Clark, John I.,* Ph.D., 1974, Washington; anatomy, lens opacification.

Clark, Judy M. (Acting), Ph.D., 1974, Boston; developmental biology.

Farr, Andrew G.,* Ph.D., 1975, Chicago; immunology.

Hamilton, Brian L.,* (Pediatrics),† Ph.D., 1975, M.D., 1976, Washington; immunology, pediatrics.

Hamilton, Marilyn S.* (Research), Ph.D., 1976, Washington; immunology.

Harris, Roger M.,* Ph.D., 1974, Washington; neuroanatomy.

Lee, Minako Y. (Research), (Medicine),† M.D., 1976, Tokyo Women's College; immunology.

Muller, Charles H. (Research), (Obstetrics and Gynecology),† Ph.D., 1976, California (Berkeley); reproductive biology.

Sage, E. Helene,* Ph.D., 1977, Utah; cell biology.

Sherk, Helen A.,* Ph.D., 1978, Massachusetts Institute of Technology; neuroanatomy.

Sieker, Larry C. (Research), Ph.D., 1981, Washington; crystallography.

Stebbins, Thomas A.,* M.A., 1965, Amherst; medical illustration.

Stenkamp, Ronald E.* (Research), Ph.D., 1975, Washington; crystallography.

Lecturer

Hamilton, Alexander L.,* (Restorative Dentistry),† D.D.S., 1936, Toronto, Ph.D., 1968, London; restorative dentistry, dentistry.

Course Descriptions

Courses numbered with a P suffix are not graduate courses and are restricted to medical student enrollment only.

B STR 301 General Anatomy (6) Sp Survey of systemic human anatomy, with correlated lectures and laboratory demonstrations.

CONJ 340-341-342 Human Anatomy and Physiology (4-4-4) See Conjoint Courses.

B STR 431 Introduction to Neuroanatomy (4) W *Prothero, Sundsten* General survey of the structure of the central nervous system, including an analysis of sensory and motor systems and higher integrative functions and clinical correlation. Prerequisite: 301 or permission of instructor.

B STR 498 Undergraduate Thesis (*) AWSpS Prerequisite: permission of instructor.

B STR 499 Undergraduate Research (*) AWSpS Prerequisite: permission of instructor.

B STR 502 Gross Anatomy (1-5) W *Graney, Rosse* Lecture and dissection course in regional anatomy: upper and lower extremities. For graduate students and medical students; others by permission of instructor.

B STR 503 Gross Anatomy (1-5) Sp *Graney, Rosse* Lecture course in regional human anatomy; head and neck. For graduate students and medical students; others by permission of instructor.

B STR 505 Comparative General Histology (3) Sp *Roosen-Runge, Sage* Study of biology, histology, and ultrastructure of general tissues in vertebrates and invertebrates. Prerequisite: permission of instructor.

CONJ 508 Ultrastructural Methods and Interpretation (6) See Conjoint Courses.

B STR 511 Cell Structure and Function (3) *Koehler* Current topics in cell biology with emphasis on experimental approaches and interpretations of hypotheses. Not intended as an introduction or overview of cell biology. Prerequisites: advanced undergraduate or graduate standing. (Offered alternate years.)

CONJ 511 Functional Neuroanatomy (4) W *Smith* See Conjoint Courses.

B STR 512 Human Microanatomy (4) A *Bolender* Lectures and laboratory treating the specialized tissues and organs of the body from the microscopic and ultramicroscopic points of view. Prerequisite: permission of instructor.

B STR 515 Biological X-ray Structure Analysis (3) W *Jensen* Theory of x-ray diffraction, with emphasis on applications to biological systems. Prerequisite: permission of instructor.

B STR 517 Embryology/Developmental Biology Seminar (1) *Nameroff* Embryology of a region or organ. Topics vary. Emphasis on original literature and developmental principles. Prerequisite: permission of instructor.

B STR 518 Structure of Biological Molecules (2) *Adman, Sieker, Stenkamp, Watanpaugh* Three-dimensional structure of biological molecules and the methods used in their elucidation. Provides working vocabulary and acquaintance with current problems and research methods of structural investigations in area of students' choice.

B STR 525 Brain Dissection (2) WSpS *Sundsten* Detailed consideration of the macroscopic anatomy of the human brain (individual study). Prerequisite: permission of instructor.

B STR 530P Gross Anatomy for Dental Students (5) Lecture and dissection in regional human anatomy: neck, thorax, abdomen, pelvis, perineum, and upper limb. For dental students; others by permission of instructor.

B STR 531, 532, 533 Electron Microscopy (1-5,1-5,1-5) A,W,Sp *Johnson, Luft* Theoretical and applied aspects of microscopy in biology, with emphasis on newer methods. Light microscopy and electron optics, the electron microscope in detail, and methods for preparation of biological specimens. Offered jointly with BIOEN 531, 532, 533. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 540 Special Problems in Anatomy (1-6, max. 6) AWSpS Special projects in anatomy under sponsorship of faculty member. Prerequisite: graduate, medical, or dental student standing and permission of instructor.

B STR 541P Microscopic Anatomy for Dental Students (4) Lecture and laboratory work in microscopic anatomy. For dental students; others by permission of instructor.

B STR 550P Head and CNS Anatomy for Dental Students (5) W *Gehrig, Kasfiwa* Lecture and dissection in head and neuroanatomy, emphasizing the oral cavity and related areas pertinent to the practice of dentistry. Prerequisite: 530P or permission of instructor.

B STR 555 Laboratory Rotation in Biological Structure (*, max. 5) Introduction to experimental design, research methods, and scientific thought in laboratories of faculty members. Provides hands-on experience, an entrance into the literature of the field, and opportunities for discussion with all members of the laboratory. Prerequisite: permission of instructor.

B STR 557 Seminar (1) AWSp Required of graduate students. Offered on credit/no credit basis only. Prerequisite: permission of graduate program adviser.

CONJ 585 Surgical Anatomy (1-3, max. 12) See Conjoint Courses.

B STR 591 Seminar on Protein Structures (1, max. 20) AWSp *Adman, Herriott, Jensen, Sieker, Stenkamp, Watanpaugh* Weekly seminar discussion of current topics in research on molecular structure, usually emphasizing techniques of X-ray cyrstallography. Offered jointly with BIOC 591. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 593 Reproduction and Development Seminar (1, max. 5) *Muller* Research conference on current research in gametogenesis, fertilization, and embryogenesis. Cell surface events and mechanisms of cell-cell interaction curing reproduction and development in mammals. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 594 Seminar in Myogenesis (1, max. 5) *Nameroff* Discussion of recent work on the differentiation of skeletal muscle and related cell types. Emphasis on the cell-biological aspects of differentiation both *in vivo* and *in vitro*. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 595 Skin Biology Seminar (1, max. 5) *Holbrook* Presentation, discussion of ongoing multidisciplinary research in basic and clinical problems of adult and fetal skin biology. Genetic diseases of epidermis and dermis, percutaneous absorption in adult and fetal skin, wound healing, cutaneous blood flow, development and prenatal diagnosis of inherited disorders, pigment cell biology. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 596 Seminar in Experimental Immunohemopoiesis (1, max. 5) Critical review of current literature on hematopoiesis, lymphopoeisis, and immunologic function of bone marrow-derived cells as covered in such journals as J. Exp. Med., J. Immunol., Exp. Hematol. Participation in detailed analysis and critique of publications selected for presentation and discussion. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 597 Topics in Neurobiology (1, max. 5) *Harris, Sherk* Presentations by participants of topics in neuroanatomy, neurophysiology, neurochemistry, and other areas relating to the nervous system. Problems of current research interest. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 598 Biological Structure Research (1) Presentation/discussion relating to original research, including but not limited to, neurobiology, cellular immunology, cell differentiation, reproductive biology, molecular structure, and their associated methodologies: electron microscopy, histology, x-ray diffraction, tissue culture, morphometric analysis. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

B STR 600 Independent Study or Research (*) AWSpS

B STR 700 Master's Thesis (*) AWSpS

B STR 800 Doctoral Dissertation (*) AWSpS

Biomedical History

Graduate Program Coordinator

James C. Whorton

The Department of Biomedical History offers a program of study leading to the Master of Arts degree in the history of biology and medicine, biomedical ethics, and medicolegal affairs. The course of study for each aspirant is developed in accordance with the student's academic background.

Special Requirements

Aspirants to the Master of Arts degree are expected to acquire a general background in the history and philosophy of biology and medicine and to develop an area of special emphasis within a general subject. Departmental requirements include completion of course sequences in the history of medicine and biology, biomedical ethics, and medical jurisprudence designed according to the student's background and area of special interest; completion of a series of approved upper-division or graduate courses in supporting fields of study; demonstration of reading knowledge in one foreign language; satisfactory completion of a general examination (written and oral) on biomedical history and appropriate supporting fields; and submission of an acceptable thesis with oral defense of the thesis. A minimum of three full-time quarters of residency is required, and it is expected that the entire program will be completed within four to six quarters.

Research Facilities

A substantial collection of appropriate rare books, microfilm, and other research materials are available in the History of Medicine and Rare Book Room.

Correspondence and Information

Graduate Program Coordinator
Department of Biomedical History, SB-20

Faculty

Chairperson

Charles W. Bodemer

Professors

Bodemer, Charles W.,* Ph.D., 1956, Cornell; history of European and Chinese medicine, medical psychology, basic medical sciences, biomedical ethics.

Odegaard, Charles E. (Emeritus), (Education),† Ph.D., 1937, Harvard; history of medical education.

Whorton, James C.,* Ph.D., 1969, Wisconsin; history of American medicine, public health, alternative healing, pharmacy and biochemistry.

Assistant Professors

Benson, Keith R.,* Ph.D., 1979, Oregon State; history of modern American biology, marine biology, and evolutionary biology.

Speer, James B., Jr.,* Ph.D., 1974, Rice, J.D., 1976, Houston; history of health policy and institutions, legal history of medicine; biomedical ethics.

Lecturer

McCormick, Thomas R.,* D.Min., 1976, Southern Methodist; biomedical ethics.

Course Descriptions

BI HS 401 Historical Development of Medical Thought (3) *Bodemer* Survey of the history of medicine from antiquity to the twentieth century, emphasizing concepts and ideas that influenced and were influenced by medicine.

BI HS 403 Issues of Life and Death in Historical Perspective (3) Sp *Speer* Examination, in terms of their historical development and relation to human values, of some critical contemporary issues arising from advances in biology and medical technology. Topics are considered in the context of past and present concepts of life, death, and the individual, and the value judgments that impact ethical dilemmas of modern medicine and society.

BI HS 409 History of Human Nutrition (3) *Whorton* Historical background of the major facets of nutrition, including growth of scientific understanding of food composition, digestion, metabolism; development of food supplies, eating patterns; occurrence and recognition of nutritional deficiency disease; problems of food contamination, adulteration; promotion of food fads. These are integrated and related to evolution of science, medicine, agriculture, industry, and other components of European and American culture.

BI HS 410 Legal Issues in Biology and Medicine (3) W *Speer* Examination of legal issues posed by advances in biology and medicine. Includes informed consent, death definition, euthanasia, organ transplantation, allocation of scarce medical resources, genetic counseling, genetic screening, abortion and contraception, sterilization, artificial insemination, government funding of research, experimentation with human subjects, and the creation of biohazards. Previous exposure to legal studies not required.

BI HS 411 The Development of Modern Pharmacy (3) *Whorton* Detailed study of evolution of drug therapy and of profession of pharmacy from antiquity to present; pharmacy in the United States.

BI HS 413 Quackery and Health Faddism in America (3) WSp *Whorton* Survey of evolution of quack and unorthodox systems of medical treatment and programs of health promotion in the United States, from colonial period to present. Theory and practice of each system related to medical, scientific, and social context in which it developed.

BI HS 414 Public Health in Nineteenth-Century America (3) *Whorton* Analysis of the patterns of epidemic illness (particularly infectious disease) in the United States for the period of the Revolution to the early twentieth century, and of the evolution of concepts and programs of disease prevention.

BI HS 416 The Use and Abuse of Drugs in Western History (3) *Whorton* Analysis of therapeutic and recreational use of drugs from ancient times to twentieth century. Prerequisite: introductory chemistry.

BI HS 417 History of Disease and Public Health (3) W *Whorton* Investigation of the role played by infectious disease in the development of Western civilization, of the theories devised to account for the origin and spread of epidemics, and of the practices adopted and institutions created to combat epidemic disease.

BI HS 418 History of American Medicine (3) A *Whorton* Study of the development of the American medical profession from the early colonial period to the twentieth century with attention to both the scientific and cultural factors that have influenced the training, practice, and social standing of physicians.

BI HS 419 Historical Foundations of Modern Biology (3) ASp *Benson* Examines origins and evolution of biological sciences from antiquity to twentieth century. Major emphasis on the natural philosophers of Greece, Hellenistic and Arabic medicine, the beginning of modern science in the Renaissance, and the diversification of the biological sciences culminating in the nineteenth century.

BI HS 421 Biology in the Nineteenth Century (3) W *Benson* Survey of the scientific developments from the mid-1700s leading to the great biological syntheses of the nineteenth century. The impact of intellectual movements, and the diversification of biological sciences are treated in some detail. Prerequisite: 5 credits in biology or permission of instructor.

BI HS 422 Evolutionary Thought and Society (3) Sp *Benson* The theory of evolution in the form of Darwinism has had a profound effect upon every aspect of human life and society. Lectures and discussions on the antecedents of this theory and the reasons for its subsequent impact.

BI HS 424 History of Twentieth-Century Biology (3) Sp *Benson* Twentieth-century biology represents the unique combination of two diverse traditions, natural history and physiology. This course examines the impact of synthesis of these traditions on character of twentieth-century biology. Developments in evolution theory and development of biological disciplines. Prerequisite: upper-class standing or permission of instructor.

BI HS 428 History of Animal Behavior (3) *Benson* Explores man's changing concept of animal intelligence and animal behavior from the Greeks to E. O. Wilson's *Sociobiology*. Major emphasis on development of animal behavior as a distinct discipline of biology in the twentieth century. The reading stresses primary course material.

BI HS 429 History of Genetics (3) *Benson* Examines the nineteenth-century roots of theories of inheritance, development of Mendelian genetics, marriage of genetics and chromosomal inheritance, investigation of biochemical nature of inheritance, and articulation of the modern gene theory for heredity. Emphasis on reading the classic original papers in the history of genetics.

BI HS 430 Medicine and Society in the Age of Reason (3) *Bodemer* Detailed consideration of medicine and its institutions during the seventeenth and eighteenth centuries. Emphasis on the interacting forces and ideas leading to the development of scientific and humanitarian medicine.

BI HS 431 Medicine During the Nineteenth Century (3) *Bodemer* Detailed consideration of the development of the basic and clinical medical sciences during the nineteenth century, emphasizing medical theory and practice.

BI HS 432 Madness and Civilization (3) *Bodemer* Survey of attitudes toward madness, concepts of psychopathology, and the treatment of the mentally ill at different periods in the development of Western civilization. Special emphasis placed on the various social, psychological, and cultural factors determining the position of the mentally ill in society.

BI HS 433 The Origins of Modern Psychiatry and Its Institutions (3) *Bodemer* Detailed consideration of the nineteenth- and early twentieth-century origins of modern medical psychology, the mental health movement, and mental institutions. Special attention is devoted to the philosophical and physiological foundations of psychopathological concepts and the treatment of the mentally ill since the end of the eighteenth century.

BI HS 434 Seminar in the History of Psychiatry (2) *Bodemer* To be taken concurrently with 433 or by permission of instructor. Readings and discussion of primary works appropriate to topics considered in 433.

BI HS 435 Medicine and Society in History (3) *Bodemer* Explores relationships among disease, medical practice, and society during various periods in the development of Western civilization. Emphasizes the interaction and interdependence of medicine and society, and is intended to provide historical analyses that illuminate this interaction in modern times.

BI HS 453 History of American Marine Biology (3) *Benson* Examines development of American marine biology from its European roots to modern marine laboratories. Of special interest is establishment of the early American biological community, institutionalization of marine study on both coasts, and formation of marine biology as a distinct discipline. Reading is from scientific and popular literature.

BI HS 464 Medicine in the History of Chinese Civilization (3) *Bodemer* Philosophical and shamanistic backgrounds of Chinese medicine and establishment of traditional Chinese medicine. Chinese responses to biology and medicine from the West since the sixteenth century are considered, and evolution of medicine in China during the twentieth century is described.

BI HS 465 Myth, Magic, and Religion in Early Chinese Medicine (3) *Bodemer* Detailed consideration of the nature and role of mythological, magical, and religious influences in early Chinese medicine and their impact upon the theory and practice of traditional Chinese medicine.

BI HS 470 Law and Medicine (3) A *Speer* Surveys the relationship of the legal system to medical practice. Considers the law's efforts to regulate medicine and to profit from medical knowledge, and the roles of participants in the health-care system and of the state. The course does not assume or require any background in law.

BI HS 471 History of Forensic Sciences (3) W *Speer* Examination of development, application, and social significance of scientific evidence in criminal cases and civil inquiries. Introduction to the legal system and trial procedures. Issues raised in death investigations, rape and other special researches, forensic psychiatry, and controversial tests and techniques now being considered in adjudicatory processes.

BI HS 480 History of Surgery (3) *Bodemer* Evolution of modern surgery from antiquity to present. Major concepts important to development of surgery, including development of anatomic conception of disease, management of pain, and control of infection. Ancillary factors important to advance of surgery. Evolution and professionalization of surgery in the United States.

BI HS 497 Biomedical History Special Electives (*) AWSpS

BI HS 498 Undergraduate Thesis (*) AWSpS

BI HS 499 Undergraduate Research (*, max. 5) AWSpS Investigative work in history of the biomedical sciences.

BI HS 500 Biomedical Historiography (*, max. 6) AWSpS Emphasis is placed on bibliography and utilization of bibliographic sources. Practice in techniques of organizing and writing history of medicine. Prerequisite: permission of instructor.

BI HS 510 Topics in Biomedical History (*, max. 6) AWSpS Detailed study of topics in biomedical history through lectures, seminars, and discussion. Open to majors and graduate students in medicine, the arts and sciences, and others with appropriate background and interest. Prerequisite: permission of instructor.

BI HS 511P Selected Topics in Biomedical Ethics (1) AWSp *McCormick* Ethics course designed especially for first- and second-year medical students, topically arranged so that students may take one, two, or three quarters. Major ethical theories presented, then applied to actual cases in medicine. Seminar-discussion format centered around text and case studies.

BI HS 520 Seminar in the History and Philosophy of Medicine (3) AWSpS *Bodemer* Origins and philosophical foundations of medical sciences. Critical analysis of processes of evaluation and explanation in biomedical sciences. Consideration of evolution and nature of modern biomedical investigation; concepts of life/death, health/disease; philosophical dimensions of clinical medicine. Open to majors, medical students, arts and sciences graduate students, and others interested.

BI HS 521 The Ethical Challenges of Modern Medicine (3) W *McCormick* Readings and discussion of critical contemporary ethical issues arising from progress in the biomedical sciences and medical technology. Emphasis on the impact of modern biology and medicine upon human values, the relation of medical practices to the moral consensus, and the role and responsibilities of the physician.

BI HS 522 Ethical Problems Surrounding Death (3) Sp *McCormick* Seminar to analyze issues arising in care and treatment of dying patients and their families (e.g., euthanasia, truth telling, right to die, guilt, grief, and hospice care). Values of patient and professional in psychosocial context of terminal care.

BI HS 523 Biomedical Ethics and the Life Sciences (3) A *McCormick* Seminar examining normative issues in medicine today. Emphasis on methods of ethical reasoning about moral dilemmas. Selected case studies to illustrate interface of ethics and medicine and to provide an opportunity for students to test their value assumptions and skills in analyzing a moral dilemma in medicine.

BI HS 525 Seminar in the History and Philosophy of Biology (3) AWSpS *Benson* Seminar tailored to individual interests in certain areas of the history and philosophy of biology. Open to majors and graduate students in medicine, the arts and sciences, and others with appropriate background and interest.

BI HS 530 Seminar in the History of American Medicine (3) AWSpS *Wharton* Selected topics in the development of medicine and public health in the United States. Open to majors and graduate students in medicine and the arts and sciences and to others with appropriate background and interest.

BI HS 535 Seminar in Medical Jurisprudence (3) AWSpS *Speer* Historical development of the intersections of American law and medicine, focusing primarily on questions of licensure and health policy regulation, public health matters, forensic medicine, professional liability, and philosophical issues relevant to life stages. Enrollment restricted to law and medical students and others with appropriate background and interest.

BI HS 600 Independent Study or Research (*) AWSpS

BI HS 700 Master's Thesis (*) AWSpS

Conjoint Courses

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

CONJ 340-341-342 Human Anatomy and Physiology (4-4-4) Introductory course integrating gross anatomy, microscopic anatomy, and physiology of the human body. Primarily for nursing students, others by permission of instructor. Coordinator: Department of Physiology and Biophysics. Prerequisites: CHEM 101-102 or equivalent and permission of instructor.

CONJ 407 Principles of Animal Experimentation (3) W *Dennis, Van Hoosier* For graduate students and advanced undergraduates; focus on biology and care of experimental animals, animal models of human disease, ethical use of animals in biomedical research and teaching; techniques of experimental surgery. Lectures, demonstrations, and experimental procedures. Prerequisite: permission of instructor.

CONJ 448 Fundamental Immunology Laboratory (2) A *Clagett* Introduction to immunologic techniques. Principles of antigen-antibody interactions and cell-mediated reactions. Medical applications of immunologic methods. Prerequisite: MICRO 441 or 447 or HUBIO 521P, or permission of instructor. Coordinator: Department of Microbiology and Immunology.

CONJ 475 Alcoholism: A Course for Medical Students and Students in the Allied Health Sciences (2) Sp *Walker* A lecture course for medical students in the allied health sciences in any year that will cover an introduction to the epidemiology, diagnostic strategies, natural history, physiologic effects, and treatment of alcohol-related disorders.

CONJ 503 Somatic Cell Genetics (2, max. 6) A *Gartler, Martin, Pious* Analysis of heritable phenomena in cultured mammalian somatic cells. Mutation, cell fusion, gene transfer, and mitotic cell cycle. Required of all pathology graduate students. May be repeated for credit.

CONJ 508 EM Methods and Interpretation (3-5) *Wright, Holbrook* Techniques used in biological transmission and scanning electron microscopy. Practical laboratory experience in research environment, tutorial discussions of cell architecture as related to the functional behavior of cells. Student projects required. Prerequisites: a basic cell biology course and graduate or postdoctoral status in pathology or biological structure.

CONJ 509 Neurochemistry (3) W *Stahl* Introductory course covering chemistry and metabolism, chemical pathology of disorders of lipid, amino acid, and carbohydrate metabolism, transport phenomenon, neurotransmitters, memory, the visual system, and unique proteins of the nervous system. Recommended for graduate and medical students. Knowledge of biochemistry is strongly advised. Prerequisite: permission of instructor. (Offered alternate years.)

CONJ 511 Functional Neuroanatomy (4) W *Smith* Lecture and laboratory course in neuroanatomy. Laboratory includes gross human brain and slide material and cat and monkey material. Offered conjointly by the departments of Biological Structure and of Physiology and Biophysics. Prerequisite: permission of instructor. Coordinator: Department of Physiology and Biophysics.

CONJ 512 Introduction to the Anatomical Analysis of Animal Disease (5, max. 10) AWSp *Giddens* Uses animals in experimental study of disease; introduction to: techniques of animal necropsy, characterization and interpretation of gross and microscopic lesions, correlation of lesions with altered physiological processes, differentiation between naturally occurring and experimentally induced lesions. Prerequisites: PATH 444-445, or equivalent, and permission of instructor. Enrollment limited to two students per quarter.

CONJ 514 Comparative Pathology Conference (1, max. 6) AWSp *Giddens, Landolt* Focus on histopathology of naturally occurring and experimentally induced lesions of primates, laboratory and domestic animals, fish, wildlife, and birds. Participants discuss the lesions and the basic pathogenetic mechanisms that underlie them. Prerequisites: PATH 500 or equivalent and permission of instructor.

CONJ 520 Anatomy and Autopsy (1 or 2) Students attend autopsies at UW affiliated hospitals. Objectives: (1) demonstration of normal anatomic relationships and features of unfixed cadavers; (2) demonstration of gross anatomical relationships in various pathological states; (3) follow-up of histological findings. Offered as elective concurrent with HUBIO 525 and 520. Prerequisites: HUBIO 510 or equivalent, HUBIO 516, permission of instructor.

CONJ 525P Preventive Medicine in Primary Care (2) Sp Practice of health maintenance is discussed in a seminar format. Goal of course is to help students develop skills in evaluating the usefulness of current and future preventive measures. Coordinator: Department of Family Medicine.

CONJ 530, 531 Diseases of Laboratory Animals (2,2) *Giddens, Van Hoosier* Analysis of etiology, pathogenesis, pathology, and disease processes in rodents, lagomorphs, carnivores, and nonhuman primates. Material organized according to etiology (e.g., viral, bacterial, parasitic).

CONJ 540 Animal Models (1) *Dennis, Giddens* Naturally occurring and experimentally induced analogs of human diseases in animals with emphasis on diseases in search of animal models, and approaches to identifying new models. Animal models of categorical disease (e.g., cancer, atherosclerosis, gerontology) discussed.

CONJ 550P Clinical Infectious Diseases (3) *Holmes, Smith, Stamm, Wedgwood* Lecture series by faculty members from various departments, authorities in the field of clinically important infectious diseases. Lectures, reading assignments, and handouts emphasize epidemiology, clinical manifestations, laboratory findings, diagnosis, treatment, and prevention. Oriented for second-year medical students. Prerequisite: HUBIO 521P or permission of coordinator, Department of Medicine.

CONJ 553P Nutrition for Physicians (2) Basic nutritional concepts directed at second-year medical students. Controversial issues relating to diet and disease, with emphasis on application of scientific reasoning and pragmatism to the search for answers. Focuses on providing practical information relevant to the practice of a physician. Prerequisites: HUBIO 514P, 524P, 536P, or equivalent.

CONJ 561 Tumor Biology (2) W *I. Hellström* Graduate students and interested medical students. The general areas covered are the basis of carcinogenesis, tumor progression and metastasis, virus-induced tumors, tumor genetics, and tumor immunology. Offered conjointly by the departments of Microbiology and Immunology and of Pathology. Prerequisite: permission of Department of Microbiology and Immunology. (Offered alternate years; offered 1986.)

CONJ 572 Advanced Immunology III—Immunopathology (2) W *I. Hellström, K. E. Hellström* Graduate students and upper-division undergraduates. In-depth treatment of basic immunology with MICRO 570, 571. Covers the mechanisms concerned with immunological tissue injuries. Prerequisites: MICRO 447 (or equivalent), biochemistry, genetics, and one quarter of general pathology. Coordinator: Department of Microbiology and Immunology. (Offered every three years; offered 1987.)

CONJ 585 Surgical Anatomy (1-3, max. 12) AWSp *Graney* Guided dissection of selected regions, supplemented by conferences. Offered conjointly by the departments of Biological Structure and Surgery. Prerequisite: permission of department. Coordinator: Department of Biological Structure.

CONJ 677P Clinical Allergy (*, max. 12) AWSpS *Van Arsdel (University Hospital)* Clinic and office experience in diagnosing and managing allergic disease. Clinical conferences, hospital rounds on clinical immunology and allergy. Student may elect a flexible program, emphasizing adult or pediatric allergy. Prerequisite: PEDS 665P or MED 665P or FAMED 665P. (Four or six weeks, full time.)

CONJ 680P An Introduction to Detoxification and Rehabilitation Programs for Alcoholism (*, max. 16) Sp *Walker* Supervised introduction to alcoholic detoxification and rehabilitation as they apply to the general physician. Supervised clinical experience in a variety of alcoholism treatment programs; accompanied by a core series of lectures and discussions. (Two, four, or six weeks, full time.)

Family Medicine

C408 Health Sciences

Family medicine is the discipline concerned with the continuing and comprehensive care of individuals and their families. The prime instructional goal of the department is the education and training of physicians who will apply the knowledge and skills of this and other medical disciplines in family practice. Implicit in this goal is the necessity for continual development of new knowledge and its application in the clinical activities of the department.

The Department of Family Medicine was founded in 1971 and is involved with instruction of medical students in several ways. These include presentations in the basic curriculum of the first two years, selective clinical clerkships as part of the clinical core curriculum, and other elective courses open to all medical students. A graduate residency program in family practice provides training consistent with the standards of the American Board of Family Practice, the American Academy of Family Physicians, and the Council on Medical Education of the American Medical Association. Active teaching affiliations are maintained throughout the WAMI region at both undergraduate and graduate levels.

Faculty

Chairperson

John P. Geyman

Professors

Geyman, John P., M.D., 1960, California (San Francisco); family medicine.

Phillips, Theodore J., M.D., 1959, Johns Hopkins; family medicine.

Smilkstein, Gabriel, M.D., 1953, Rochester; family medicine.

Smith, Charles K., M.D., 1963, Northwestern; family medicine.

Associate Professors

Berg, Alfred O., M.D., 1974, Washington (St. Louis); family medicine.

Gordon, Michael J., Ph.D., 1973, Michigan State; educational psychology.

Leversee, John H., M.D., 1951, Minnesota; family medicine.

Phillips, William R. (Clinical), M.D., 1975, Washington; family medicine.

Rosenblatt, Roger A., M.D., 1971, Harvard; family medicine.

Schneeweiss, Ronald, M.B., Ch.B., 1964, Cape Town (South Africa); family medicine.

Taylor, Thomas R., M.B., Ch.B., 1957, Glasgow (Scotland); family medicine.

Assistant Professors

Cherkin, Daniel C. (Research), Ph.D., 1978, Washington; epidemiology.

Coggan, Peter G., M.B., B.S., 1969, London; family medicine.
Eggertsen, Sam C., M.D., 1976, Washington; family medicine.
Elsbury, Kathleen E., M.D., 1977, Johns Hopkins; family medicine.
Kirkwood, C. Richard, M.D., 1971, Washington; family medicine.
Meyer, Barbara A., M.D., 1976, Michigan; family medicine.
Stevens, Nancy G., M.D., 1979, Washington; family medicine.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

FAMED 499 Undergraduate Research (*) AWSpS *Berg* Research activities are arranged with faculty members in various areas related to family medicine. Research is generally clinically oriented and centered around patient care. Prerequisite: permission of course coordinator.

FAMED 501P Introduction to Family Medicine: Preceptorship (2½) AWSpS *Leversee* Students are introduced to family medicine and its practice through preceptorship assignments with practicing family physician clinical faculty and seminars. First-year (occasionally second-year) medical students. Prerequisite: permission of course coordinator.

FAMED 520P-521P-522P Continuity Clerkship in Family Medicine (3-3-2) *Meyer, Smith* Students spend one morning a week in the office of a family physician participating in the continuous comprehensive care of patients. A weekly lecture/workshop series during the first two quarters covers major topics in primary care and family medicine. Students enroll in all three quarters to gain the benefits of a continuity experience. Prerequisites: HUBIO 513P, 522P, 535P.

CONJ 525 Preventive Medicine in Primary Care (2) Sp See Conjoint Courses.

FAMED 664P Basic Clerkship in Family Medicine (8 or 12) AWSp *Coggan, Kirkwood* Emphasizes the clinical approach to the common problems. Includes regular seminars, readings, and daily patient workups under the supervision of family practice faculty and residents in the University's Affiliated Family Practice Residency Network. Students work closely with residents in an intensive experience stressing the family orientation to disease and the impact of illness on the patient's life. Prerequisite: third- and fourth-year medical student standing. Six weeks, four weeks by special arrangement.

FAMED 665P Community Clinical Clerkship in Family Medicine (12) AWSpS *Phillips* Stresses the common and important clinical problems in family practice. Student functions as clinical clerk in a community clinical unit of the Department of Family Medicine, where he or she participates in care of assigned patients, using office, hospital, home, and community resources. Prerequisites: HUBIO 563P and MED 665P or permission. (Six weeks, full time.)

FAMED 670P Advanced Preceptorship in WAMI Area (*, max. 24) AWSpS *Smilkstein* For late third/fourth-year medical students interested in practicing in underserved National Health Service Corps/Indian Health Service sites. Appropriate for NHSC scholarship recipients and students of all pathways. Focus on, and attention to, attitudes, knowledge and skills, and community organizations responsible for health-care delivery. Prerequisite: permission of course coordinator.

FAMED 671P Advanced Preceptorship in United States (*, max. 24) AWSpS *Smilkstein* For late junior or senior medical students interested in experiencing family medicine in community or clinic setting not already established through family medicine curriculum. Students expected to design special project for study. Prerequisites: prior permission of course coordinator and letter confirmation from chosen site; course coordinator establishes criteria for acceptance.

FAMED 672P Advanced Preceptorship International (*, max. 24) AWSpS *Smilkstein* For senior medical students desiring family medicine experience abroad. Site must be confirmed as acceptable by University faculty member. Special project deals with influences of social, cultural, educational, and economic forces on health-care delivery. Prerequisites: prior permission of course coordinator and letter of confirmation from chosen site; course coordinator establishes criteria for acceptance.

Human Biology

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only. This sequence is required for all medical students. Other students may enroll by permission of the Assistant Dean for Curriculum, School of Medicine.*

HUBIO 500P Medical Practice Preceptorship at WAMI Sites (1, max. 3) AWSp Personal experience with, and insight into, medical practice situations. Student is stationed with carefully selected clinical faculty members in their offices in accordance with the student's preference of discipline at the WAMI sites. Registration limited to first-year medical students at WAMI sites.

HUBIO 501P Human Biology Special Projects (*) AWSpS *Loeser* Designed for medical students electing a special study project related to the introduction to Clinical Medicine or other human biology courses, which are offered during the first and second years in the School of Medicine. Primarily intended for students in remedial or extended programs. Prerequisite: permission of assistant dean of curriculum.

HUBIO 510P Microscopic Anatomy (Histology) (3) A *Bolender* Lectures and laboratories in microscopic anatomy designed to provide the principles and concepts of histology, to define the morphological characteristics of the cells, tissues, and organs of the human body, and to relate this information to functional processes studied in concurrent and subsequent courses.

HUBIO 511P Gross Anatomy and Embryology (3½) A *Rosse* Structural organization of human body at the macroscopic level to provide a foundation for physical examination and functional assessment of the human organism. Integrates embryological development with study of the cadaver and examination of the normal living body. Concentrates on exploration of the body cavities and the viscera they contain.

HUBIO 512P Mechanisms in Cell Physiology (5) A *Detwiler* Physiology of the cell membrane, including ionic and electrical potential gradients; active transport, excitability, and action potentials; biophysics of sensory receptors; neuromuscular transmission; muscle energetics and contractility; spinal reflexes and central synaptic transmission; autonomic nervous system; energy metabolism and temperature regulation; epithelial transport; gastrointestinal motility and secretions.

HUBIO 513P Introduction to Clinical Medicine (1) A *Smith* Instruction in communication skills and interview techniques to form the basis for the doctor-patient relationship and for the skills of communicating with patients. The patient profile is obtained. Attention to developing comfort in the physician role.

HUBIO 514P Biochemistry (4) A *Shapiro* First portion of a coordinated course covering classical molecular and cellular biochemistry, cellular physiology, and molecular genetics. Metabolic interrelationships as they occur in the individual stressed and related to disturbances in disease states.

HUBIO 515P The Ages of Man (3) A *Novack* Physical and psychological development of the whole individual from embryo through old age (including teratology, obstetrics, neonatal adaptation, nutrition, and developmental milestones in childhood and adolescence, middle and old age, and dying). Includes patient presentations, movies, television tapes, and small-group discussions.

HUBIO 516P Cell Biology (2) *Koehler* Structure and function of cell components, interactions of cells with their substates and with other cells and events of cell differentiation, including the cell cycle, cell proliferation, and cell potential. Basic aspects of cell biology relevant to medicine; complements concurrent and subsequent courses.

HUBIO 520P Cell and Tissue Response to Injury (6) W *Loeb, Monnat* Patterns of cell and tissue response to injury. Mechanisms of cell injury, the inflammatory process, immunology, immunopathology, thrombosis, normal and abnormal growth, neoplasia, clinicopathological correlation.

HUBIO 521P Natural History of Infectious Diseases and Chemotherapy (6) W *Sharris* Pathogenesis and immunity of infectious diseases, natural barriers. Microbiology, epidemiology, clinical manifestations and control of representative bacterial, fungal, parasitic, and viral infectious diseases. Chemotherapeutics and principles of chemotherapy. Sterilization, principles of asepsis, nosocomial and iatrogenic infections and their prevention.

HUBIO 522P Introduction to Clinical Medicine (1) W *K. Smith* Medical history is introduced and instruction in data collection is begun. Experience in conducting medical interviews with patients to obtain the medical history and patient profile. Special problems related to interviewing are addressed.

HUBIO 524P Biochemistry (2) W *Shapiro* Second portion of a coordinated course covering classical molecular and cellular biochemistry, cellular physiology, and molecular genetics. Metabolic interrelationships as they occur in the individual are stressed and related to disturbances in disease states.

HUBIO 525P Gross Anatomy and Embryology (3½) *Graney* Organization of the human body at the macroscopic level. Integrates embryological development with study of cadaver and examination of normal living body. Concentrates on study of body cavities and viscera they contain.

HUBIO 530P Epidemiology (2) Sp *Koepsell* Community health and disease, including assessment of disease risk and mechanisms of epidemic detection, spread, and control; interpretation of research design, data analysis, bias source; and clinical epidemiology, including evaluation and application of diagnostic tests, natural history of disease, and quantitative aids for clinical decision making.

HUBIO 531P Head, Neck, Ear, Nose, and Throat (5) Sp *D. Graney* Gross anatomy (including skull, pharynx, and larynx). Audition and balance. Physiology and clinical evaluation. Maxillofacial disorders, diseases of nasal passages, nasopharynx and oropharynx, accessory sinuses. Physical examination.

HUBIO 532P Nervous System (6) Sp *Sundsten* Integrated approach to normal structure and function of the nervous system, including the eye. Neuropathological examples, as well as clinical manifestations of neurological disease are presented.

HUBIO 533P System of Human Behavior I (3) Sp *Carr* Effects of behavioral factors in major management problems faced in medical practice relating to cultural background, social role, sexual identity, and belief systems. Acquisition of skills in analyzing behavior, defining objectives, and designing precise treatment strategies.

HUBIO 535P Introduction to Clinical Medicine (4) Sp *Pierson* Adult screening physical examination is taught through the use of lecture, audiovisual aids, and small-group tutorial, where students in supervised setting practice the physical examination on each other. Further practice in the performance and recording of the patient profile and medical history.

HUBIO 540P Cardiovascular Respiratory System (9½) A *Feigl* Introduction to cardiovascular-respiratory medicine organized about physiological functions and pathophysiology of the cardiovascular-respiratory system divided into three parts: (1) respiration, (2) cardiovascular, (3) combined cardiovascular respiratory problems. Content spans histology to cardiac surgery.

HUBIO 542P Introduction to Clinical Medicine (2½) A *McArthur* Advanced instruction in interview technique, history taking, and physical examination, with emphasis on detection of abnormalities.

HUBIO 543P Principles of Pharmacology I (4) A *Vincenzi* Includes general principles of pharmacology and the specific pharmacology of major drugs acting on the autonomic and cardiovascular systems.

HUBIO 544P Endocrine System (2½) A *Knopp* Normal, gross, and microscopic anatomy and physiology of the endocrine system. Illustrations examining the clinical relevance of homeostasis, feedback, and other controlling mechanisms previously learned. Endocrine integration of metabolism. Clinically important endocrine pathophysiology.

HUBIO 545P Reproductive Biology (3½) A *Steiner* Traces normal development of reproductive function in human beings, including the formation and maturation of ova and sperm, gamete transport, fertilization, menstruation, implantation, physiology and endocrinology of placenta, intrauterine development and nutritional requirements of the growing fetus, normal pregnancy, parturition, lactation, adaptation of newborns to extrauterine life.

HUBIO 550P Introduction to Clinical Medicine (3½) W *McArthur* Continuation of 542 with emphasis on identification of problems and correlation of findings with pathophysiological mechanisms.

HUBIO 551P Gastro-Intestinal System (4) W *Rubin* Anatomy of the gastrointestinal system; physiology and pathology of digestion and hepatic function; and physical and laboratory examination.

HUBIO 553P Musculoskeletal System (4½) W *Teitz* Gross, surface, applied, and x-ray anatomy of system, including entire spine but excluding head and neck. Histology of bone, cartilage, tendon-myotendinal junction and joints. Musculoskeletal trauma and healing. Pathology and clinical manifestations of other degenerative, inflammatory, metabolic, nutritional, and congenital disorders. Physical examination.

HUBIO 554P Genetics (2½) W *Stamatoyannopoulos* Review of basic genetic principles and their applications in clinical medicine. Includes human chromosomal disorders; patterns of inheritance, genetic counseling, amniocentesis; pathogenesis of hereditary diseases, monogenic and multifactorial; role of genetics in common diseases; behavioral genetics; drug-gene interactions; and prevention and treatment of genetic diseases, including prenatal diagnosis and population screening.

HUBIO 555P Medicine, Health, and Society (3½) W *Connell* Interrelationships between provision of medical care and nonbiological factors that influence health. Includes relative impor-

tance of society, environment, and individual choice in determining health status; impact of organizational, economic, and political influences on medical practice and choice; their importance in decision making.

HUBIO 556P Skin System (2) W *Odland* Gross and microscopic anatomy. Physiology, protection, temperature control, pigmentation, and photosensitivity. Pathology and genetics of skin abnormalities, including tumors. Introduction to clinical evaluation, including physical examination and illustrating examples of inflammatory, vascular, immunological (including drug hypersensitivity), and neoplastic diseases.

HUBIO 560P Introduction to Clinical Medicine (5) Sp *McArthur* Continuation of 550P. Introduction to clinical and laboratory diagnosis.

HUBIO 561P Hematology (3) Sp *McArthur* Familiarizes students with the basic pathophysiologic mechanisms leading to disturbances of red cell, white cell, and platelet production, as well as abnormalities of hemostasis presenting clinical problems. Pathophysiology, rather than minute details of individual disease, is stressed.

HUBIO 562P Urinary System (4) Sp *Sherrard* Anatomy, physiology, and pathology of the kidney, ureter, bladder, and prostate; pathophysiology and treatment of common fluid and electrolyte problems; renal pharmacology; major clinical urinary system syndromes, with current diagnostic approaches and therapy.

HUBIO 563P System of Human Behavior II (3) Sp *M. Scher* Major psychiatric disorders are defined and described, and a systematic approach to differential diagnosis is presented. Conceptual development, pathogenesis, epidemiology, nomenclature, and the terminology used in psychiatry are discussed.

HUBIO 564P Principles of Pharmacology II (3) Sp *Horita* Lectures and conferences on drugs that act on the central nervous system. Emphasis on physiological and biochemical mechanisms, with consideration of therapeutic and adverse effects.

HUBIO 565P Saturday Morning Clinical Conferences (3) AWSp *Bennett* Didactic seminar sessions covering basic science and clinical curriculum. Lecture-seminars, held Saturdays from 8:30 to noon, are problem-oriented and include a question-and-answer period. Third- and fourth-year students are excused from clerkships these hours and are expected to attend. Prerequisite: completion of human biology series.

HUBIO 568P Systemic Pathology (2) Sp *Alvord* Multidisciplinary approach to some diseases that affect more than one organ system (nervous, cardiovascular, respiratory) and that are caused by different mechanisms (congenital, inflammatory, vascular, traumatic, metabolic, neoplastic).

Laboratory Medicine

NW120 University Hospital

The Department of Laboratory Medicine includes divisions of clinical chemistry, hematology, microbiology, coagulation, immunology, genetics, virology, information processing, and electroencephalography and neurophysiology. In addition to courses for medical students, the department offers Bachelor of Science in Medical Technology and Master of Laboratory Medicine degree programs.

Undergraduate Program

Bachelor of Science in Medical Technology Degree

The medical technology program is a four-year college program, supervised by the College of Arts and Sciences in the freshman and sophomore years (preprofessional, 90 credits) and by the Department of Laboratory Medicine in the junior and senior years (professional, 105 credits).

Admission Requirements: The professional curriculum consists of seven consecutive quarters of study that must be taken in the School of Medicine. Prerequisite requirements may be satisfied at the University or at other accredited colleges and universities. Completion of 90 quarter credits, or achievement of junior standing, must be attained and must include the following preprofessional courses: one year of general chemistry, quantitative analysis, 12 credits of organic chemistry, college algebra, and 15 credits of biological science. Admission to the professional program is competitive and requires submission of an application to the Department of Laboratory Medicine by April 15 of the year the applicant plans to enroll. The Allied Health Professions Admission Test is required, and the scores from the test should be available by the April 15 deadline for application to the program. A grade-point average of 2.00, both cumulative and in required courses, is necessary for admission consideration.

Graduation Requirements: MICRO 441, 442, 443, 444; PATH 410; BIOC 405, 406, 426; LAB M 321, 322, 418, 419, 420, 421, 422, 423, 424, 425, 426, and 427. A 2.00 grade-point average in the required courses, as well as an overall cumulative average of 2.00, is necessary for graduation. The medical technology curriculum is accredited by the Committee on Allied Health Education and Accreditation. Graduates are eligible and are encouraged to take an appropriate examination to become certified medical technologists.

Graduate Program

The Department of Laboratory Medicine offers a graduate program leading to the Master of Laboratory Medicine degree. The program includes course work and a thesis based on research performed in one of the divisions of the department. The divisions are chemistry, hematology, microbiology, immunology, coagulation, genetics, virology, and information processing. A full-time student normally completes the program in two years. The program prepares qualified candidates for careers in teaching and/or for investigation in an area of clinical laboratory science and/or for supervisory positions in clinical laboratories.

Research Facilities

Each division in the department is equipped with modern facilities for research in its specialty area. The department has faculty and laboratories at the University and Veterans Administration hospitals, Harborview Medical Center, Children's Orthopedic Hospital and Medical Center, and Providence Medical Center.

Admission Requirements

Applicants must have a B.S. or B.A. degree in a field appropriate to the graduate study (medical technology, biochemistry, biology, chemistry, or microbiology) and meet the Graduate School's requirements for admission. The applicant must also be certified as a medical technologist or as a specialist in a particular area of laboratory medicine by one of the national certifying agencies. In addition, applicants must take the Graduate Record Examination aptitude test.

Financial Aid

Some limited loan funds or fellowships may be available, but students should be prepared to finance their graduate education. Part-time employment in departmental laboratories may be available.

Correspondence and Information

Graduate Program Coordinator
Department of Laboratory Medicine, SB-10

Faculty

Chairperson

Paul E. Strandjord

Professors

Chatrian, Glan E., (Neurological Surgery),† M.D., 1951, Naples; electroencephalography and clinical neurophysiology.

Corey, Lawrence,* (Microbiology and Immunology),† M.D., 1971, Michigan; virology, infectious disease, herpes viruses.

Detter, James C.,* M.D., 1962, Kansas; red-cell disorders, with emphasis on biochemical genetics.

Gilliland, Bruce C.,* (Medicine),† M.D., 1960, Northwestern; immune complex disorders, hemolytic anemia, complement abnormalities.

Kadin, Marshall E.,* (Pathology),† M.D., 1965, Northwestern; hematopathology, *in vitro* studies of tumor cell growth and differentiation.

Kaplan, Alex (Emeritus), Ph.D., 1936, California; clinical chemistry.

Kenny, Margaret A.,* (Anesthesiology), Ph.D., 1968, Illinois; development of laboratory procedures for cancer detection, hormone regulation of calcium metabolism, transcutaneous monitoring.

Labbe, Robert F.,* (Pediatrics), Ph.D., 1951, Oregon State; metabolism of pyrrole compounds, nutritional biochemistry.

Plorde, James J.,* (Medicine),† M.D., 1959, Minnesota; studies of applied diagnostic microbiology and pathogenesis.

Schmer, Gottfried,* (Biochemistry), M.D., 1956, Vienna; synthesis of artificial organs, molecular engineering of antitumor enzymes.

Schoenknecht, Fritz D.,* (Microbiology and Immunology),† M.D., 1957, Freie (Berlin); *in vitro* antibiotic action, clinical microbiology, nosocomial infections.

Sherris, John C.,*‡ (Microbiology and Immunology, Pathobiology), M.D., 1950, London; medical microbiology, antibiotic action and resistance.

Strandjord, Paul E.,* M.D., 1959, Stanford; clinical chemistry.

Associate Professors

Benjamin, Denis R.,* (Pathology),† M.B., B.Ch., 1968, Witwatersrand (South Africa); metabolic changes in total parenteral nutrition, bile acid metabolism, circadian rhythms and laboratory values.

Clayson, Kathleen J.,* M.S., 1968, Minnesota; enzymology in clinical chemistry.

Coyle, Marie B.,* (Microbiology and Immunology),† Ph.D., 1965, Kansas State; clinical microbiology, antimicrobial susceptibility, corynebacteria, mycobacteria.

Delaney, Colleen J.,* Ph.D., 1971, Illinois; clinical chemistry, application of 2-D high-resolution electrophoresis to the study of diabetes (types I and II) and alcoholism.

Minshew, Barbara H.,* (Microbiology and Immunology), Ph.D., 1972, Texas Southwest Medical; surgical infection, antibiotic susceptibility testing, microbial virulence.

Petra, Philip H.,*‡ (Obstetrics and Gynecology, Biochemistry), Ph.D., 1966, Tulane; biochemistry, structure and function of proteins.

Ralsys, Vidmantas A.,* Ph.D., 1969, State University of New York (Buffalo); clinical toxicology, drug assays and binding of drugs to plasma proteins.

Schiller, Harvey S.,* (Obstetrics and Gynecology),† M.D., 1966, Washington (St. Louis); clinical chemistry, hematology, interpretation of laboratory data.

Smith, Elizabeth K. (Emeritus) (Research), (Pediatrics),† Ph.D., 1943, Iowa; pediatric endocrinology, steroid assays for congenital adrenal hyperplasia, metabolic disease testing.

Wilkus, Robert J., (Medicine),† M.D., 1962, Loyola; electroencephalography and clinical neurophysiology.

Assistant Professors

Ashley, Rhoda L. (Research), Ph.D., 1977, California (Davis); viral pathogenesis, herpes simplex immunity.

Bauer, Larry A.,*‡ (Pharmacy Practice), Ph.D., 1980, Kentucky; clinical pharmacokinetic applications, physiologic perfusion models, drug disposition in obese patients.

Behrens, Joyce A., M.S., 1971, Minnesota; clinical hematology and clinical coagulation methodologies.

Fine, James S., M.D., 1972, Minnesota; enzymology, medical computer applications.

LeCrone, Carol N.,* M.S., 1966, Colorado State; hematology, hemoglobinopathies.

McGonagle, Lee Anne, M.P.H., 1969, Michigan; clinical microbiology, procedures for diagnostic bacteriology.

Ophelm, Kent E.,* Ph.D., 1972, Cornell; therapeutic drug monitoring, pediatric clinical chemistry.

Szabo, LaVerne L., M.S., 1970, Washington; general clinical chemistry, heavy metals in clinical chemistry.

Tenover, Fred C., Ph.D., 1980, Rochester; molecular biology of plasmids, infectious diseases.

Lecturers

Anderson, Carol S., B.A., 1966, Concordia; immunohematology.

Hamarnyik, Peggy V., B.S., 1954, Nebraska; clinical microscopy of urine and body fluids, clinical chemistry.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

LAB M 321 Medical Technology: Introductory Clinical Hematology (5) W *Behrens, Hamarnyik, LeCrone* Lecture-laboratory coverage of the theoretical and practical concepts associated with cellular morphology, instrumentation, quality control, and selected hematological diagnostic studies. Prerequisite: permission of instructor.

LAB M 322 Medical Technology: Introductory Clinical Chemistry (5) A *Szabo* Lecture and laboratory covering the theoretical and practical concepts associated with testing procedures performed in clinical chemistry. Prerequisite: permission of instructor.

LAB M 418 Topics in Clinical Chemistry (4) Sp *Clayson, Hamarnyik, Szabo* Lecture and laboratory exercises covering fundamentals of instrumentation, methodology, and quality control in the clinical chemistry laboratory. Prerequisite: 322.

LAB M 419 Clinical Coagulation (3) S *Behrens* Lecture and laboratory covering the theory and pathology of coagulation with inclusion of selected diagnostic procedures. Prerequisite: permission of instructor.

LAB M 420 Clinical Microscopy (3) S *Hamarnyik, LeCrone* Lecture and laboratory covering urinalysis testing procedures and associated disease entities. Prerequisite: permission of instructor.

LAB M 421 Medical Microbiology (1 or 5) S *McGonagle* Lecture and laboratory designed to prepare medical technology students for further training in a clinical microbiology laboratory. Prerequisite: permission of instructor.

LAB M 422 Topics in Hematology (2) S *Behrens* Advanced didactic coverage of topics relating to theoretical concepts and pathology in hematology. Prerequisite: permission of instructor.

LAB M 423 Clinical Chemistry (10) AW *Szabo, Staff* Clinical testing related to protein and amino acid determinations, pancreatic functions and intestinal absorption, renal and liver function, enzymes, electrolytes, and acid-base balance, lipids, toxicology, and endocrinology. Prerequisite: permission of instructor.

LAB M 424 Clinical Microbiology (8) AW *McGonagle, Staff* Clinical review of general techniques, study of clinically significant bacteria, including specific methods of specimen examination, fluorescence microscopy, and testing for antibiotic susceptibility. Prerequisite: permission of instructor.

LAB M 425 Clinical Hematology (8) AW *Behrens, Staff* Clinical coverage of automated and manual cell counting, cellular morphology, and testing procedures related to red and white cell disorders. Prerequisite: permission of instructor.

LAB M 426 Clinical Immunohematology (6) AW *Hamernyik, Staff* Clinical study of immunohematology of the red cells and hemagglutination techniques. Prerequisite: permission of instructor.

LAB M 427 Selected Studies in Laboratory Medicine (15) Sp *Behrens, Clayson, Hamernyik, LeCrone, McGonagle, Szabo* Selected study in either one of the major disciplines of laboratory medicine, in all major disciplines of this field; or pursuance of a clinical research problem. Prerequisite: permission of instructor.

LAB M 499 Undergraduate Research (*) AWSpS Specific project in clinical laboratory investigation. Offered on credit/no credit basis only.

LAB M 501 Clinical Laboratory Diagnosis (3) W *Fine* Orientation to role of clinical laboratory in diagnostic medicine. Emphasis on appropriate test selection, interpretation, principles, problems, and limitations. Lecture-discussion with illustrative case presentations and demonstrations. For third- and fourth-year medical students and graduate students. Recommended: HUBIO 560P or 563P.

LAB M 502 Laboratory Medicine Seminar (1, max. 6) AWSp *Detter, Staff* Current topics in the field of laboratory medicine. Open to graduate students in laboratory medicine and other medical sciences. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

LAB M 510 Clinical Chemistry Research Conference (1, max. 6) AWSp *Labbe* Current projects under research and development in clinical chemistry and immunology. Open to graduate students in laboratory medicine and other medical sciences. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

LAB M 520 Seminar in Organization and Management in Laboratory Medicine (3) Sp *Strandjord, Staff* Core course for the Master of Laboratory Medicine degree. Prerequisite: graduate student standing in laboratory medicine or permission of instructor. (Offered odd-numbered years.)

LAB M 521 Advanced Laboratory Hematology (1, max. 2) AW *Detter, Kadin* Lecture demonstrations of laboratory diagnosis in clinical hematology. Emphasis on clinicopathological correlation. For physicians and laboratory medicine graduate students with special interest in diagnostic clinical hematology. Students required to read literature in preparation for the lectures. Prerequisites: graduate or postgraduate standing and permission of instructor.

LAB M 522 Hematopathology (2) W *Kadin* Identification of normal lymphocyte and bone marrow subpopulations, diagnosis of leukemias, lymphomas, and benign conditions that resemble them. Emphasis on histopathology, cytochemical, and immunological markers. Clinicopathologic correlation. Offered jointly with PATH 522. Offered on credit/no credit basis only. (Offered even-numbered years.)

LAB M 590P Research Projects in Laboratory Medicine (*) AWSpS *Schmer* Opportunity for laboratory experience on a research problem related to laboratory medicine. Students investigate new areas of potential clinical importance. Highly variable selection of projects includes chemistry, coagulation, hematology, immunology, microbiology, and virology. Goals established by instructor. Prerequisite: permission of instructor.

LAB M 596 Clinical Chemistry Seminar (2) AWSp *Delaney, Raisys* Conferences on research and development in clinical chemistry. For postdoctoral students in clinical chemistry and graduate students. May be repeated for credit. Prerequisite: permission of instructor.

LAB M 677P Clinical Electroencephalography (*, max. 12) AWSpS *Chatrian, Wilkus* For third- and fourth-year students who desire to acquire familiarity with the techniques, interpretive criteria, and clinical applications of electroencephalography. Prerequisite: MED 680P.

LAB M 680P Clinical Laboratory Testing: Methods and Interpretation (*) AWSpS *Detter* Provides the third- and fourth-year medical student the opportunity to develop the ability to evaluate clinical laboratory data and to gain insight into methodologies, equipment, principles, and quality control in the laboratory.

LAB M 700 Master's Thesis (*) AWSpS

Medical Education

The objectives of the Division of Research in Medical Education are to discover, disseminate, and apply knowledge of educational theory and practice in medical education. Research seeks to increase the basic fund of knowledge in educational theory and practice in medical education. Through teaching, the educational knowledge base is transmitted to faculty, fellows, residents, and students. Through scholarly research, teaching, and service, educational expertise is used to enhance the quality of academic programs in medicine and the health sciences.

Faculty

Director

Charles W. Dohner

Professor

Dohner, Charles W.,* (Education),† Ph.D., 1966, Ohio State; educational psychology, research in medical education.

Associate Professors

Gordon, Michael J.,* (Family Medicine),† Ph.D., 1973, Michigan State; educational psychology, research in medical education.

Irby, David M.,* (Obstetrics and Gynecology),† Ph.D., 1977, Washington; educational psychology, research in medical education.

Assistant Professors

Carline, Jan D. (Research), Ph.D., 1979, Washington; educational psychology, research in medical education.

Cullen, Thomas J. (Research), Ph.D., 1974, Washington; educational psychology, research in medical education.

Rakestraw, Phillip G. (Research), Ph.D., 1981, Washington; higher education, research in medical education.

Scott, Craig S. (Research), Ph.D., 1973, Iowa; educational psychology and measurement, higher education administration.

Course Descriptions

MEDED 510 Topics in Medical Education Research (2-3) Selected research topics in medical education. Development of skills in critical analysis and production of original research. Optional: 1 additional credit for seminar focusing on application of issues in education practice. May be repeated for credit. Offered on credit/no credit basis only.

MEDED 520 Teaching Methods in Medical Education (2) Empirical and theoretical merits of different teaching methods as applied to medical education. Structuring and leading group discussions, using questions, organizing and delivering lectures, identifying styles of clinical supervision, providing constructive feedback, and presenting effective clinical demonstrations. Combines seminar and microteaching. Offered on credit/no credit basis only.

Medical Practice

Course Descriptions

Courses numbered with a P prefix are not graduate courses and are restricted to medical student enrollment only.

MED P 501P Medical Practice Preceptorship in Medicine (1) To provide opportunity for first- and second-year medical students to gain personal experience with medical practice situations by being stationed with carefully selected clinical faculty members in their offices. Prerequisite: permission of instructor. Coordinator: Department of Medicine.

MED P 502P Medical Practice Preceptorship in Pediatrics (1) To provide opportunity for first- and second-year medical students to gain personal experience with medical practice situations for pediatricians by being stationed with carefully selected clinical faculty members in their offices. Prerequisite: permission of instructor. Enrollment limited. Coordinator: Department of Pediatrics.

MED P 503P Medical Practice Preceptorship in CHAP (1) Opportunity to work in variety of projects in community settings to serve disadvantaged populations. Weekly seminar to share experiences and hear community speakers. Prerequisite: permission of instructor. Coordinator: Department of Family Medicine.

Medicine

RR512 University Hospital

Active programs in teaching, research, and patient care are carried on at the University Hospital, Veterans Administration Hospital, Harborview Medical Center, Pacific Medical Center, and the Fred Hutchinson Cancer Research Center. Major affiliations for clinical teaching also exist with Providence Medical Center and Swedish Hospital Medical Center. There are many additional affiliations with community hospitals in Seattle, the state of Washington, and the WAMI region. Medical students, interns, medical residents, and postdoctoral research fellows rotate through these various hospitals and participate in the learning experiences offered at each.

Faculty

Chairperson

Philip J. Fialkow

Professors

Aagaard, George N. (Emeritus), (Pharmacology),† M.D., 1937, Minnesota; clinical pharmacology.

Adamson, John W., M.D., 1962, California (Los Angeles); hematology.

Albers, John J. (Research), Ph.D., 1969, Illinois; metabolism and endocrinology.

Beeson, Paul B. (Emeritus), M.D., 1933, McGill.

Belknap, Benjamin H., M.D., 1961, Rochester; metabolism and endocrinology.

Bierman, Edwin L., M.D., 1955, Cornell; metabolism and endocrinology.

Blackmon, John R., M.D., 1956, Case Western Reserve; cardiology.

Blagg, Christopher R., M.D., 1964, Leeds; nephrology.

Bornstein, Paul,* (Biochemistry),† M.D., 1958, New York.

Bruce, Robert A., M.D., 1943, Rochester; cardiology.

Brunzell, John D., M.D., 1963, Washington; metabolism and endocrinology.

Buchanan, Thomas M.,* (Pathobiology),† M.D., 1967, Washington; infectious disease.

Buckner, C. Dean, M.D., 1961, Michigan; oncology.

Burnell, James M. (Research), M.D., 1949, Stanford; nephrology.

Butler, John, M.D., 1957, Birmingham; respiratory diseases.

Camerman, Arthur* (Research), (Pharmacology),† Ph.D., 1964, British Columbia; neurology.

Chase, John D., M.D., 1945, Case Western Reserve; internal medicine.

Chesnut, Charles H. III, (Radiology),† M.D., 1966, Florida.

Cobb, Leonard A., M.D., 1952, Minnesota; cardiology.

Copass, Michael K., (Surgery), M.D., 1964, Northwestern; neurology/surgery.

Couser, William, M.D., 1965; Harvard; nephrology.

Crill, Wayne E.,* (Physiology and Biophysics),† M.D., 1962, Washington; neurology.

Dale, David C., M.D., 1966, Harvard; internal medicine.

Dodge, Harold T., M.D., 1948, Harvard; cardiology.

Eliel, Leonard P., M.D., 1940, Harvard; metabolism and endocrinology.

Ensinck, John W., M.D.C.M., 1956, McGill; metabolism and endocrinology.

Farrell, Donald F., M.D., 1965, George Washington; neurology.

Feter, Alexander, M.D., 1964, Stanford; oncology.
Fialkow, Phillip J.,* M.D., 1960, Tufts; medical genetics.
Figley, Melvin M.,* (Radiology),† M.D., 1944, Harvard.
Finch, Clement A., M.D., 1941, Rochester; hematology.
Fujimoto, Wilfred Y., M.D., 1965, Johns Hopkins; metabolism and endocrinology.
Gartler, Stanley M.,* (Genetics),† Ph.D., 1952, California (Berkeley); medical genetics.
Gibbett, Eloise R. (Research), M.D., 1951, Washington; hematology.
Gilliland, Bruce C.,* (Laboratory Medicine),† M.D., 1960, Northwestern; laboratory medicine.
Glomset, John A.,* (Biochemistry), M.D., 1960, Upsala; metabolism and endocrinology.
Goodell, Brian W., M.D., 1966, Washington; oncology.
Goodner, Charles J.,* (Physiology and Biophysics), M.D., 1955, Utah; metabolism and endocrinology.
Green, William L., M.D., 1954, Harvard; metabolism and endocrinology.
Hammarsten, James F., M.D., 1945, Minnesota; pulmonary medicine.
Hansen, John A., M.D., 1970, Stanford; oncology.
Henderson, Maureen M.,* (Epidemiology),† D.P.H., 1956, Durham (England); internal medicine.
Hildebrandt, Jacob,* (Physiology and Biophysics),† Ph.D., 1966, Washington; internal medicine/physiology and biophysics.
Hlastala, Michael P.,* (Physiology and Biophysics),† Ph.D., 1969, State University of New York (Buffalo); respiratory diseases.
Holmes, King K.,* (Epidemiology, Microbiology and Immunology), M.D., 1963, Cornell, Ph.D., 1967, Hawaii; infectious diseases.
Hudson, Leonard D., M.D., 1964, Washington; respiratory diseases.
Kennedy, J. Ward, M.D., 1959, Rochester; cardiology.
Kirby, William M. M., M.D., 1950, Cornell; infectious disease.
Klebanoff, Seymour J.,* (Microbiology and Immunology), M.D., 1951, Toronto; infectious disease.
Knopp, Robert H., M.D., 1964, Cornell; obstetrics-gynecology.
Koerker, Donna J.,* (Physiology and Biophysics),† Ph.D., 1970, Michigan; endocrinology.
Lakshminarayan, Sambasiva, M.B.B.S. (M.D.), 1965, All India Institute of Medical Sciences; pulmonary medicine.
Livingston, Robert, M.D., 1967, Oklahoma; oncology/radiation oncology.
LoGerfo, James P.,* (Health Services),† M.D., 1968, Rochester; internal medicine.
Mannik, Mart,* (Microbiology and Immunology), M.D., 1959, Case Western Reserve; rheumatology.
McArthur, James R., M.D., 1956, Harvard; hematology.
Motulsky, Arno G.,* (Genetics),† M.D., 1947, Illinois; medical genetics.
Neiman, Paul E., M.D., 1964, Washington; oncology.
Nelp, Wil B.,* (Radiology),† M.D., 1955, Johns Hopkins; nuclear medicine.
Odland, George F., (Biological Structure),† M.D., 1946, Harvard; dermatology.
Omenn, Gilbert S., (Environmental Health),† Ph.D., 1972, Washington.
Papayannopoulou, Thalia P., M.D., 1961, D.M.Sci., 1964, Athens; hematology.
Paulsen, C. Alvin, M.D., 1952, Oregon; metabolism and endocrinology.
Plorde, James J.,* (Laboratory Medicine),† M.D., 1959, Minnesota.
Pope, Charles E. II, M.D., 1957, Case Western Reserve; gastroenterology.
Porte, Daniel, Jr., M.D., 1957, Chicago; metabolism and endocrinology.
Preston, Thomas A., M.D., 1962, Pennsylvania; cardiology.
Ritchie, James L., M.D., 1967, Case Western Reserve; cardiology.
Root, Richard, M.D., 1963, Johns Hopkins; internal medicine.
Rubin, Cyrus E., M.D., 1945, Harvard; gastroenterology.
Saunders, David R., M.D.C.M., 1957, McGill; gastroenterology.
Schwartz, Theodore, M.D., 1943, Johns Hopkins; metabolism and endocrinology.
Scribner, Belding H., M.D., 1945, Stanford; nephrology.
Sherrard, Donald J., M.D., 1960, Washington; nephrology.
Simkin, Peter A., M.D., 1961, Pennsylvania; rheumatology.
Stichter, Sherill J., M.D., 1963; George Washington; hematology.
Stahl, William L.,* (Physiology and Biophysics),† Ph.D., 1963, Pittsburgh; neurology.
Stamatoyannopoulos, George, M.D., 1960, Athens; medical genetics.
Storb, Rainier, M.D., 1960, Freiburg (Germany); oncology.
Sumi, S. Mark,* (Pathology),† M.D., 1956, Toronto; neurology.
Swanson, Phillip D., M.D., 1958, Johns Hopkins; neurology.
Thomas, E. Donnall, M.D., 1946, Harvard; oncology.
Thompson, Arthur R., M.D., 1966, Ph.D., 1972, Washington; hematology.
Tompkins, Richard K.,* (Health Services),† M.D., 1965, Colorado; health sciences.
Turck, Marvin, M.D., 1959, Illinois; infectious disease.
VanArsdel, Paul P., Jr., M.D., 1951, Columbia; allergy.
VanCitters, Robert L.,* (Physiology and Biophysics),† M.D., 1953, Kansas; cardiology.
Volwiler, Wade (Emeritus), M.D., 1943, Harvard; gastroenterology.
Wallace, James F., M.D., 1961, Washington (St. Louis); internal medicine.

Associate Professors

Abrass, Itamar B., M.D., 1966, California; gerontology.
Albert, Richard K., M.D., 1971, Colorado; respiratory diseases.
Altman, Leonard C., M.D., 1969, Harvard; allergy and infectious disease.
Applebaum, Frederick R., M.D., 1972, Tufts; oncology.
Baskin, Denis G.* (Research), (Biological Structure),† Ph.D., 1969, California (Berkeley); metabolism and endocrinology.
Belcher, Donald W., M.D., 1962, Pennsylvania; ambulatory medicine.
Bird, Thomas D., M.D., 1968, Cornell; neurology.
Bremner, William J., M.D., 1969, Washington, Ph.D., 1977, Monash (Australia); endocrinology.
Brown, B. Gregory, M.D., Ph.D., 1969, Johns Hopkins; neurology.
Byers, Peter H.,* (Pathology),† M.D., 1969, Case Western Reserve; medical genetics.
Caldwell, James H., Jr., M.D., 1970, Missouri, cardiology.
Chait, Alan, M.D., 1974, Cape Town; metabolism and endocrinology.
Cheever, Martin A., M.D., 1970, Michigan; oncology.
Chen, Mei, M.D., 1968, Taiwan; internal medicine.
Counts, George W., M.D., 1965, Iowa; infectious disease.
Counts, Richard B., M.D., 1967, Washington (St. Louis); hematology.
Culver, Bruce H., M.D., 1969, Washington; respiratory diseases.
Curtis, F. Kingsbury, M.D., 1956, Columbia; nephrology.
Davidson, Robert C., M.D., 1953, Washington; nephrology.
Deeg, H. Joachim, M.D., 1972, Bonn (Germany); oncology.
de Haen, Christoph* (Research), (Biochemistry),† Dr.Sc., 1969, Swiss Federal Institute of Technology (Zurich); metabolism and endocrinology.
Dorsa, Daniel M.* (Research), (Pharmacology),† Ph.D., 1977, California (Davis); gerontology.
Eisenberg, Mickey S., M.D., 1971, Case Western Reserve; emergency medicine.
Emlen, J. Woodruff, M.D., 1972, California (San Diego); rheumatology.
Featherstone, Harvey J., M.D., 1971, Washington; internal medicine.
Fleet, Wendell P., M.D., 1965, Creighton; internal medicine.
Furlong, Clement E.* (Research), (Genetics),† Ph.D., 1968, California (Davis); medical genetics.
Greenberg, Philip D., M.D., 1971, State University of New York (Downstate); oncology.
Greene, H. Leon, M.D., 1969, Johns Hopkins; cardiology.
Griep, Robert J., (Radiology),† M.D., 1958, Texas; internal medicine/radiology.
Halter, Jeffrey B., M.D., 1969, Minnesota; metabolism and endocrinology.
Hammond, William P., M.D., 1972, Tufts; hematology.
Handsfield, Hunter H., M.D., 1968, Columbia; infectious disease.
Harlan, John M., M.D., 1973, Chicago; hematology.
Henderson, William R., Jr., M.D., 1973, California (San Francisco); allergy and infectious disease.
Hirschmann, Jan V., M.D., 1970, Washington; internal medicine.
Howard, Guy A.* (Research), (Oral Biology),† Ph.D., 1970, Oregon; mineral metabolism.
Huebers, Helmet A. (Research), M.D., 1976, Saarlund (West Germany); hematology.
Inui, Thomas S.,* (Health Services),† M.D., 1969, Johns Hopkins; internal medicine.
Kirby, Barbara, M.D., 1974, Washington; emergency medicine.
Larson, Eric B.,* M.D., 1973, Harvard; internal medicine.
Lindner, Armando, M.D., 1964, Buenos Aires; nephrology.
McDonald, George B., M.D., 1967, Washington (St. Louis); gastroenterology.
Meyers, Joel D., M.D., 1970, Harvard; infectious disease.
Nardella, Francis A., M.D., 1968, West Virginia; rheumatology.
Nolan, Charles M., M.D., 1969, Arkansas; infectious diseases.
Olerud, John E., M.D., 1971, Washington; dermatology.
Palmer, Jerry P., M.D., 1970, Upstate Medical (New York); metabolism and endocrinology.
Pearlman, Alan S.,* (Bioengineering),† M.D., 1970, Harvard; cardiology.
Peterson, Malcolm L.,* (Health Services),† Ph.D., 1960, Rockefeller, M.D., 1954, Washington.
Pierson, David J., M.D., 1969, Johns Hopkins; respiratory diseases.
Price, Thomas H., M.D., 1966, Johns Hopkins; hematology.
Reddy, Aram L. (Research), Ph.D., 1972, Pittsburgh; medical genetics.
Robertson, H. Thomas, M.D., 1968, Harvard; respiratory diseases.
Rosen, Henry, M.D., 1972, Rochester; allergy and infectious diseases.
Rudd, Thomas G., (Radiology),† M.D., 1963, Michigan; radiology.
Schuffler, Michael D., M.D., 1966, Illinois; gastroenterology.
Schwindt, Peter C.,* (Physiology and Biophysics),† Ph.D., 1972, Washington.
Shen, Fu Hsiung, M.D., 1965, National Taiwan University, Ph.D., 1969, California (San Francisco); nephrology.
Silverstein, Fred E., M.D., 1967, Columbia; gastroenterology.
Singer, Jack W., M.D., 1968, State University of New York; oncology.
Sobolewski, John S.* (Research), (Computer Science),† Ph.D., 1970, Washington State; cardiology.
Sparkman, Donal R. (Emeritus), M.D., 1934, Pennsylvania.
Spence, Alexander M., (Pathology),† M.D., 1965, Chicago; neurology.
Stamm, Walter E.,* M.D., 1971, Harvard; infectious disease.
Stewart, Douglas K., M.D., 1965, Harvard; cardiology.
Stewart, Patricia, M.D., 1969, West Virginia; oncology.
Sullivan, Keith M., M.D., 1971, Indiana; oncology.
Taborsky, Gerald J., Jr. (Research), Ph.D., 1973, Southern California; metabolism and endocrinology.
Tsoi, Mang-So (Research), Ph.D., 1966, Washington; oncology.
Vestal, Robert E., M.D., 1971, California (San Francisco); clinical pharmacology.
Wilensky, Alan J., (Neurological Surgery),† M.D., 1967, Western Ontario, Ph.D., 1973, Toronto; neurosurgery.
Wilkus, Robert J., (Laboratory Medicine),† M.D., 1962, Loyola.
Willson, Richard A., M.D., 1962, Minnesota; gastroenterology.
Witherspoon, Robert P., M.D., 1970, Baylor; oncology.
Wood, Francis C., Jr., M.D., 1954, Harvard; metabolism and endocrinology.
Wood, Robert W., M.D., 1970, Rochester; internal medicine.

Assistant Professors

Adler, Stephen, M.D., 1976, New York; nephrology.
Ahmad, Suhail, M.B.B.S. (M.D.), 1968, Allahabad (India); nephrology.
Baker, Patricia (Research), Ph.D., 1977, Illinois; nephrology.
Bardy, Gust, M.D., 1977, Northwestern; cardiology.
Beatty, Patrick, M.D., Ph.D., 1975, Chicago; oncology.
Benedetti, Jacqueline K.* (Research), Ph.D., 1974, Washington; infectious disease.
Bensinger, William I., M.D., 1973, Northwestern; oncology.
Bomsztyk, Carol, M.D., 1977, Rochester.
Charan, Nirmal B., M.B.B.S. (M.D.), 1968, Christian Medical College (India); respiratory disease.
Cheung, Marlan C. (Research), Ph.D., 1975, State University of New York (Buffalo); metabolism and endocrinology.
Collins, Steven J., M.D., 1973, Columbia; internal medicine.
Cook, Daniel L. (Research), M.D., 1977, Ph.D., 1980, Washington; neurology.
Cummins, Richard O., M.D., 1972, Case Western Reserve; internal medicine.
Cusack, Barry J., M.D., 1980, University College (Dublin); gerontology.
Doney, Kristine C., M.D., 1972, Michigan; hematology/oncology.
Eriksson, Charles E., M.D., 1969, Washington; cardiology.
Fihn, Stephan, M.D., 1972, St. Louis, M.P.H., 1982, Washington; internal medicine.
Fleckman, Phillip, M.D., 1973, Washington (St. Louis); dermatology.
Franz, Thomas J., M.D., 1965, Oregon; dermatology.
Haakenstad, Alan O., M.D., 1967, Pennsylvania, Ph.D., 1975, Washington; rheumatology.
Harris, Ward E. (Research), Ph.D., 1967, Oregon State; neurology.
Hill, Roger, M.B., 1956, Ch.B., 1962, Otago (New Zealand); oncology.
Ivey, Joel L. (Research), Ph.D., 1971, Oregon; mineral metabolism.

Jong, Elaine C., M.D., 1974, California (San Diego); allergy and infectious disease.

Kennedy, Michael S., M.D., 1974, New Mexico; clinical pharmacology.

Klaff, Leslie J., M.B.B.Ch., 1971, Witwatersrand (South Africa); metabolism and endocrinology.

Knapp, F. Joan (Research), Ph.D., 1972, Queensland (Australia); infectious disease.

Kraning, Kenneth K. (Research), (Environmental Health),† Sc.D., 1964, Pittsburgh; dermatology.

Lee, Minako Y., (Biological Structure),† M.D., 1963, Tokyo Women's Medical College (Japan); hematology.

Lipsky, Benjamin A., M.D., 1973, Cornell; internal medicine.

Liu, Chung-Ching (Research), Ph.D., 1972, Illinois State; mineral metabolism.

Locksley, Richard M., M.D., 1976, Rochester, infectious diseases.

Longstreth, William T., M.D., 1975, Pennsylvania, M.P.H., 1982, Washington; neurology.

Lukehart, Sheila A. (Research), Ph.D., 1978, California (Los Angeles); infectious disease.

Martin, Paul J., M.D., 1974, Pennsylvania; oncology.

Martin, Thomas R., M.D., 1973, Pennsylvania; internal medicine.

Mathews, Meredith W., M.D., 1972, Washington; nephrology.

Matsumoto, Alvin, M.D., 1975, Washington; metabolism and endocrinology.

McGuffin, Robert, M.D., 1973, Washington; oncology.

Morgan, Michael (Research), Ph.D., 1980, Utah; pharmacology.

Ogilvie, James T., M.D., 1963, Harvard; gerontology.

Oram, John F., Jr. (Research), (Orthopaedics),† Ph.D., 1972, Pennsylvania State; metabolism and endocrinology.

Ostenson, Richard C., M.D., 1974, Washington; internal medicine, oncology.

Ott, Susan, M.D., 1974, Washington; nephrology.

Paquette, Thomas L. (Research), Ph.D., 1977, Oregon; metabolism and endocrinology.

Pearlman, Robert A., M.D., 1975, Boston; gerontology.

Pecoraro, Roger E., M.D., 1970, Washington; ambulatory medicine.

Pesando, John, M.D., Ph.D., 1974, Albert Einstein; oncology.

Ralph, David D., M.D., 1972, Stanford; respiratory diseases.

Ramsey, Paul G., M.D., 1975, Harvard; infectious diseases, ambulatory medicine.

Raugi, Gregory J., M.D., Ph.D., 1975, Duke; biochemistry.

Rockey, Paul H., M.D., 1970, Chicago; ambulatory medicine.

Rosenstock, Linda, M.D., M.P.H., 1977, Johns Hopkins; ambulatory medicine.

Ruff, Robert L.,* (Physiology and Biophysics),† M.D., Ph.D., 1972, Washington; neurology.

Sawyer, Thomas K., M.D., 1962, Vanderbilt, nephrology.

Sayers, Merlin H., M.B., B.Ch., 1968, Ph.D., 1978, Witwatersrand (South Africa); hematology.

Schellenberg, Gerard (Research), Ph.D., 1977, California (Riverside); neurology.

Schoene, Robert K., M.D., 1972, Columbia; respiratory diseases.

Schwartz, Robert, M.D., 1974, Ohio State; gerontology.

Starkebaum, Gordon A., M.D., 1970, Columbia; rheumatology.

Stevens, Dennis L., M.D., 1971, Utah; infectious disease.

Stratton, John R., M.D., 1973, Yale; cardiology.

Subbaiah, Papasani V. (Research), Ph.D., 1971, Indian Institute of Science; metabolism and endocrinology.

Surawicz, Christina M., M.D., 1973, Kentucky; gastroenterology.

Tennican, Patrick O., M.D., 1965, Washington; infectious disease.

Torok-Storb, Beverly J. (Research), Ph.D., 1975, Pittsburgh; hematology.

Trobaugh, Gene B., M.D., 1969, Oregon; cardiology.

Uhlman, Richard F., M.D., 1978, Chicago; gerontology.

Weaver, W. Douglas, M.D., 1971, Tufts; cardiology.

Yerby, Mark S., (Neurological Surgery),† M.D., 1976, Vermont; neurosurgery.

Yergan, John, M.D., 1976, Columbia College of Physicians and Surgeons, M.P.H., 1980, Washington; internal medicine, public health.

Instructor

Krishnamurthy, Shoba, M.B.B.S., 1974, Bangalore Medical College (India); gastroenterology.

Course Descriptions

Courses numbered with a P suffix are not graduate courses and are restricted to medical student enrollment only.

MED 498 Undergraduate Thesis (*) AWSpS For medical students. Prerequisite: permission of department.

MED 499 Undergraduate Research (*) AWSpS Case studies, with laboratory research. For medical students. Prerequisite: permission of department.

MED 531P Human Genetics (*) AWSp *Motulsky* Weekly seminar dealing with a variety of topics in medical genetics given by staff of the Division of Medical Genetics and related departments and divisions. Open to medical students with a good foundation in genetics.

MED 533P Clinical Endocrinology (2) Sp *Wood* Emphasis on the most major and dependable symptoms, signs, laboratory tests, and therapy for clinical endocrinopathies. Patient-illustrated.

MED 534P Clinical Respiratory Physiology (2) AWSp *Culver, Hlastala, Hudson* Intermediate-level course in respiratory physiology. Basic physiology, pulmonary function testing, applied physiology to clinical problems, and review of related literature. Covers clinical respiratory physiology in three sequential quarters, but students may register for any single quarter if desired. Prerequisite: permission of instructor. (Twelve weeks.)

MED 535P Prevention of Cardiovascular Disease (2) *Van Citters* Incidence and mortality from cardiovascular disease. Risk factors associated with heart disease. Major epidemiological studies and clinical trials. Controversies in prevention. Approaches to patient education and modification of behavior associated with high risk of cardiovascular disease.

MED 548P Genetics, Medicine, and Society (1) WSp *Motulsky, Omenn* Students and faculty discuss in lectures and seminars the aspects of genetics relevant to medicine and society. Prerequisite: completion of human biology series.

CONJ 550P Clinical Infectious Diseases (3) See Conjoint Courses.

CONJ 553 Nutrition for Physicians (2) See Conjoint Courses.

MED 604P Clinical Preceptorship in Internal Medicine (8) AWSpS *Hamon* (Bremerton), *Thorson* (Longview) Working closely with primary-care physicians, the student is exposed to the private practice of internal medicine in a small community. Operating on a one-to-one basis with an internist (tutor), the student evaluates and manages inpatients and outpatients on a primary care, consultative, and emergency basis. Prerequisite: 665P. (Four weeks, full time.)

MED 640P Dermatology Clinic (*, max. 5) AWSpS *Odland* Students attend dermatology clinic on Monday mornings and Thursday afternoons for twelve weeks. Two half-days per week. Prerequisite: 665P.

MED 641P Clinical Gastroenterology (8) AWSp *Gelfand* (Virgina Mason Hospital) Combined inpatient-outpatient elective in clinical gastroenterology, which includes practical experience in GI endoscopy and liver biopsy. Directed tutorial work. Special arrangements can be made for students with special interests. Prerequisite: 665P. (Four weeks, full time.)

MED 642P Clinical Oncology (*, max. 24) AWSpS *Buckner, Thomas* (Fred Hutchinson Cancer Research Center) Students functioning as primary physicians are responsible for the workups and daily care of patients receiving marrow transplants, high-dose chemotherapy or immunotherapy on an intensive-care research ward. Emphasis is on the management and supportive care of patients with pancytopenia and immunosuppression, transplantation biology, cancer chemotherapy, and infectious disease problems. Prerequisite: 665P. (Four, six, or twelve weeks.)

MED 643P Clerkship in Clinical Pharmacology (*, max. 12) AWSpS *Robertson* Clinical problems related to drugs from joint points of view of physicians and pharmacists. Daily ward rounds at University Hospital with pharmacy service during which drug-related problems are reviewed. Additional experience can be gained at Children's Orthopedic Hospital and Medical Center, in the Poison Control Center, and in research laboratories where drug-related research and cellular receptor-related research is conducted. Register for five days per week. Prerequisite: permission of instructor.

MED 644 Management of Sexually Transmitted Diseases (1-3, max. 9) AWSpS *Corey, Handsfield, Holmes, Stamm* Instruction and clinical experience in diagnosis, treatment, and management of sexually transmitted diseases. Four four-hour sessions at Harborview STD clinic. Instruction in genitourinary physical examination skills; relevant laboratory techniques and management of patients with STDs. Prior to the elective, each student must review a packet of didactic materials.

MED 645P Clinical Endocrinology and Geriatric Medicine (8) AWSpS *Bremner, Halter* Students spend one-half time on endocrinology and one-half time on geriatric medicine services. Two one-half-day outpatient clinics per week, plus inpatient endocrinology and geriatric consultation services. Prerequisite: 665P.

MED 649P Application of Genetic Principles to Medicine (*) AWSpS *Motulsky, Stamatoyannopoulos* Ward rounds, clinic, and seminar discussions of patients and topics in clinical genetics. Students must be available all day Mondays or Tuesdays to attend a medical genetics clinic and be available for ward rounds Wednesday afternoons. Course includes taking pedigrees from patients, examining patients and families with genetic diseases, and discussing cases with faculty. Prerequisite: 665P.

MED 665P Clinical Clerkship (*, max. 24) Third-year medical students assume increasing responsibility for care of hospitalized patients in a teaching-hospital setting. Daily rounds with resident and attending physicians, with lectures and conferences. Progress evaluated by supervising physicians and a written examination. (Twelve weeks, full time.)

MED 666P Advanced Clinical Clerkship in Internal Medicine—WAMI (12) AWSpS *Wallace* Advanced clinical preceptorship in internal medicine in three small urban communities. Supervised, structured experience in dealing with situations commonly encountered by the practicing internist. Continuity of care and the relationship between care given in the ambulatory setting and in the hospital, as well as by other community health services, is emphasized. Prerequisite: 665P. (Six weeks, full time. Limit: six students.)

CONJ 677P Clinical Allergy (*, max. 12) See Conjoint Courses.

MED 678P Clinical Dermatology (8) AWSpS *Odland* Participants in dermatology clinics and inpatient consultations at University Hospital, Harborview Medical Center, Pacific Medical Center, Veterans Administration Hospital, and Children's Orthopedic Hospital and Medical Center. Journal club and clinical conferences each week with entire staff. A continuing series of teaching seminars and weekly dermatopathology conferences. Prerequisite: 665P. (Four weeks.)

MED 679P Clinical Gastroenterology (*, max. 12) AWSpS *Valwiler* (University Hospital) Participation in consulting ward rounds, procedures, conferences, and selected clinics with full-time divisional staff at University and Veterans Administration hospitals, and at Pacific and Harborview medical centers, plus directed tutorial work. Prerequisite: 665P. (Four or six weeks, full time.)

MED 680P Rheumatology (8) AWSp *Mannik* Full-time inpatient-outpatient clerkship in rheumatology. Clinical experience provided in diagnosis and treatment of rheumatic diseases, utilizing outpatient clinics and hospitalized patients at the University Hospital and the Harborview Medical Center. Emphasis on concepts in pathophysiology, diagnosis, and treatment of these diseases. In addition to patient contact, reading, seminars, and preceptorial sessions are the methods of instruction. Prerequisite: 665P.

MED 681P Advanced Clinical Endocrinology (*, max. 24) AWSpS *Paulsen* (Pacific Medical Center) Full-time inpatient-outpatient clerkship in clinical endocrinology at Pacific Medical Center. Library review on selected topics in the field and participation in medical clinical research problems optional during this clerkship. Prerequisite: 665P. (Four, six, or twelve weeks.)

MED 682P Clinical Cardiology and Electrocardiography (8) AWSpS *Bruce* (University Hospital), *Cobb* (Harborview Medical Center), *Eiriksson* (Boise Veterans Administration Medical Center), *Kennedy* (Veterans Administration Hospital), *Leftik* (Madigan Hospital Medical Center), *Preston* (Pacific Medical Center) Clerkship in clinical cardiology-combined inpatient-outpatient assignments, ECG interpretation. Prerequisite: 665P. (Four weeks.)

MED 683P Clinical Respiratory Disease and Critical Care Medicine (8) AWSpS *Culver* Training in respiratory disease diagnosis and pulmonary therapy, with special emphasis on cardiopulmonary function testing and interpretation. Inpatient and outpatient teaching rounds, conferences, and basic science integration. Prerequisite: 665P. (Four weeks.)

MED 684P Clinical Hematology/Oncology (*, max. 24) AWSpS Outpatient and inpatient experience with hematologic/oncologic disorders. The elective includes teaching rounds, conferences, and evaluation of laboratory work. Prerequisite: 665P. (Four weeks.)

MED 685P Clinical Genetics (*, max. 12) AWSpS *Motulsky, Stamatoyannopoulos* Intensive study of genetic principles required in clinical work. May work in depth on one or more clinical problems or get broader experience in working up a variety of clinical cases. Prerequisite: 665P. (Six weeks.)

MED 686P Clinical Neurology (*, max. 8) AWSpS *Swanson* Inpatient and outpatient experience at University Hospital, Veterans Administration Hospital, Pacific Medical Center, Harborview Medical Center, Virginia Mason Hospital, American Lake Veterans Administration Hospital, or Children's Orthopedic Hospital and Medical Center. Students attend clinical conferences and seminars with neurology staff and become familiar with diagnostic neurological procedures. (Four weeks. Limit: ten students.)

MED 687P Ambulatory Medicine Elective (*, max. 12) AWSpS *Clark* (Harborview Medical Center), *Featherstone* (University Hospital) Students acquire knowledge and skill in dealing with ambulatory patients with problems commonly encountered in the office practice of internal medicine. Prerequisite: 665P or FAMED 665P. (Twelve weeks. Limits: five students at University Hospital, four students at Harborview Medical Center.)

MED 688P Ward Medicine Subinternship (*, max. 24) AWSpS *Rosen* (Swedish Hospital Medical Center), *Emlen* (Pacific Medical Center), *Leftik* (Madigan Hospital Medical Center), *Turck* (Harborview Medical Center), *Goodell* (Providence Medical Center) Students act in the capacity of interns on the medical wards under supervision of house staff and visiting physicians. They attend all regular medicine rounds and conferences as their schedules permit. Prerequisite: 665P. (Four or six weeks.)

MED 689P Clinical Infectious Diseases (*, max. 12) AWSpS *Kirby* (University Hospital) Students participate in the consulting service throughout the hospital, attend daily plate rounds, conferences, and seminars. (Two, four, or six weeks.) *Count* (Harborview Medical Center), *Holmes* (Pacific Medical Center), *Plorde* (Veterans Administration Hospital) Participate in consulting service throughout hospital to learn microbiological aspects of infectious diseases through the clinical laboratories. Prerequisite: 665P. (Four weeks.)

MED 690P Cardiology Subinternship (8) AWSpS *Bruce* Students act in the capacity of interns on the white service under the supervision of house officer. Prerequisite: 665P. (Four weeks.)

MED 692P Clinical Endocrinology and Metabolism (*, max. 12) Inpatient rounds, conferences, and outpatient clinics at University Hospital and Harborview Medical Center (two weeks each). Directed tutorial work in selected aspects of endocrinology and metabolism. Madigan Hospital Medical Center: 600-800 endocrine patients per month in both outpatient clinic and inpatient consult. Flexible schedule possible. Prerequisite: 665P.

MED 693P Nephrology and Fluid Balance (8) AWSpS *Couser* (University Hospital), *Sherrard* (Veterans Administration Hospital), *Matthews* (Pacific Medical Center) Students see clinical nephrologic problems under close supervision, participate in nephrology and transplant rounds, see consults with renal fellow and attending, and work up patients in renal clinics, participate in seminars with clerks from all three hospitals. Prerequisite: 665P. (Four weeks.)

MED 694P Metabolism and Diabetes (4 or 8) AWSp *Nielsen* (Virginia Mason Clinic) Clinical evaluation of patients with endocrine disorders. Student becomes actively involved in the treatment of metabolic disorders, with particular emphasis on the education of the diabetic and on the control of his disorder. Open only to fourth-year medical students. Prerequisite: 665P. (Two or four weeks, full time.)

MED 695P Clinical Aspects of Aging (*, max. 8) AWSpS *Pelletier* (American Lake Veterans Administration Hospital), *Uhlmann* (Harborview Medical Center) American Lake: Pathophysiology and disease processes associated with aging. Harborview: Work with elderly patients as subintern with Senior Care Program. Inpatient and ambulatory setting in nursing homes and patients' homes. Interdisciplinary approach.

MED 697P Medicine Special Electives (*, max. 24) AWSpS *Ramsey* Special clerkship, externship, or research opportunities that can at times be made available at institutions other than University of Washington. Faculty can advise students of opportunities. Students wishing to elect this course should obtain from Dean's office a special assignment form at least three months before preregistration. Prerequisite: permission of department. (Six or twelve weeks.)

Microbiology and Immunology

G305 Health Sciences

Microbiology is a natural science that deals with microscopic organisms, including bacteria, viruses, fungi, protozoa, and algae. It is concerned with the nature and properties of these organisms, their effects on man and the environment, and how microorganisms can be exploited to provide useful products.

Immunology is a natural science that deals with specific and nonspecific resistance to tissue injury by both foreign and self substances. The mechanisms of resistance involve primarily the activities of leukocytes and antibodies, including those concerned with the specific immune response.

Undergraduate Program

Bachelor of Science Degree

Admission Requirements: A minimum of 75 credits with overall grade-point average of 2.25 in required chemistry and biology courses. Students should complete departmental requirements in biology and in inorganic and organic chemistry before applying for admission to the major.

Major Requirements: 45 credits in biological science, including BIOL 210, 211, 212 (preferred) or an equivalent 10 to 15 credits in botany or zoology, or both; a minimum of 30 credits in microbiology courses and approved electives, including MICRO 400, 401, 402, 431, 441, 442, and 443, (MICRO 101, 301, 302, 319 cannot be used); a minimum grade-point average of 2.25 in the required microbiology courses as well as in the entire 30 credits of microbiology and approved electives; PHYS 114, 115, 116, or 121, 122, 123; CHEM 140, 150, 151, 160; CHEM 231, 232 or 231, 235, 236 or 335, 336, 337 (three-quarter sequence preferred); CHEM 321, MATH 124 or 157 or Q SCI 381 or 291. Transfer students must complete at least 15 of the 30 credits of required microbiology and immunology courses at this university.

Graduate Program

The Department of Microbiology and Immunology offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. Students interested in graduate work should obtain the necessary application forms from the department.

The choice of an adviser and research problem is a matter of mutual consent between the student and a faculty member. The course work taken by a graduate student depends to a certain extent upon his or her background and chosen area of specialization, but, in general, courses are chosen from the fields of microbiology, immunology, biochemistry, genetics, and pathobiology. Students whose primary interests are in animal virology or immunology are encouraged to take courses in general histology and pathology. The master's degree program without thesis is available on a limited basis. An M.S. degree is not necessarily a prerequisite for the Ph.D. degree.

Applicants are evaluated by a committee that considers the student's grades, scores on the Graduate Record Examination, letters of recommendation, and any other data that might provide an indication of the student's capabilities for success in a career in science. An average number of ten students are accepted for the Ph.D. degree program of the approximately 150 that apply.

Students are normally admitted into the graduate program only in Autumn Quarter, and all application materials should be received by the department no later than the preceding February 1. Graduate Record Examination aptitude scores are required as part of the application, and the examination should be taken no later than in December. Three letters of recommendation also must be sent directly to the department.

Students with a variety of academic backgrounds are accepted for graduate study in microbiology or immunology, but it is highly desirable that their undergraduate preparation include at least a year of general chemistry and a year of college physics, courses in organic chemistry and quantitative analysis, calculus, one year of biology, courses in genetics, microbiology, and/or immunology.

Students in the Ph.D. program are usually supported by funds from training grants, research grants, or teaching assistantships.

Correspondence and information: Graduate Program Coordinator, Department of Microbiology and Immunology, SC-42.

Faculty

Chairperson

Eugene W. Nester

Professors

Birdsell, Dale C.,* (Oral Biology),† Ph.D., 1967, California (Riverside); structure and function of surfaces of oral bacteria and their activation of host responses leading to oral diseases.

Buchanan, Thomas M.,‡ (Medicine, Pathobiology), M.D., 1967, Washington; microbial pathogenesis.

Champoux, James J.,* (Genetics), Ph.D., 1970, Stanford; DNA replication, tumor virology.

Douglas, Howard C. (Emeritus), Ph.D., 1949, California (Berkeley); microbiology, immunology and genetics.

Evans, Charles A. (Emeritus), M.D., 1937, Ph.D., 1943, Minnesota; microbial flora of human skin.

Gilliland, Bruce C.,*‡ (Laboratory Medicine, Medicine), M.D., 1960, Northwestern; complement and immunologic mechanisms of injury in human disease and immune complex disorders.

Gordon, Milton P.,*‡ (Biochemistry), Ph.D., 1953, Illinois; biochemistry of plant tumors.

Groman, Neal B.,* Ph.D., 1960, Chicago; gene flow, evolution, medical microbiology.

Hakomori, Sen-itirch,* (Pathobiology),† M.D., 1952, D.Med.Sci., 1956, Tohoku (Japan); membrane biochemistry as related to neoplasia.

Hellström, Ingegerd E.,* M.D., 1964, Ph.D., 1966, Karolinska Instit. (Sweden); tumor immunology and transplantation immunology.

Hellström, Karl E.,*‡ (Pathology), M.D., Ph.D., 1964, Karolinska Instit. (Sweden); oncology, cancer immunology.

Holmes, King K.,*‡ (Epidemiology, Medicine), M.D., 1963, Cornell, Ph.D., 1967, Hawaii; clinical epidemiology and pathogenesis of infectious diseases, specifically sexually transmitted diseases.

Kenny, George E.,*‡ (Pathobiology), Ph.D., 1961, Minnesota; antigenic structure.

Klebanoff, Seymour J.,*‡ (Medicine), M.D., 1951, Toronto, Ph.D., 1954, London (England); host defense mechanisms against bacterial, viral, fungal, and parasitic agents, with particular regard to microbicidal mechanisms in phagocytes (neutrophils, eosinophils, mononuclear phagocytes).

Mannik, Mart,*‡ (Medicine), M.D., 1959, Case Western Reserve; immunologic mechanisms of tissue injury and characteristics of antigen-antibody complexes.

Nester, Eugene W.,* Ph.D., 1959, Western Reserve; microbial genetics and biochemistry, Crown-gall tumors.

Ordal, Erling J. (Emeritus), Ph.D., 1936, Minnesota; microbiology and immunology.

Plorde, James J.,*‡ (Laboratory Medicine, Medicine), M.D., 1959, Minnesota; studies of applied diagnosis microbiology and pathogenesis.

Schoenknecht, Fritz D.,* (Laboratory Medicine),† M.D., 1957, Freie (Berlin); clinical microbiology; *in vitro* antibiotic susceptibility testing, anaerobic microbiology, nosocomial infections.

Sherris, John C.,* (Laboratory Medicine, Pathobiology), M.D., 1950, London; medical microbiology, antibiotic action and resistance.

Staley, James T.,* Ph.D., 1967, California (Davis); microbial ecology, general microbiology.

Storb, Ursula B.,* M.D., 1960, Freiburg; immunology with emphasis on mechanisms of antibody synthesis and genetics of immunoglobulins.

Weiser, Russell S. (Emeritus), Ph.D., 1934, Washington; microbiology and immunology.

Whiteley, Helen R.,* Ph.D., 1951, Washington; regulation of transcription in phage-infected bacteria, development biology.

Associate Professors

Clagett, James A.,* (Periodontics),† Ph.D., 1970, Nebraska; cellular immunology-monocyte and -lymphocyte differentiation in the bone marrow.

Corey, Lawrence,* (Laboratory Medicine),† M.D., 1971, Michigan; virology, infectious disease, herpes viruses.

Coyle, Marie B.,* (Laboratory Medicine),† Ph.D., 1965, Kansas State; clinical microbiology, antibiotic susceptibility.

Greenberg, Philip D.,‡ (Medicine), M.D., 1971, State University of New York (Downstate); oncology.

Lara, Jimmie C.,* Ph.D., 1970, California (Riverside); microbial physiology and cytology, sporulation and gas vesicle synthesis and regulation.

Linial, Maxine L.* (Research), Ph.D., 1970, Tufts; genetics and molecular biology of RNA tumor viruses, interaction of host and viral genomes.

Minshew, Barbara H.,*‡ (Laboratory Medicine), Ph.D., 1972, Texas Southwestern; surgical infection, antibiotic susceptibility testing, microbial virulence.

Assistant Professors

Lidstrom, Mary E.,* (Oceanography), Ph.D., 1977, Wisconsin; microbial physiology, one-carbon metabolism, general microbiology.

Lory, Stephen, Ph.D., 1980, California (Los Angeles); biochemistry and genetics of microbial virulence factors.

Raff, Howard V.,* Ph.D., 1977, Washington State; interaction mechanisms between lymphocytes and macrophages leading to expression of immune activity.

Rohrschneider, Larry R.,* (Research), Ph.D., 1973, Wisconsin; mechanism of transformation by avian sarcoma viruses, *src* gene product.

Stanton, Thomas H.,* Ph.D., 1974, Alabama; immunogenetics, cell interactions in the immune response.

Tenover, Fred C.,‡ Ph.D., 1980, Rochester; marrow transplantations.

Wilson, Ronald E. (Research), Ph.D., 1975, Chicago; molecular biology of immunoglobulin genes and genes associated with T-cell function.

Wong, Timothy Chee-Hing, Ph.D., 1979, Texas Southwestern Medical School; pathogenesis of slow viruses, tumor virology.

Yoshimura, Fayth K.* (Research), Ph.D., 1972, Yale; molecular biology of RNA tumor viruses, regulation of transcriptional control and mechanisms of leukemogenicity.

Lecturers

Barnes, Glover W.,* (Urology),† Ph.D., 1962, New York (Buffalo); tissue antigens, immunoreproduction and microbiology.

Bicknell, Mary E., M.S., 1962, Washington; microbiology laboratory teaching.

Cramer, Dorothy I. (Emeritus), B.S., 1945, Washington; microbiology laboratory teaching.

Fulton, Janis R., M.S., 1977, Montana State; microbiology, laboratory teaching.

Laxson, Carol F., M.S., 1959, Wisconsin; microbiology laboratory teaching.

Memmer, Ramona J., M.S., 1959, Washington; microbiology laboratory teaching.

Parkhurst, Dale J., B.S., 1960, Washington; microbiology laboratory teaching.

Course Descriptions

Courses for Undergraduates

MICRO 101 The Microbial World (5) W For majors in the social sciences and humanities, but open to premajors and to science majors other than biologists. Activities of bacteria, viruses, or other microorganisms and their interactions with humans and their environment are examined and a number of major biological concepts developed. Topic material and inclusion of a laboratory vary with individual instructors.

MICRO 301 General Microbiology (3) AWSpS *Nester, Staff* Acquaints students with microorganisms and their activities. Topics include microbial cell structure and function, metabolism, microbial genetics, and the role of microorganisms in disease, immunity, and other selected applied areas. Prerequisite: two quarters of chemistry; recommended: a course in biological science.

MICRO 302 General Microbiology Laboratory (2) AWSpS *Bicknell, Fulton, Laxson* Laboratory course primarily for students taking 301. Covers a variety of microbiological techniques, with experiments designed to illustrate major concepts of microbiology, virology, and immunology. No auditors. Prerequisite: concurrent or previous registration in 301 or permission of instructor.

MICRO 319 Laboratory Techniques in Microbiology (1) AWSp *Parkhurst* Self-instruction laboratory. Student performs the techniques fundamental to microbiology. Instructional material presented in visual, audiovisual, and written form. Not recommended for those who have taken a laboratory in microbiology. Prerequisite: prior or concurrent enrollment in a microbiology course or permission of instructor.

MICRO 320 Media Preparation (2) AWSpS *Parkhurst* Practical work in the preparation of culture media. Nutritional requirements of microorganisms and sterilization methods are considered. For students expecting to enter vocations involving laboratory work with bacteria. Offered on credit/no credit basis only. Prerequisites: 301 and 302, or equivalent, and permission of instructor.

MICRO 322 Applied Clinical Microbiology (5) AWSp *Schoenknecht* Practical experience in a clinical or public health laboratory; fifteen hours per week. For students majoring in medical microbiology. Three quarters advance sign-up in G303 Health Sciences recommended. Applicants are selected by interview. Prerequisites: 443 and permission of instructor. (Limit: three students.)

MICRO 400 Fundamentals of General Microbiology (3) A *Whiteley* Survey of the microbial world, metabolism, biosynthesis, regulation, growth, structure, and function. Required for students majoring in microbiology; recommended for students majoring in biology. Prerequisites: BIOL 210, 211, 212 and two quarters of organic chemistry.

MICRO 401 Fundamentals of General Microbiology (3) W *Lidstrom* Structure, biochemical properties, and genetics of the major groups of procaryotes, and viruses. Required for students majoring in microbiology, recommended for students majoring in biology. Prerequisite: 400 or permission of instructor.

MICRO 402 Fundamentals of General Microbiology Laboratory (3) AW *Bicknell, Fulton, Laxson* Isolation of a broad range of nonpathogenic bacteria from natural sources, using selective and enrichment techniques, with microscopic and biochemical identification. Related exercises include genetics, quantitation, and growth kinetics. Prerequisite: 400, which may be taken concurrently, or permission of instructor.

UCONJ 420 Biological Safety Practices (1) A For course description, see Interschool or Intercollege Programs.

MICRO 431 Methods in Microbiology (2) Sp *Bicknell, Groman, Lidstrom, Staley* Laboratory exercises emphasizing methods used in microbial metabolism, virology, and ecology. Limited to microbiology majors. No auditors. Prerequisites: 400, 401, 402.

MICRO 432 Mechanisms of DNA Exchange in Procaryotes (2) Sp *Champoux, Groman, Nester* Emphasizes mechanisms of DNA exchange in procaryotic organisms, particularly those functioning in bacteria. Prerequisite: 400 or BIOL 210, or equivalent.

MICRO 435 Microbial Ecology (3) W *Staley* Consideration of the various roles that microorganisms, particularly bacteria and bluegreens, play in environmental processes. The interrelationships among microorganisms and the effects of the physical, chemical, and biological properties of their environment are discussed and assessed. Prerequisites: 400 and 401 or equivalent, or permission of instructor.

MICRO 440 Introductory Bacteriology for Medical Technologists (1) A Limited introduction to basic microbiology, with focus on structure, metabolism, and genetics of medically important organ- isms. Prerequisite: medical technology student, or permission of instructor.

MICRO 441, 442 Immunology, Medical Bacteriology, and Virology (3,3) A,W *Raff, Stark, Staff* 441: basic immunological concepts, host-parasite relationships, and study of pathogenic bacteria. 442: continuation of 441, followed by consideration of pathogenic viruses. Laboratory course, 443, coordinates. Prerequisites: 10 credits in basic biology, 6 credits in organic chemistry and previous or concurrent course work covering procaryotic cell structure and function (e.g., 400 or 440—1 credit); 441 for 442.

MICRO 443 Medical Microbiology Laboratory (3) AW *Coyle, Memmer, Schoenknecht* Required for medical technology students, microbiology majors; elective for medical students. Procedures for isolation and identification of pathogenic bacteria, testing their susceptibility to antibiotics. No auditors. Prerequisites: 441, 442 sequence taken concurrently or HUBIO 521P.

MICRO 444 Medical Mycology and Parasitology (4) Sp *Coyle, Laxson* Consideration of medically important fungi and parasites, with emphasis on their biology in relation to disease and its laboratory diagnosis. For medical technology students, microbiology majors, and medical students as an elective. No auditors. Prerequisites: basic biology and permission of instructor.

MICRO 447 Fundamentals of Immunology (3) Sp *Stanton* For undergraduate and graduate students. Synthesis, nature, fate, and activities of antibodies, antigen-antibody interactions, mechanisms of antibody-mediated and cell-mediated immunity, hypersensitivity, genetic control of immune responses, tissue transplantation, tumor immunology, autoimmune disease. Prerequisites: 441 or HUBIO 520P, or equivalent, and upper-division standing.

CONJ 448 Fundamental Immunology Laboratory (2) A See Conjoint Courses.

MICRO 450 Molecular Biology of Viruses (3) Sp *Champoux* Introduction to the molecular biology of viruses and virus-host relationships. Designed for advanced undergraduates and graduate students in the biological sciences. Coverage includes bacterial and animal viruses, the nature of infection, the variety of virus-host relationships, and discussion of some models of viral pathogenesis. Prerequisites: 400, 401, and/or GENET 451.

MICRO 453 Pathogenic Microbiology (4) Sp *Birdsell, Groman* Introduction to concepts and techniques of general microbiology, to major groups of infectious agents affecting the human body, and to mechanisms and models of pathogenesis. Prerequisites: BIOL 210, 211, 212, or equivalent and some basic immunology; for dental students, others by permission of instructor.

MICRO 495- Honors Undergraduate Research (*-) AWSpS *Stanton* Specific problems in microbiology or immunology. Prerequisite: permission of honors adviser.

MICRO 496 Undergraduate Library Research (2) AWSpS *Nester* Introduction to library research and to the microbiological literature. Topics are assigned and supervised by staff members. Offered on credit/no credit basis only. Prerequisite: permission of instructor; senior standing desirable.

MICRO 497 Microbiology Special Electives (*) AWSpS Special clerkships, externships, or research opportunities are occasionally available at institutions other than the University of Washington. Obtain from the Dean's office a special assignment form and contact the Chairperson of the Department of Microbiology and Immunology at least one month before preregistration. Limited to medical students. Prerequisite: permission of instructor.

MICRO 498 Undergraduate Thesis (*) AWSpS For medical students. Prerequisite: permission of instructor.

MICRO 499- Undergraduate Laboratory Research (*-) AWSpS *Stanton* Specific problems in microbiology or immunology. Prerequisite: permission of departmental adviser; senior standing desirable. Offered on credit/no credit basis only.

Courses for Graduates Only

MICRO 500 Introduction to Research (*, max. 20) AWSpS *Nester* Introduction to research areas of the faculty and the techniques employed in their investigations. Offered on credit/no credit basis only. Prerequisites: graduate standing in microbiology or immunology or permission of instructor.

MICRO 506 Techniques in Electron Microscopy of Microorganisms (3) Sp *Lara* Techniques used in the preparation of microorganisms for electron microscopy, the operation of the electron microscope, and the photographic reproduction of observations. Offered on credit/no credit basis only. Prerequisites: major in a biological science and permission of instructor.

MICRO 510 Physiology of Bacteria (3) W *Whiteley, Staff* Fundamentals of physiological and metabolic processes of bacteria with emphasis on the synthesis of cellular constituents and mechanisms. Prerequisites: 400 and BIOC 440, 441, 442, or permission of instructor. (Offered alternate years; offered 1985.)

MICRO 512 Physiology of Gene Expression (1, max. 15) AWSpS *Whiteley* Weekly one-hour seminar in which students discuss current literature dealing with selected aspects of microbial physiology. Offered on credit/no credit basis only. Prerequisites: 400, GENET 552, 553, BIOC 440, 441, 442, and permission of instructor.

MICRO 520 Seminar (1) AWSp *Staley* May be repeated for credit. Offered on credit/no credit basis only.

MICRO 525 Cell Surface Membrane in Cell Sociology and Immunology (2) Sp *Hakomori* Structure and function of cell surface membranes in relation to various immunobiological and pathobiological phenomena (differentiation, organization, infection, and cancer, etc.). Offered jointly with PABIO 525. Prerequisites: 447, BIOC 440, 441, 442, and permission of instructor.

MICRO 530 Advanced General Microbiology (4) A *Lidstrom, Staley* Enrichment, isolation, and comparative morphology and physiology of selected bacteria. Open to qualified undergraduates. Prerequisites: 400, 401, and 402, or equivalent, and permission of instructor.

MICRO 532 Seminar in General Microbiology and Microbial Ecology (1, max. 15) AWSp *Lidstrom* Weekly one-hour seminar and discussion concerning selected topics of current research interest in the areas of general microbiology and microbial ecology. Offered on credit/no credit basis only. Prerequisites: 400, 401, and permission of instructor.

MICRO 540 Virology (3) W Lecture-seminar course concerning host-viral interactions. Immunological and genetic approaches are emphasized. Prerequisite: permission of instructor. (Offered alternate years; offered 1985.)

MICRO 550 Selected Topics in Immunology (2, max. 18) ASp Formal seminar-discussion course for advanced students focused on recent developments in the field of immunology and consisting of literature research and intensive in-depth study of important and timely topics. Two-hour seminars semimonthly and a comprehensive final examination. Offered on credit/no credit basis only. Prerequisites: 447 or equivalent and permission of instructor.

MICRO 553 Pathogenesis of Infectious Diseases of Man (4) W *Groman, Raff, Sherris* Lecture course on mechanisms of microbial infection and pathogenicity. Host-parasite interactions of selected models are explored on biochemical, physiological, and immunological levels. Prerequisites: 441, 442 or HUBIO 521P, PATH 444 or HUBIO 520P, BIOC 405 or HUBIO 521P and permission of instructor. (Offered alternate years; offered 1986.)

MICRO 554 Seminar in Molecular and Medical Microbiology (1, max. 15) AWSpS *Groman, Raff, Sherris* Weekly one-hour seminar in which recent advances in molecular biology and medical microbiology or the current research of the participants is presented and discussed critically. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 555 Advanced Clinical Microbiology (2½) AWSpS *Schoenknecht, Sherris* Attendance at daily plate rounds of the Division of Clinical Microbiology. Designed to increase understanding of clinical microbiological work and its application to the care of the patient. Offered on credit/no credit basis only. Prerequisites: 443 and permission of instructor.

MICRO 556 Clinical Microbiology Training and Research (*, max. 12) AWSpS Training in clinical microbiology and research. Attendance at daily laboratory rounds in addition to bedside training and research. For medical students and microbiology graduate students only. Offered on credit/no credit basis only. Prerequisites: 443 and permission of instructor.

CONJ 561 Tumor Biology (2) W See Conjoint Courses.

MICRO 570 Advanced Immunology I: Molecular Immunology (2) W *Storb* For graduate students and upper-division undergraduates. Together with 571 and CONJ 572, the course provides an in-depth treatment of basic immunology. Part I: Structure, function, and gene organization of immunoglobulins, histocompatibility, and complement. Prerequisites: 447 or equivalent, biochemistry, genetics. (Offered every three years; offered 1985.)

MICRO 571 Advanced Immunology II: Cellular Immunology (2) W For graduate students and upper-division undergraduates. Together with 570 and CONJ 572, the course provides an in-depth treatment of basic immunology. Part II covers the cellular mechanisms of antibody synthesis, the activities of T- and B-cells, the mechanisms of cell-mediated immunity, and regulation of the immune response. Prerequisites: 447 or equivalent, biochemistry, genetics. (Offered every three years; offered 1986.)

CONJ 572 Advanced Immunology III: Immunopathology (2) W See Conjoint Courses.

MICRO 573 General Immunology Seminar (1, max. 15) AWSp *Wilson* Weekly one-hour seminar in which original research results are presented and discussed. Occasional seminars are concerned with review of important topics in immunology, but the emphasis, in general, is on new and original contributions to the field. Offered on credit/no credit basis only. Prerequisites: firm background in immunology and permission of instructor.

MICRO 574 Antibody Response (1, max. 15) AWSpS *Storb* Weekly one-hour seminar in which subcellular aspects of antibody synthesis are discussed with current research findings presented. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 576 Basic Tumor Immunology (1, max. 15) AWSpS *Hellström* Weekly one-hour seminar. Current research findings. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 577 Cellular Immunity (1, max. 10) AWSpS *Clagett* Weekly one-hour seminar in which cellular aspects of B- and T-cell differentiation and their role in disease processes are discussed and current research findings presented. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 578 Cellular Immunology (1, max. 10) AWSpS *Raff* Weekly one-hour seminar in which various aspects of cellular immunology are discussed together with current research findings. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 585 Research in Cell and Molecular Biology (1, max. 15) AWSp *Champoux* Weekly research seminar. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 599 Topics in Microbiology and Immunology (*, max. 6) AWSpS Current problems in microbiological or immunological research. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

MICRO 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

MICRO 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

MICRO 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Neurological Surgery

RR744 University Hospital

The Department of Neurological Surgery is dedicated to teaching and research in the entire spectrum of diseases of the central and peripheral nervous system. Instruction in this area is provided for medical students and postgraduate physicians.

The department's medical student instruction includes participation in the human biology curriculum as well as in elective basic science and clinical experiences. These are available at University Hospital and Harborview Medical Center, including the Epilepsy Center at Harborview. The department also has several course offerings correlating research and clinical problems of the nervous system, including the neuroscience research seminar, and clinical and basic science correlates of the epilepsies.

Selected medical students also may elect research experience within the Department of Neurological Surgery. The department research facilities are housed in the Medical Research Tower of the University Hospital, at Harborview Hall, and at the Epilepsy Center at Harborview. Investigations are under way at these institutions in many areas of neurophysiology, in behavioral research in man and primates, in light and electron microscopic examination of the anatomy of the nervous system, and in cerebral vascular physiology. Particular research interests encompass the basic aspects of animal models of such disease processes as epilepsy, including confirmation from human material, and the mechanisms and pathways of pain.

In addition to undergraduate instruction, a fully certified residency program in neurological surgery is available for selected postgraduate physicians. The seven-year program emphasizes preparation for a career in academic neurosurgery.

Faculty

Chairperson

H. Richard Winn

Professors

Canfield, Robert C.,*‡ (Dentistry), D.D.S., 1951, Washington; tooth pulp, dental pathways, pain.

Chatrian, Gian E., (Laboratory Medicine),† M.D., 1951, Naples; electroencephalography and clinical neurophysiology.

Harris, A. Basil, M.D., 1954, Alabama; neurosurgery, neuroanatomy, microvascular, arteriovenous malformations, epilipsy mechanisms, cortex, biochemical, blood flow.

Kelly, William A., M.D., 1954, Cincinnati; neurosurgery, neuroendocrinology, microneurosurgery, cerebrovascular, gross surgical anatomy of brain, rheology and endocrinology.

Levy, René H.,* (Pharmaceutics),† Ph.D., 1970, California (San Francisco); biopharmaceutics, neurophysiology, epilepsy.

Lockard, Joan S.,* (Psychology),† Ph.D., 1963, Wisconsin; primatology, epilepsy, sociobiology, animal models and behavior.

Loeser, John D., M.D., 1961, New York University; pain, neurophysiology.

Ojemann, George A., M.D., 1959, Iowa; neurophysiology, organization of higher functions in human brain, language, memory.

Ward, Arthur A., Jr., M.D., 1942, Yale; neurological surgery.

Westrum, Lesnick E.,* (Biological Structure),† M.D., 1963, Washington, Ph.D., 1966, University College (London); neuroanatomy, synaptology, plasticity, olfactory and trigeminal systems, dental pathways.

Winn, H. Richard, M.D., 1968, Pennsylvania; cerebral blood flow regulation.

Associate Professors

Dikmen, Sureyya S.,*‡ (Rehabilitation Medicine), Ph.D., 1973, Washington; clinical neuropsychology, traumatic head injury, epilepsy.

Dodrill, Carl B., (Psychiatry and Behavioral Sciences),† Ph.D., 1970, Purdue; human neuropsychology, epilepsy, electroencephalogram and performance, antiepileptic medications and performance.

Schwartzkroin, Philip A.,* (Physiology and Biophysics),† Ph.D., 1972, Stanford; neurophysiology, epilepsy, CNS development, plasticity.

Wilensky, Alan J., (Medicine),† M.D., 1967, Western Ontario, Ph.D., 1973, Toronto; neurology, treatment of epilepsy, testing and use of anticonvulsants.

Wyler, Allen R.,* M.D., 1969, Washington; neurophysiology, epilepsy, cortex, motor control, epilepsy surgery, trauma.

Assistant Professors

Burchiel, Kim J., M.D., 1976, California (San Diego); neurophysiology, pain, epilepsy, head trauma.

Dacey, Ralph G., Jr., M.D., 1974, Virginia; cerebrovascular smooth muscle physiology, infectious diseases of central nervous system.

Farwell, Jacqueline R.,‡ (Pediatrics),† M.D., 1972, California (San Francisco); child neurology, especially epilepsy, neonatal neurology, brain tumors in children.

Fraser, Robert T., (Rehabilitation Medicine),† Ph.D., 1976, Wisconsin (Madison); prediction of rehabilitation outcome, program evaluation, brain impairment and vocational potential, brief therapy interventions.

Mateer, Catherine A.* (Research), (Speech and Hearing Sciences),† Ph.D., 1977, Western Ontario; human neurophysiology; speech and language pathology, memory, mechanisms of motor control.

Ojemann, Linda M., M.D., 1960, Illinois; neurology, treatment of epilepsy.

Temkin, Nancy R.,* (Biostatistics),† Ph.D., 1976, State University of New York (Buffalo); statistical research.

Yerby, Mark S., (Medicine),† M.D., 1965, Vermont; epidemiology, epilepsy, dementia.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

NR 498 Undergraduate Thesis (*) AWSpS *G. Ojemann* Prerequisite: permission of instructor.

NR 499 Undergraduate Research (*) AWSpS *G. Ojemann* Investigation of special problems as an intimate member of the research team in the neurological surgery laboratories. Research to lead to a thesis, if desired. List of projects available on request. Prerequisite: permission of instructor.

NR 505P Preceptorship in Academic Neurosurgery (1) AWSpS *Loeser* Opportunity for first- and second-year medical students to observe the research, teaching, and patient-care activities of academic neurosurgery. Prerequisite: permission of instructor.

NR 528P Neurological Surgery Seminar (1) AWSpS *Calvin* Weekly seminar centered around neurological research topics with discussion by staff and students. Prerequisite: HUBIO 532P or permission of instructor.

NR 541P Neurosurgery for the Generalist and Clinical Specialist (2) W *Kelly, Loeser* Diagnostic and therapeutic aspects of neurosurgical disease. No experience in patient care or emphasis on research data or techniques. Initial diagnosis and management of head and spinal injuries, intracranial hemorrhage, CNS mass lesions, disk disease, hydrocephalus, and chronic pain are covered in depth. Not intended for those planning to take 680P. Prerequisite: HUBIO 532P.

NR 542 Clinical and Basic Research Correlates of Epilepsy (2) A *G. Ojemann, Westrum* Clinical symptoms and treatment of epilepsy; related basic research in neuroanatomy, neurophysiology, neuropsychology, and neuropharmacology of epilepsy. Prerequisite: HUBIO 532P for medical students; permission of instructor for others.

NR 680P Neurological Surgery Clerkship (*, max. 8) AWSpS *G. Ojemann* Student serves clinical clerkship as an intimate member of the staff, participating in inpatient and outpatient care, both preoperative and postoperative, involving neurological surgery patients. University Hospital or a University-affiliated hospital may be selected, subject to approval of the department. Prerequisite: HUBIO 563P. (Four weeks.)

NR 681P Seizure Clinic Clerkship (2½) AWSpS *A. Wilensky, Staff* Initial evaluation and follow-up of patients with seizure disorders. Definition of medical and social problems and drug therapy are stressed. Alternate forms of therapy are considered. Linear follow-up of patients. Limited contact with inpatients. Specialized contact with specific neurologic problem and experience in prolonged follow-up and management planning for a chronic disease. Prerequisites: MED 665P and permission of instructor.

NR 697P Neurological Surgery Special Electives (*, max. 24) AWSpS *Winn* By specific arrangement, for qualified students, special clerkship, externship, or research opportunities can be made available at institutions other than the University of Washington. Students wishing to elect this course should obtain from the Dean's office a special assignment form at least one month before preregistration. Prerequisite: permission of instructor.

Obstetrics and Gynecology

BB607 Health Sciences

The Department of Obstetrics and Gynecology is involved with teaching patient care and research in the areas of normal and abnormal human reproduction: growth and development of the fetus, normal and complicated obstetrics, and surgical and medical diseases of the female reproductive system, including endocrinology.

Faculty

Chairperson

Morton A. Stenchever

Professors

Eschenbach, David A., M.D., 1968, Wisconsin; gynecology and infectious disease.

Figge, David C., M.D., 1950, Northwestern; gynecologic oncology.

Lein, John N., M.D., 1955, Washington; continuing medical education, government relations.

Petra, Philip H.,* (Biochemistry, Laboratory Medicine), Ph.D., 1966, Tulane; reproductive biochemistry.

Spadoni, Leon R., M.D., 1957, Washington; reproductive endocrinology.

Stenchever, Morton A., M.D., 1956, Buffalo; reproductive genetics, medical education.

Vontver, Louis A., M.D., 1960, M.Ed., 1970, Washington; medical education.

Associate Professors

Benedetti, Thomas J., M.D., 1973, Washington; perinatal medicine.

Brown, Zane A., M.D., 1966, Temple; perinatal medicine.

Greer, Benjamin E., M.D., 1966, Pennsylvania; gynecologic oncology.

Moore, Donald E., M.D., 1967, Case Western Reserve; reproductive endocrinology.

Prince, C. Edward, M.D., 1955, Washington; gynecology.

Shy, Kirkwood K., M.D., 1973, M.P.H., 1979, Washington; gynecology.

Soules, Michael R., M.D., 1972, California; reproductive endocrinology.

Steiner, Robert A.,* (Physiology and Biophysics),† Ph.D., 1976, Oregon; reproductive physiology.

Tamimi, Hisham K., M.D., 1969, Cairo (Egypt); gynecologic oncology.

Assistant Professors

Clifton, Donald K. (Research), Ph.D., 1979, California; reproductive physiology.

Gravett, Michael G., M.D., 1977, California (Los Angeles); perinatal medicine and infectious diseases.

Kuzan, Frank B., Ph.D., 1982, Washington State; reproductive physiology.

Lenke, Roger R., M.D., 1971, Columbia; perinatal medicine and reproductive genetics.

Muller, Charles H. (Research), Ph.D., 1976, California; reproductive biology.

Smith, James R., M.D., 1956, Case Western Reserve; perinatal medicine.

Zabriskie, Vinetta, M.D., 1978, Arizona; gynecology.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

OB GY 498 Undergraduate Thesis (*) AWSpS *Vontver* By arrangement.

OB GY 499 Undergraduate Research (*) AWSpS *Vontver* Prerequisite: permission of instructor.

OB GY 579P Obstetric and Gynecologic Investigation (*) AWSpS *Vontver* The investigation may cover any one of the following fields: uterine muscle physiology, toxemias of pregnancy, hormone assays in obstetrics and endocrinology, obstetric and gynecologic oncology. By arrangement.

OB GY 665P Introduction to Obstetrics and Gynecology, UH-HMC (*, max. 12) AWSpS *Vontver* Introductory clerkship providing comprehensive medical care and counseling to female patients. Includes management and delivery of obstetrical patients, diagnosis and management of gynecologic diseases, hospital rounds, outpatient clinics, seminars, tutorial, and community health-care agencies for women. Rotation between University Hospital and Harborview Medical Center. Prerequisite: HUBIO 552P. (Six weeks; limit: six students.)

OB GY 666P Introduction to Obstetrics and Gynecology, Boise (*, max. 12) AWSpS *Vontver* Clerkship equivalent to 665P offered at Boise, Idaho (WAMI). Includes experience in several private physician offices. Prerequisite: HUBIO 552P. (Six weeks; limit: three students.)

OB GY 667P Introduction to Obstetrics and Gynecology, Madigan (*, max. 12) AWSpS *Vontver* Clerkship equivalent to 665P offered at Madigan Hospital Medical Center, Tacoma. During Summer Quarter, available for last six weeks only. Prerequisite: HUBIO 552P. (Six weeks; limit: three students.)

OB GY 668P Introduction to Obstetrics and Gynecology, Spokane (12) AWSpS *Vontver* Clerkship, equivalent to 665P, offered at Spokane (WAMI). Includes experience in several private physicians' offices. Prerequisite: HUBIO 552P. (Six weeks; limit: three students.)

OB GY 669P Introduction to Obstetrics and Gynecology, Swedish (12) AWSpS *Vontver* Clerkship, equivalent to 665P, offered at Swedish Hospital Medical Center. Prerequisite: HUBIO 552P. (Six weeks; limit: two students.)

OB GY 670P Introduction to Obstetrics and Gynecology, Group Health (12) AWSpS *Vontver* Clerkship, equivalent to 665P, offered at either Central or Eastside Group Health Cooperative of Puget Sound, a prepaid medical plan facility. Prerequisite: HUBIO 552P. (Six weeks; limit: four students.)

OB GY 671P Introduction to Obstetrics and Gynecology, Anchorage (12) AWSpS *Vontver* Clerkship, equivalent to 665P, offered at Anchorage, Alaska (WAMI). Includes experience in several private physicians' offices as well as Providence Hospital and Elmendorf Air Force Base. Prerequisite: HUBIO 552P. (Six weeks; limit: three students.)

OB GY 680P Clinical Clerkships (*, max. 12) AWSpS *Vontver* Experience in the specialty clinics of obstetrics and gynecology at University Hospital. Includes dystocia, infertility, endocrinology, oncology, and genetics. By prior arrangement; other options available. Prerequisites: 665P and permission of instructor. (Limit: one student each four weeks.)

OB GY 682P Antenatal High-Risk Obstetrics (8) AWSpS *Benedetti, Brown, Lenke, Smith, Vontver* Four weeks on high-risk antenatal obstetrics ward and clinic. Students responsible for initial workups, daily laboratory evaluations, continuing care of high-risk antepartum patients. Weekly conference with obstetrics attending; presentation of one or more topics per rotation. Excellent coordination with resident and attending staff required to maintain patient-care continuity. (Limit: one student each four weeks.)

OB GY 684P Endocrinology of Reproduction (*, max. 12) AWSpS *Vontver* The biochemistry of steroids. Steroid metabolism as related to clinical problems. Diagnosis and treatment of endocrine disorders. Case studies with special emphasis on modern methods of investigation. (Limit: one student each four weeks.)

OB GY 685P Obstetrics/Gynecology Preceptorship (*, max. 8) AWSpS *Vontver* Close working relationship with physician in private practice of obstetrics and gynecology, including: hospital rounds, surgery, deliveries, and office and business aspects of private practice as individually arranged. Forty hours minimum can be arranged to fit schedule not to exceed 8 credits. Prerequisites: 665P or equivalent and permission of instructor. (Limit: two students.)

OB GY 697P Obstetrics and Gynecology Special Electives (*, max. 24) AWSpS *Vontver* By arrangement, for qualified students, special clerkship or research opportunities can sometimes be made available at other institutions. Students wishing this course should obtain special assignment form one month before preregistration. Department evaluates student performance. Prerequisite: permission of instructor.

Ophthalmology

RR801 University Hospital

The Department of Ophthalmology is responsible for the instructional and research programs in diseases of the eye and its adnexae as well as the visual system.

Medical student instruction is provided at all levels, including multiple electives in the clinical years. Graduate physicians are provided with three or four years of residency training at the affiliated hospitals. Patient care is provided under the supervision of full- and part-time faculty physicians at University Hospital, Harborview Medical Center, Pacific Medical Center, Veterans Administration Hospital, and Children's Orthopedic Hospital and Medical Center.

Clinical research programs relate to blinding eye diseases. Laboratory research encompasses neurophysiology of vision, morphology of the retina and visual system, and biochemistry of ocular tissues. Postdoctoral training is offered in all these disciplines, and predoctoral training is offered in morphology.

Faculty

Chairperson

Robert E. Kalina

Professors

Bunt-Milam, Ann, Ph.D., 1967, Texas Southwestern (Dallas); ophthalmology.

Hendrickson, Anita E.,* (Biological Structure),† Ph.D., 1964, Washington; ophthalmology.

Kalina, Robert E., M.D., 1960, Minnesota; ophthalmology.

Rodieck, Robert W., Ph.D., 1964, Sydney (Australia); ophthalmology.

Associate Professors

Kinyoun, James L., M.D., 1971, Nebraska; ophthalmology.

Mills, Richard P., M.D., 1968, Yale; ophthalmology.

Saari, John C., (Biochemistry), Ph.D., 1970, Washington; ophthalmology.

Sarthy, P. Vijay, Ph.D., 1973, Bombay (India); ophthalmology.

Assistant Professors

Chan, Kwan Y., Ph.D., 1976, California (Los Angeles); ophthalmology.

Grutzmacher, Richard D., M.D., 1976, Northwestern; ophthalmology.

Orcutt, James C., M.D., Ph.D., 1977, Colorado; ophthalmology.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

OPHTH 498 Undergraduate Thesis (*) AWSpS *Rodieck* (University Hospital) Thesis-based research in vision and ophthalmology. Elective. Prerequisite: permission of instructor. (Limit: two students.)

OPHTH 499 Undergraduate Research (*) AWSpS *Rodieck* (University Hospital) Laboratory or clinical research in morphology, biochemistry, immunology, experimental pathology, or clinical studies of the eye and visual system. Prerequisite: permission of instructor. (Limit: two students.)

OPHTH 681P Ophthalmology Clerkship (4) *Reeh, Milam* (Harborview Medical Center) Students gain experience in the diagnosis and treatment of common ocular disorders. Basic examination techniques, including tonometry, ophthalmoscopy, and biomicroscopy. Students work with an eye pathologist in gross and microscopic examination of surgical and autopsy eyes. Prerequisite: completion of human biology series. (Limit: one student.)

OPHTH 682P Ophthalmology Externship (4) AWSpS *Kramar* (Pacific Medical Center) Student works with a faculty member in the diagnosis and treatment of ocular diseases in both outpatient and inpatient populations. Experience in common ocular disorders is gained, and neurological and other consultations seen. Prerequisite completion of human biology series. (Limit: one student.)

OPHTH 683P Pediatric Ophthalmology (4) AWSpS *Kalina* Student examines and observes treatment of children with ocular diseases and learns to differentiate trivial from potentially blinding disorders. Programmed text in general ophthalmology furnished. Two weeks full time. Prerequisite: completion of human biology series. (Limit: one student.)

OPHTH 685P Ophthalmology Externship (4) *Orcutt* (Veterans Administration Hospital) Participation in diagnosis and treatment of medical and surgical ocular disease. Outpatient examinations, inpatient surgery, and neuro-ophthalmological, retinal, and medical consultations. Basic techniques involved in tonometry ophthalmoscopy, and biomicroscopy of eye. Prerequisite: completion of human biology series. (Limit: one student.)

OPHTH 686P Ophthalmology Externship (4) AWSp *Bortner, Brandt, McEvoy* (Group Health Hospital) Diagnosis and treatment of ocular diseases in outpatients. Weekly assignment to Group Health ophthalmologist responsible for the care of walk-in and urgent patients, which may demonstrate findings pertinent to the future practice of primary-care physicians. Examination techniques, including tonometry, ophthalmoscopy, and biomicroscopy. Prerequisite: completion of human biology series. (Limit: one student.)

OPHTH 687P Ophthalmology Clerkship (4) AWSpS *Kinyoun* (University Hospital) Inpatient and outpatient diagnosis and treatment of eye diseases. Subspecialty clinics include cornea, retina, neuro-ophthalmology, glaucoma, contact lenses, and strabismus. Student attends regularly scheduled conferences in ophthalmic basic and clinical science. Prerequisite: completion of human biology series. (Limit: one student.)

OPHTH 697P Ophthalmology Special Electives (*, max. 24) AWSpS *Kalina* By specific arrangement, for qualified students, special clerkship, externship, or research opportunities can at times be made available at other institutions. Students wishing to elect this course should obtain from the Dean's office a special assignment form at least one month before preregistration. Prerequisite: permission of instructor.

Orthopaedics

BB1043 University Hospital

In addition to providing instruction for medical students, the Department of Orthopaedics participates in the teaching program of stu-

dents in the School of Nursing, the School of Dentistry, and the Department of Rehabilitation Medicine. A fully approved residency with opportunities to carry out fundamental research is offered. Residents may work toward the Master of Science degree by meeting the requirements of the Graduate School and the academic unit offering the degree program. Sports Medicine is a division of the Department of Orthopaedics.

Faculty

Chairperson

Sigvard T. Hansen, Jr.

Professors

Hansen, Sigvard T., Jr., M.D., 1961, Washington; orthopaedics.

Matsen, Frederick A. III, M.D., 1968, Baylor; orthopaedics.

Smith, Nathan J., (Pediatrics),† M.D., 1945, Wisconsin; pediatrics.

Staheli, Lynn T., M.D., 1959, Utah; orthopaedics.

Associate Professors

Greenlee, Theodore K., Jr., M.D., 1959, Northwestern; orthopaedics.

Kilcoyne, Raphael F.,‡ M.D., 1963, Marquette; bone and joint radiology.

Lippert, Frederick G. III, M.D., 1965, Vermont, Ph.D., 1971, Karolinska Instit. (Sweden); orthopaedics.

Olerud, John E., (Medicine),† M.D., 1971, Washington; dermatology.

Assistant Professors

Bigos, Stanley J., M.D., 1975, Missouri; orthopaedics.

Larson, Roger V. (Acting), M.D., 1975, Utah; orthopaedics.

Riederer-Henderson, Mary Ann (Research), Ph.D., 1971, Georgia; biochemistry.

Teitz, Carol C., M.D., 1974, Yale; orthopaedics.

Wyss, Craig R. (Research), Ph.D., 1978, Washington; physiology and biophysics.

Lecturer

Rice, Stephen G., M.D., Ph.D., 1974, New York; pediatrics.

Course Descriptions

Courses numbered with a P suffix are not graduate courses and are restricted to medical student enrollment only.

ORTHP 498 Undergraduate Thesis (*) AWSpS *Greenlee* Student works directly with a preceptor in selecting a suitable area for laboratory or clinical research in the area of orthopaedics, and develops a thesis recognition. Prerequisites: HUBIO 523P and permission of department. (Twelve weeks.)

ORTHP 499 Undergraduate Research (*) AWSpS *Greenlee, Lippert, Matsen* Investigation of problems pertinent to the study of musculoskeletal problems in the orthopaedic laboratories as part of the research group. Prerequisite: permission of department. (Twelve weeks.)

ORTHP 585P Sports Medicine (2) Lectures, patient problem presentations, and seminar discussions to explore impact of exercise and sport participation on various body systems. Biomechanics of certain sports injuries and adaptations of cardiovascular, pulmonary, and muscle functions. Sport participation at different ages and nutrition concerns in sports. Prerequisite: second-year medical student standing.

ORTHP 675P Preceptorship in Orthopaedics (*, max. 4) AWSpS Student spends full time with the preceptor during all his or her working day in order to gain a better understanding of the diagnosis and the management of problems of the musculoskeletal system as seen in the private orthopaedic practice. Prerequisites: SURG 665P or HUBIO 563P and permission of department. (Two weeks, full time.)

ORTHP 676P Pediatric Orthopaedics (*, max. 8) AWSpS *Staheli, Staff* Acquaint students with all aspects of musculoskeletal problems in childhood. Didactic conferences and seminars, and opportunities for active participation in both inpatient and outpatient care at Children's Orthopedic Hospital and Medical Center, and correlative anatomy and pathology. Prerequisite: SURG 665P or HUBIO 563P. (Four weeks, full time.)

ORTHP 677P Musculoskeletal Trauma (*, max. 8) AWSp *Greenlee, Hansen, Lippert, Matsen* Harborview Medical Center for musculoskeletal trauma. Emergency room, wards, operating room, and outpatient clinics. Instruction in general and special clinics, including hand, hip, foot, and fracture, with emphasis placed on physical examination of the patient. Students take correlative anatomy and pathology. Prerequisites: SURG 665P and HUBIO 563P. (Four weeks, full time.)

ORTHP 680P General Orthopaedic Clerkship (*, max. 8) AWSp *Greenlee, Hansen, Lippert, Matsen* University Hospital: general inpatient and outpatient clinics, general trauma, bone and joint infections, degenerative joint disease, rheumatoid arthritis, and outpatient pediatrics. Veterans Administration Hospital: musculoskeletal problems, including reconstruction of war injuries. Emphasis is on the diagnosis and the evaluation of functional deficits. Anatomic, clinical, and radiographic correlation of disease processes.

ORTHP 697P Orthopaedic External Elective (*, max. 12) AWSpS *Greenlee* Special arrangements can be made for students desiring to take orthopaedic electives at other institutions. Programs generally approved include orthopaedic clerkships at other universities or at large orthopaedic institutes. Prerequisites: HUBIO 563P and permission of department.

Otolaryngology

BB1165 University Hospital

The Department of Otolaryngology undertakes the teaching of the principles and the practical aspects of the diagnosis and treatment of diseases of the ear, nose, throat, and larynx to first-, second-, third-, and fourth-year medical students. The department assumes responsibility for the organization and supervision of a residency training program and provides consultation and instruction to interns and members of the residency training program at the University.

Faculty

Chairperson

Charles W. Cummings

Professors

Cummings, Charles W., M.D., 1957, Virginia; otolaryngology.

Donaldson, James A., M.D., 1954, Minnesota; otolaryngology.

Associate Professors

Dobie, Robert A., M.D., 1971, Stanford; otolaryngology.

Duckert, Larry G., M.D., Ph.D., 1972, Minnesota; otolaryngology.

Richardson, Mark A., M.D., 1975, South Carolina; otolaryngology.

Snyder, Jack M., Ph.D., 1970, Washington; otolaryngology.

Spelman, Francis A. (Research), (Bioengineering),† Ph.D., 1975, Washington; otolaryngology.

Sutton, Dwight, Ph.D., 1962, California; otolaryngology.

Weymuller, Ernest A., Jr., M.D., 1966, Harvard; otolaryngology.

Assistant Professors

Hillel, Allen D., M.D., 1976, Stanford; otolaryngology.

Kaplan, Jory N., M.D., 1971, Texas (Houston); otolaryngology.

Rees, Thomas S., Ph.D., 1972, Washington; otolaryngology.

Richtsmeier, William J., M.D., 1975, Case Western Reserve, Ph.D., 1975, Wisconsin; otolaryngology.

Course Descriptions

Courses numbered with a P suffix are not graduate courses and are restricted to medical student enrollment only.

OTOL 490 Neural Mechanisms of Hearing (3) Sp *Clopton* Major areas within auditory neurophysiology, including peripheral mechanisms of analysis and encoding, central aspects of the development of auditory structures, binaural hearing, representations of complex sounds, and other topics of current interest. Introductory knowledge of neurophysiology and sensory physiology assumed. Lectures, discussions, assigned readings. Prerequisite: permission of instructor.

OTOL 498 Undergraduate Thesis (*) AWSpS *Miller* Student works directly with department faculty in selecting a suitable area for laboratory or clinical research in the area of otolaryngology, and develops a thesis for recognition. Prerequisite: permission of instructor.

OTOL 499 Undergraduate Research (*) AWSpS *Miller* Research opportunities offered under direction in the area of otolaryngology. May be repeated for credit. (Twelve weeks.)

OTOL 681P Otolaryngology Clerkship (*, max. 8) AWSpS *Cummings* (University Hospital) Student participates in evaluation and care of outpatients and inpatients at the University Hospital. Department conferences. Prerequisite: completion of human biology series. (Four weeks, full time.)

OTOL 682P Otolaryngology Externship (*, max. 8) AWSpS *Kaplan* (Pacific Medical Center) In outpatient clinic, where visits average six hundred per month, supplemented by inpatient assignments. Individual training gives student opportunity to utilize own diagnostic abilities in all phases of patient workups and care; attends ward rounds and conferences. Prerequisite: completion of human biology series. (Four weeks, full time.)

OTOL 683P Otolaryngology Externship (*, max. 8) AWSpS *Hays* (Madigan Hospital Medical Center) Individual externship training at outpatient clinic, where visits average twelve hundred per month, supplemented by inpatient assignments. Students reside at the hospital during externship, using facilities of BOQ and hospital mess. Prerequisite: completion of human biology series. (Two or four weeks, full time.)

OTOL 684P Otolaryngology Clerkship (*, max. 8) AWSpS *Duckert, Weymuller* (Harborview Medical Center) Evaluation and care of outpatients and inpatients. Assists in surgery, and in addition, attends department conferences at both Harborview Medical Center and University Hospital in conjunction with department training. Prerequisite: completion of human biology series. (Four weeks.)

OTOL 685P Otolaryngology Externship (*, max. 8) AWSpS *Richardson* (Children's Orthopedic Hospital and Medical Center) To give medical students additional training in pediatric otolaryngology at Children's Orthopedic Hospital and Medical Center. Students assist in patient workups, surgery, and postoperative care, and study general otolaryngology problems with special emphasis on childhood disease entities. Prerequisite: SURG 665P. (Four weeks.)

OTOL 686P Otolaryngology: Medical and Surgical Aspects (*, max. 12) AWSpS *Cummings* Clinical in-depth study for the student whose interest lies in pathology of the head and neck. Reasonable flexibility to arrange course content that provides exposure to all aspects of patient care.

OTOL 687P Otolaryngology Clerkship (*, max. 8) AWSpS *Hillel, Richtsmeier* (Veterans Administration Hospital) Student participates in the evaluation and care of outpatients and inpatients to provide him or her with an adequate introduction to ear, nose, and throat problems. Must attend department conferences at University Hospital. Prerequisite: completion of human biology series. (Four weeks. Limit: one student.)

OTOL 697P Otolaryngology Special Electives (*, max. 24) AWSpS *Cummings* By specific arrangement. Special clerkship, externship, or research opportunities can at times be made available at institutions other than the University of Washington. Students wishing to elect this course should obtain from the Dean's office a special assignment form at least one month before preregistration. Prerequisite: permission of instructor.

Pathology

C506 Health Sciences

Pathology is both a basic biological science and a specialty of medicine. As a basic science, it deals with the natural history and mechanisms of initiation and expression of disease processes. In its broadest sense, the study of disease encompasses the entire animal and plant kingdoms. The interests of the department focus on diseases of vertebrates, especially of man. The principal aim of the pathologist is to understand disease manifestations and processes in whatever terms are required. Therefore, the techniques of the pathologist range from those of the physicist and physical chemist through those of the physiologist to the realm of the epidemiologist. Present emphasis in the department is on cellular and molecular pathology, environmental pathology, analysis of disease by light and electron microscopy, histochemistry and cytochemistry, analytical biochemistry, cell and organ culture, and immunology.

Graduate Program

Peter H. Byers, Graduate Program Coordinator
Thomas N. Wight, Graduate Program Coordinator

The Department of Pathology offers graduate training in experimental pathology, with an emphasis on the cellular and molecular biological

basis of disease, leading to Master of Science and Doctor of Philosophy degrees in experimental pathology. Aim of the graduate program is to train individuals for a career in the scientific investigation of basic disease mechanisms. The program encompasses students and faculty members with diverse interests, which range from investigation of specific disease conditions to the molecular basis of alterations in cell function and of gene expression. Faculty members' interests include the normal and pathological aspects of cardiovascular biology, tumor biology, environmental effects on normal processes, biology of aging, neurobiology, immune response, inflammation and repair, immunopathology and biology of extracellular matrix, as well as fundamental processes that underlie disease, such as regulation of gene expression and protein synthesis, structure and function of oncogenes, viral and nonviral transformation, chromatin structure, mutagenesis and DNA repair, and genetic recombination. The department's graduate faculty comprises forty members, who are located at the Health Sciences Center, Veterans Administration Hospital, Harborview Medical Center, Children's Orthopedic Hospital and Medical Center, and Fred Hutchinson Cancer Research Center. Forty full-time students are pursuing the Ph.D. degree.

Students in the program are expected to fulfill course work requirements during the first two years. In line with the diversity of faculty members' interests within the department, requirements are kept to a minimum to provide students with maximum flexibility.

Special Requirements

Prospective candidates are expected to have had undergraduate experience in biology, physics, chemistry, and mathematics and acceptable scores on the Graduate Record Examination, including advanced biology or chemistry. Those wishing to matriculate toward both the M.D. and Ph.D. degrees must, of course, gain admission to both the Graduate School and the School of Medicine.

Financial Aid

Funding for students is provided from departmental and University funds, training grants, a variety of institutional fellowships, and research grants of individual projects.

Research Facilities

The department emphasizes the cellular and molecular approach to the investigation of the pathogenesis of disease in mammalian species. Special facilities exist for training in electron microscopy; cell, tissue, and organ culture; histochemistry and cytochemistry; analytical biochemistry; and immunology.

Correspondence and Information

Graduate Program Coordinator
Department of Pathology, SM-30

Residency Training Program

The department supervises an internship and residency training program in anatomic pathology and, jointly with the Department of Laboratory Medicine, in clinical pathology for qualified medical doctors. Persons who complete the residency program are eligible for certification by the American Board of Pathology. Dennis D. Reichenbach is program director.

Faculty

Chairperson

Russell Ross

Professors

Alvord, Ellsworth C.,* M.D., 1946, Cornell; neuropathology, experimental allergic encephalitis.

Beckwith, J. Bruce,* (Pediatrics),† M.D., 1958, Washington; pediatric pathology, sudden-death syndrome, pediatric neoplasia.

Benditt, Earl P.,* M.D., 1941, Harvard; atherosclerosis, diabetes mellitus, amyloidosis.

Hellström, Karl-Erik,* (Microbiology and Immunology), M.D., Ph.D., 1964, Karolinska Instit. (Sweden); tumor immunology.

Kadin, Marshall E.,* (Laboratory Medicine),† M.D., 1965, Northwestern; cell differentiation, leukemia, lymphoma.

Loeb, Lawrence A.,* (Biochemistry), M.D., Ph.D., 1961, California (Berkeley); fidelity of DNA replication, molecular basis of mutagenesis, chemical carcinoma.

Martin, George M.,* (Genetics), M.D., 1953, Washington; somatic cell genetics, pathobiology of aging.

McDougall, James K.* (Research), Ph.D., 1971, Birmingham (England); virology, neoplasia.

Mottet, N. Karle,* (Environmental Health),† M.D., 1952, Yale; environmental pathology, teratology, toxic effects of mercury and other trace metals.

Nishimura, Edwin T.,* M.D., 1945, Wayne State; oxidative enzymes, hematopoiesis, alcoholic injury.

Page, Roy C.,* (Periodontics),† D.D.S., Ph.D., 1967, Washington; connective-tissue pathology, chronic inflammation, immunopathology, periodontal disease.

Reichenbach, Dennis D.,* M.D., 1958, Washington; cardiovascular pathology.

Ross, Russell,* (Biochemistry), D.D.S., Ph.D., 1955, Washington; atherosclerosis, connective tissue pathology, wound healing.

Schwartz, Stephen M.,* M.D., Ph.D., 1973, Washington; vascular pathology, atherosclerosis, hypertension, cell kinetics.

Shaw, Cheng-Mei.,* M.D., 1950, National Taiwan; neuropathology, immunopathology, trace metal neurotoxicology.

Striker, Gary E.,* M.D., 1959, Washington; renal pathology, inflammation, connective tissue.

Striker, Lilane M., M.D., 1963, Paris (France).

Sumi, S. Mark,* (Medicine),† M.D., 1956, Toronto; neuropathology, neuromuscular disease.

Van Hoosier, Gerald L.,* (Animal Medicine),† D.V.M., 1957, Texas A&M; veterinary pathology.

Vracko, Rudolf,* M.D., 1955, Munich (Germany); endocrine pathology, tissue complications of diabetes mellitus, function of basal lamina in tissue repair.

Associate Professors

Benjamin, Denis R.,* (Laboratory Medicine),† M.D., B.Ch., 1968, Witwatersrand (South Africa); pediatric pathology.

Byers, Peter H.,* (Medicine),† M.D., 1969, Case Western Reserve; extracellular matrix synthesis, genetic disorders of estrogen metabolism, secretion of collagen.

Giddens, W. Ellis,* (Animal Medicine),† D.V.M., Ph.D., 1969, Michigan State; comparative pathology.

Huang, Thomas W.,* M.D., Ph.D., 1973, Washington; pulmonary pathology, renal pathology, structure and function of basal lamina.

Narayanan, A. Sampath* (Research), Ph.D., 1967, Madras (India); periodontal disease, connective tissue.

Norwood, Thomas H.,* M.D., 1966, Maryland; somatic cell genetics, pathobiology of aging, miotic cell cycle regulatives.

Reay, Donald T., M.D., 1963, Utah; forensic medicine.

Sale, George E., M.D., 1968, Stanford; immunopathology of bone marrow, graft-*vs.*-host reaction.

Spence, Alexander M., (Medicine),† M.D., 1965, Chicago; neuropathology.

Thorning, David R., M.D., 1965, Kansas; anatomic pathology, pulmonary pathology, electron microscopy.

Wiegenstein, Louise L. (Emeritus), M.D., 1946, Tufts; pathology.

Wight, Thomas N.,* Ph.D., 1972, New Hampshire (Durham); atherosclerosis, ultrastructure, proteoglycan chemisty.

Wolf, Norman S.,* (Animal Medicine),† D.V.M., Ph.D., 1960, Northwestern; radiobiology, developmental hematology, reticuloendothelial system, laboratory animal disease.

Assistant Professors

Bowen-Pope, Danial F. (Research), Ph.D., 1979, California (Berkeley); molecular biology of the platelet-driven growth factor receptor.

Chi, Emil Y. (Research), Ph.D., 1971, California (Santa Barbara); lung pathology, mast cell structure.

Cowan, Marie J.,* (Nursing),† Ph.D., 1979, Washington; cardiovascular pathology, electrocardiography.

Disteche, Christine,* Ph.D., 1976, Liege (Belgium); molecular genetics, human and mouse cytogenetics.

Eriksen, Nils (Research), Ph.D., 1944, Washington; amyloidosis.

Gajdusek, Corrina M. (Research), Ph.D., 1972, Colorado; endothelial cells.

Galloway, Denise (Research), Ph.D., 1975, City (New York); herpes viruses transformation and latency.

Gown, Allen G., M.D., 1975, Albert Einstein; human atherosclerosis, immunohistochemistry.

Haas, Joel E., M.D., 1967, Pittsburgh; pediatric pathology.

Kiviat, Nancy C., M.D., 1975, Washington.

Kocan, Richard M.* (Research), (Fisheries),† Ph.D., 1967, Michigan State; mutagenesis, environmental toxicology, genotoxicity.

Nelson, Karen A. (Research), Ph.D., 1975, Washington; immunopathology, aberrant regulation of immunity as involved in neoplasia and other diseases.

Rabinovitch, Peter S.,* M.D., 1979, Ph.D., 1980, Washington; miotic cell cycle in senescence and neoplasia, flow cytometry.

Reay, Donald T., M.D., 1963, Utah; forensic medicine.

Reidy, Michael A. (Research), Ph.D., 1972, Cambridge; atherosclerosis, vascular endothelial cells, arterial injury and repair.

Salk, Darrell J.,* (Pediatrics), M.D., 1974, Johns Hopkins; human cytogenetics chromosomal instability syndromes.

Shulman, Howard, M.D., 1971, California (Los Angeles); graft-*vs.*-host disease.

Vogel, Arthur M.,* M.D., Ph.D., 1975, New York; neoplasia, growth regulation, cytoskeletal system.

Instructor

Hackman, Robert E. (Research), M.D., 1971, Stanford; marrow transplantation.

Lecturers

Ek, Marit, M.D., Ch.B., 1959, Cape Town (South Africa); surgical pathology, anatomical pathology, gynecological pathology.

Lee, Ming-Jong, M.D., 1963, Gunma (Japan); surgical pathology, anatomical pathology.

Nussbaum, Berl E., M.D., 1970, Albert Einstein; computerization of medical records.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

PATH 410 Introduction to Pathology (3) A *Wolf* Study of causes, processes, and effects of important diseases. Required for students in medical technology, physical therapy, and pharmacy. Prerequisites for other students: CONJ 317-318 and MICRO 301, or equivalent courses in human anatomy, human physiology, and microbiology, and permission of instructor or adviser.

PATH 444 General Pathology (4) W *Norwood, Page* Basic pathologic processes that underlie disease, including cell alterations, genetic and developmental pathology, environmental pathology, neoplasia, immunopathology, inflammation, and infection. Correlates the gross, functional, and biochemical alterations. For second-year dental students and graduate students. Requires a reasonable grounding in biological and chemical sciences. Prerequisite for nondental students: permission of instructor.

PATH 445 Systemic Pathology (3) A *Reichenbach, Wolf* Survey of pathologic processes affecting organs and systems pertinent to the practice of dentistry. Lectures and demonstrations present a coherent picture of systemic disease. For second-year dental students, graduate students, and others with a reasonable background in biologic and chemical sciences. Prerequisites: 444 and permission of instructor for nondental students.

PATH 498 Undergraduate Thesis (*) AWSpS Elective. Prerequisite: permission of instructor.

PATH 499 Undergraduate Research (*) AWSpS Elective. May be repeated for credit. Prerequisite: permission of instructor.

PATH 500 Principles of Pathology (5) *Vogel* Basic disease processes such as inflammation, neoplasia, cell alteration, and genetic and developmental pathology. Lectures, laboratory exercises, and demonstrations that are important in biologic medical research. For graduate students and advanced undergraduates in the biological sciences. Suitable knowledge of either biochemistry or biological structure is strongly recommended. Prerequisite: permission of instructor.

PATH 501 Cellular Response to Injury (3, max. 9) AWSpS Lecture-seminar. Considerations of current concepts of cellular and subcellular reactions to injury, including neoplasia, as studied by modern techniques of cell biology. Required of all pathology graduate students. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PATH 502 Inflammation and Repair (2) Sp Lecture-seminar; a seminar course dealing with an in-depth examination of the processes involved in inflammation and repair. Required of all pathology graduate students. Offered on credit/no credit basis only. Prerequisite: permission of instructor. (Offered even-numbered years.)

CONJ 503 Somatic Cell Genetics (2, max. 6) *Gartler, Martin, Pious* See Conjoint Courses.

PATH 504 Cell and Molecular Biology and Disease (3) A *Byers* Nucleus and events associated with normal and abnormal function. Cell replication and chromosome segregation, meiosis and mitosis, recombination, transcription initiation and termination, RNA processing, chromatin structure and its role in regulation of gene expression. Regulatory mechanisms governing these processes. Prerequisites: biochemistry or genetics and permission of instructor.

PATH 505 Cell and Molecular Biology and Disease (3) W *Wight* Cytoplasm and detailed consideration of normal and abnormal structure and function of cell organelles. Membrane receptors, membrane transport, functional complexes, protein synthesis, cytoskeleton and cell-extracellular matrix interaction. Role of various organelles in processes fundamental to disease, such as cell proliferation, migration, adhesion, and macromolecular turnover and processing. Prerequisites: 504 and permission of instructor.

PATH 506 Cell and Molecular Biology and Disease (3) Sp *Vogel* Use of fundamental concepts discussed in the previous two quarters and consideration of the molecular and cellular mechanisms involved in various disease states, including atherosclerosis, neoplasia, diabetes, and genetic disorders of connective tissue metabolism. Prerequisites: 505 and permission of instructor.

PATH 507 Cellular Pathology (2) S *Schwartz* Emphasis on application of recent developments and techniques in biology to problems of pathology. Series of lectures by eminent visiting scientists with expertise in the area being discussed. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

CONJ 508 EM Methods and Interpretation (3-5) *Holbrook, Wight* See Conjoint Courses.

PATH 510 Anatomical Analysis of Disease (*, max. 30) AWSpS The anatomical features of human disease as revealed at surgery or postmortem by gross examination and light microscopy are correlated with chemical and physiologic changes. Prerequisites: graduate student standing and permission of instructor.

CONJ 512 Introduction to the Anatomical Analysis of Animal Disease (5, max. 10) AWSp See Conjoint Courses.

CONJ 514 Comparative Pathology Conference (1, max. 6) AWSp See Conjoint Courses.

PATH 520 Experimental Pathology Seminar (1) AWSpS *Wolf* Review of current research in various areas of experimental pathology by members of the department and visiting scientists. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

CONJ 520 Anatomy and Autopsy (½) See Conjoint Courses.

PATH 522 Hematopathology (2) W *Kadin* Identification of normal lymphocyte and bone marrow subpopulations, diagnosis of leukemias, lymphomas, and benign conditions that resemble them. Emphasis on histopathology, cytochemical and immunological markers. Clinicopathologic correlation. Offered jointly with LAB M 522. Offered on credit/no credit basis only.

PATH 530 Human Cytogenetics (*, max. 4) W *Disteche, Norwood* Sources and methods of preparation and identification of human chromosomes. Human cytogenetic pathology; karyotype-phenotype interactions. Prerequisite: permission of instructor.

PATH 535 Fundamentals of Human Disease (*, max. 20) AWSpS *Mottet* Participation in observation and study of human disease processes as seen in autopsy cases at University and Veterans Administration hospitals and Harborview Medical Center. Prerequisites: 444 or 500 or 555, and permission of instructor.

PATH 536 Microscopy of Human Disease (3) W *Mottet* Examples of human disease selected to cover major patterns of disease processes. Summaries of clinical and autopsy findings and microscope slides from unusually instructive cases are studied. Case reviewed with graduate faculty member, and gross organ lesions shown. Emphasis on critical evaluation of literature and areas needing search. Prerequisites: 444 or 500 or 555, and permission of instructor.

PATH 551 Experimental and Molecular Pathology (2-5, max. 20) AWSpS *Byers, Wight, Staff* Introduction to experimental pathology. A tutorial course designed to introduce a graduate student (medical, dental) or senior undergraduate to selected methods and problems through literature surveys and/or laboratory experience. Exploration of causes at the cellular and molecular levels in the study of disease is emphasized. Prerequisite: permission of instructor.

PATH 552 Contemporary Anatomic Pathology (2-5, max. 30) AWSpS Study of recent developments in anatomic pathology. Subject includes areas of basic science and review of systemic pathology. Recent developments and interpretation of these findings are stressed. For pathology residents, fellows, and trainees. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PATH 555 Environmental Pathology (3) Sp *Mottet* Survey of exogenous environmental agents (chemicals—agricultural, industrial, household; physical—electrical, thermal, radiation) and of how they are involved in the causation and expressions of human disease processes such as developmental anomalies, mutagenesis, carcinogenesis, and degenerative diseases. Prerequisite: 444 or 500 or HUBIO 520P, or permission of instructor.

CONJ 560, 561 Tumor Biology (3,2) See Conjoint Courses.

PATH 560P Analysis of Human Disease (*, max. 10) AWSpS *Mottet* Beginning with a human disease problem, the student individually develops a working hypothesis, discusses the problem with appropriate pathology faculty member, and jointly designs an experiment to test the hypothesis. A written report is required. Prerequisite: second-year medical student standing.

PATH 562P Cardiovascular Pathology Conference (*) AWSpS *Reichenbach* Course consists of two parts: a laboratory review of gross and microscopic cardiovascular pathology of selected autopsied cases followed by a combined clinical (medical and/or surgical) and pathology conference discussing these cases. Prerequisites: HUBIO 540P and permission of instructor.

PATH 563 Neuropathology (*) AWSpS *Alvord, Shaw, Sumi* Course consists of ten parts. Conferences on gross neuropathology (brain cutting and clinicopathologic correlations) held at six hospitals. Weekly neurology or surgical neuropathology conferences, neuropathology slide show, and neuropathology laboratory case studies. Prerequisite: permission of instructor.

PATH 564 Neuropathology Brain Modeling (4) S *Alvord* Designed along clinically important, functional, neuroanatomic lines, generally based first on the embryologic development of the most primitive segmental elements (sensory, motor and association cells, and simple reflexes), followed by the more elaborate suprasegmental elements (cerebellum, colliculi, and forebrain).

PATH 571 Neuroanatomic Pathology (*) W *Alvord, Shaw, Sumi* The particular diseases occurring in specific parts of the nervous system are considered in terms of the segmental, intersegmental, and suprasegmental components. Clinicopathologic correlations are emphasized. Prerequisite: permission of instructor; recommended as concurrent course: 563.

PATH 572 Neuropathologic Reactions (*) A *Alvord, Shaw, Sumi* The reactions of the nervous system, considered in terms of congenital malformations, inflammations, vascular, traumatic, metabolic-toxic, degenerative, and neoplastic diseases peculiar to the nervous system as a whole. Clinicopathologic correlations are emphasized. Prerequisite: permission of instructor; recommended as concurrent course: 563.

PATH 574 Systemic Pathology I (3) W Analysis of disease processes organized on the basis of the organ systems with emphasis on dynamics of lesions and physiologic and biochemical correlations. Organ systems reviewed include cardiovascular, respiratory, gastrointestinal (including liver and pancreas), central nervous, and endocrine. Prerequisite: permission of instructor.

PATH 576 Systemic Pathology Laboratory I (2) W Common and uniquely informative specimens of lesions from human autopsies are reviewed grossly and microscopically. Lesions from same organ systems presented in 574 are studied. Prerequisites: for paramedical students, an introductory pathology course, 410; for graduate students, 500 or 555; for medical students, HUBIO 540 or Module 21; and permission of instructor for all students.

PATH 584 Neuropathology Brain Modeling Laboratory (4) S *Alvord* Clinically important, functional neuroanatomic study based on embryologic motor, sensory, and association cells and simple reflexes, followed by the more elaborate suprasegmental elements (cerebellum, colliculi, forebrain). Three-dimensional neuroanatomical relationships, critical for understanding neuropathology, can best be obtained in constructing a brain model. Prerequisite: 546, which may be taken concurrently.

PATH 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

PATH 665P Surgical Pathology (*) AWSpS *Mottet* Study of fresh gross surgical specimens and review of microscopic sections of diagnostic problems in general surgery. Prerequisites: HUBIO 563P and permission of instructor.

PATH 666P Renal Pathology Conference (1) AWSpS *Striker* Conference-seminar on the histopathologic aspects of renal disease. May be taken concurrently with MED 693P. For third- and fourth-year students. Prerequisite: permission of instructor.

PATH 667P Renal Pathology Laboratory (*, max. 6) AWSpS *Striker* Laboratory elective for third- and fourth-year medical students. Read current literature, review various renal biopsies and urine sediments, and read standard texts prior to a weekly topic-oriented conference. All students earn 1 credit for one-hour seminar per week. May be taken concurrently with MED 693P. Prerequisite: permission of instructor.

PATH 668P Skin Pathology (*) AWSpS Histopathological aspects of skin diseases are presented and discussed in a group-conference type of seminar. Current dermatologic cases also are discussed. Prerequisites: dermatology elective and permission of instructor.

PATH 673P Cardiovascular Pathology (*) W *Reichenbach* Spectrum of cardiovascular pathology covered in depth by case studies and gross and microscopic material. Case analysis for presentation, including clinical and gross and microscopic material, prepared outside of class time. Clinicopathologic correlation is emphasized. Prerequisites: HUBIO 540P and permission of instructor and second-year medical student standing. (Limit: fourteen students.)

PATH 679P Pathology Summer Clerkship (*, max. 24) S *Mottet* Dissection, writeup, and literature review of autopsy and some surgical pathology specimens by students. Emphasis on etiology and pathogenesis of disease as a biological process. Designed for students who have not completed organ systems as covered in Human Biology courses. Offered at University Hospital, Harborview Medical Center, Veterans Administration Hospital, and Cabrini Hospital. Prerequisites: HUBIO 520P and completion of first year of medical school.

PATH 680P Diagnostic Pathology Clerkship—University Hospital (*, max. 24) AWSp *Mottet* Medical student participation in dissection and study of autopsy and surgical pathology cases. Cases worked up under senior staff, including dissection, microscopic examination, and literature review. Attendance at pathology conferences and seminars expected. Prerequisite: third- or fourth-year student standing.

PATH 681P Diagnostic Pathology Clerkship—Harborview Medical Center and King County Medical Examiner Office (*, max. 24) AWSp *Barker, Reay, Reichenbach* For description and prerequisites, see 680P.

PATH 682P Diagnostic Pathology Clerkship—Veterans Administration Hospital (*, max. 24) AWSp *Vracko* For description and prerequisites, see 680P.

PATH 683P Diagnostic Pathology Clerkship—Group Health (*, max. 24) AWSp *Mullen* For description and prerequisites, see 680P.

PATH 684P Diagnostic Pathology Clerkship—Cabrini Hospital (*, max. 24) AWSp *LaZerte* For description and prerequisites, see 680P.

PATH 685P Diagnostic Pathology Clerkship—Children's Orthopedic Hospital and Medical Center (*, max. 24) AWSp *Haas* For description and prerequisites, see 680P.

PATH 686P Diagnostic Pathology Clerkship—Madigan Hospital Medical Center (*, max. 24) AWSp *Coppin* For description and prerequisites, see 680P.

PATH 687P Diagnostic Pathology Clerkship—Other Locations (*, max. 24) AWSp Participation in laboratory functions within the community hospital, including autopsy and surgical pathology. Emphasis on function of laboratories in clinical care. Locations: Deaconess, Northwest, Overlake, Providence (Everett), Sacred Heart, Swedish, Valley General, Virginia Mason, and Everett General hospitals, and Pacific Medical Center. Prerequisites: third- or fourth- year student standing and permission of instructor.

PATH 700 Master's Thesis (*) AWSpS

PATH 800 Doctoral Dissertation (*) AWSpS

Pediatrics

RR314 Health Sciences

Pediatrics involves the study of physical and behavioral development of man, in health and disease, from conception to maturity.

Instruction is provided through conjoint courses, lectures, conferences, clerkships, and electives. Faculty members participate in teaching the basic curriculum and offer twenty-four electives, including PEDS 665P (Pediatric General Clerkship), which almost all medical students take. A residency program is offered with a wide variety of electives in addition to traditional hospital inpatient and clinic experience and a new primary care/general pediatric track. Postdoctoral training is available in virtually every subspecialty area of pediatrics. The major teaching hospitals are Children's Orthopedic Hospital and Medical Center, University Hospital, and Harborview Medical Center.

Faculty

Chairperson

Herbert T. Abelson

Professors

Abelson, Herbert T., M.D., 1966, Washington (St. Louis); hematology-oncology.

Beckwith, Bruce J.,* (Pathology),† M.D., 1958, Washington; pathology, pediatrics.

Bergman, Abraham B., M.D., 1958, Western Reserve; ambulatory pediatrics.

Bernstein, Irwin D., M.D., 1967, New York; hematology, oncology.

Bleyer, Werner A., (Medicine, Radiation Oncology), M.D., 1969, Rochester; hematology, oncology.

Deisher, Robert W., M.D., 1944, Washington; adolescent medicine.

Emanuel, Irvin,* (Epidemiology),† M.D., 1960, Rochester; child development and mental retardation.

French, James W., M.D., 1963, Michigan; pediatric cardiology.

Graham, C. Benjamin, M.D., 1958, Washington; radiology, pediatrics.

Guntheroth, Warren G., M.D., 1952, Harvard; pediatric cardiology.

Hodson, W. Alan, M.D., 1959, Manitoba; neonatal biology.

Kelley, Vincent C., Ph.D., 1942, M.D., 1946, Minnesota; endocrinology.

Labbe, Robert F.,*‡ (Laboratory Medicine), Ph.D., 1959, Oregon State; laboratory medicine.

Lemire, Ronald J., M.D., 1962, Washington; teratology.

Mackler, Bruce, M.D., 1943, Temple; developmental biology.

Neff, John M., M.D., 1960, Harvard; infectious disease.

Novack, Alvin H., M.D., 1958, Temple; ambulatory pediatrics.

Ochs, Hans D., M.D., 1962, Frieburg; immunology.

Picus, Donald A.,* (Genetics), M.D., 1956, Pennsylvania; developmental biology.

Reichler, Robert J.,‡ (Psychiatry and Behavioral Sciences), M.D., 1961, Albert Einstein; psychiatry.

Robertson, William O., M.D., 1949, Rochester; ambulatory pediatrics.

Robinson, Nancy M.,‡ (Psychiatry and Behavioral Sciences), Ph.D., 1958, Stanford; psychology.

Rothenberg, Michael B., M.D., 1954, Western Reserve; psychiatry and behavioral sciences.

Ruvalcaba, Rogelio H. A., M.D., 1957, Universidad de Guadalajara; endocrinology.

Scott, C. Ronald, M.D., 1959, Washington; pediatric genetics.

Sells, Clifford J.,* M.D., 1963, Washington; child development and mental retardation.

Shepard, Thomas H. II,* (Environmental Health), M.D., 1948, Rochester; embryology.

Shurtleff, David B.,* M.D., 1955, Tufts; congenital defects.

Smith, Arnold L., M.D., 1964, Missouri; infectious disease.

Smith, Elizabeth K. (Emeritus), (Laboratory Medicine), Ph.D., 1943, Iowa; laboratory medicine, pediatrics.

Smith, Nathan J., (Orthopaedics),† M.D., 1945, Wisconsin; orthopedics, pediatrics.

Wedgwood, Ralph J., M.D., 1947, Harvard; arthritis.

Woodrum, David E., M.D., 1965, Illinois; neonatal biology.

Associate Professors

Benjamin, Denis,*‡ (Laboratory Medicine, Pathology), M.B., B.Ch., 1968, Witwatersrand (South Africa); laboratory medicine and pathology.

Bennett, Forrest C., M.D., 1970, Minnesota; child development and handicapped children.

Chen, Shi-Han (Research), Ph.D., 1968, Texas; pediatric genetics.

Clarren, Sterling K., M.D., 1973, Minnesota; congenital defects.

Corey, Lawrence,*‡ (Laboratory Medicine, Microbiology and Immunology), M.D., 1971, Michigan; laboratory medicine.

Fantel, Alan G. (Research), Ph.D., 1974, Washington; embryology, teratology.

Hayden, Patricia W., M.D., 1953, Rochester; congenital defects.

Holm, Vanja A., M.D., 1954, Karolinska Instit. (Sweden); child development and mental retardation.

Kawabori, Isamu, M.D., 1966, Washington; pediatric cardiology.

Koup, Jeffrey R.,‡ (Pharmacy Practice), Pharm.D., 1974, State University of New York; pharmacy practice.

McLaughlin, John F., M.D., 1970, Northwestern; congenital defects.

Milstein, Jerrold M., M.D., 1964, Minnesota; pediatric neurology.

Mirkes, Philip E. (Research), Ph.D., 1970, Michigan; teratology.

Osborne, William R. A. (Research), Ph.D., 1972, Kings; pediatric genetics.

Pagon, Roberta A., M.D., 1972, Harvard; ophthalmology, pediatrics.

Pendergrass, Thomas W., M.D., 1971, Tennessee; hematology, oncology.

Sanders, Jean E., M.D., 1970, Iowa; hematology, oncology.

Stevenson, James G., M.D., 1970, Baylor; pediatric cardiology.

Sulzbacher, Stephen I., (Psychiatry and Behavioral Sciences),† Ph.D., 1971, Washington; psychiatry and behavioral sciences.

Truog, William E., M.D., 1973, Chicago; neonatal biology.

Wilson, Christopher B., M.D., 1972, California; infectious disease.

Assistant Professors

Brewer, David K.,‡ (Radiology), M.D., 1972, Harvard; radiology.

Blumhagen, Joel D.,‡ (Radiology), M.D., 1973, Washington (St. Louis); radiology.

Connell, Frederick A.,*‡ (Health Services), M.P.H., 1978, Washington; health services.

Cotner, Thomas (Research), M.D., Ph.D., 1978, Massachusetts Institute of Technology; developmental biology.

Davis, Kenneth A. (Research), Ph.D., 1966, Toronto; developmental biology.

Evans, Timothy C. (Research), Ph.D., 1976, Michigan; developmental biology.

Farwell, Jacqueline R., M.D., 1972, California; neurological surgery, pediatrics.

Haas, Joel E.,‡ (Pathology), M.D., 1967, Pittsburgh; pathology.

Hamilton, Brian L., (Biological Structure),† M.D., 1976, Washington; biological structure.

Jaffe, Kenneth M.,‡ (Rehabilitation Medicine), M.D., 1975, Harvard; rehabilitation medicine.

Lum, Lawrence G., M.D., 1973, California; hematology, oncology.

Lynn, Arine M.,‡ (Anesthesiology), M.D., 1975, Stanford; anesthesiology.

Morray, Jeffrey P.,‡ (Anesthesiology), M.D., 1974, Rochester; anesthesiology.

Murphy, Janet H., Ch.B., 1967, Victoria (England); neonatal biology.

Parish, Ruth Ann, M.D., 1977, Case Western Reserve; ambulatory pediatrics.

Quan, Linda, M.D., 1971, Washington; ambulatory pediatrics.

Redding, Gregory J., M.D., 1974, Stanford; neonatal biology.

Roberts, Marilyn C., Ph.D., 1978, Washington; infectious disease.

Rosenbaum, David M., M.D., 1977, Albert Einstein; radiology.

Salk, Darrel J.,*‡ (Pathology), M.D., 1974, Johns Hopkins; pathology.

Shaul, William L., M.D., 1973, Pennsylvania State; ambulatory pediatrics.

Standaert, Thomas A. (Research), Ph.D., 1970, Duke; neonatal biology.

Sybert, Virginia P., M.D., 1974, State University of New York (Buffalo); genetics and dermatology.

Tyler, Donald C. (Research), M.D., 1970, Pennsylvania; anesthesiology, pediatrics.

Williams, Virginia,‡ (Anesthesiology), M.D., 1973, Tulane; anesthesiology.

Lecturers

Fischer, Susanna, M.D., 1959, Leiden (Holland); immunology.

Holterman, Virgil L., M.S.W., 1960, Washington; adolescent medicine.

Lamson, Fred W., D.Ed., 1966, Oregon; educational psychology.

Ramsey, Bonnie W., M.D., 1976, Harvard; ambulatory pediatrics.

Rice, Stephen G., Ph.D., 1974, New York; adolescent medicine.

Course Descriptions

Courses numbered with a P *are not graduate courses and are restricted to medical student enrollment only.*

PEDS 498 Undergraduate Thesis (*) AWSpS *Robertson* For medical students. Prerequisite: permission of instructor.

PEDS 499 Undergraduate Research (*) AWSpS *Robertson* Participation in various clinical or basic research programs in progress, specifically: child development, developmental biology, human embryology and teratology, medical genetics, infectious diseases, neonatology, neuroembryology, cardiology, endocrinology and metabolism, immunology, respiratory disease. Prerequisite: permission of instructor.

PEDS 500P Topics in Adolescent Medicine for Medical Professionals (1) WS *Farrow* Survey course on adolescent health-care topics, including psychological and physical development, sexuality, gynecological problems, chronic illness and hospitalization, acne treatment, office approach. Prerequisites: 665P, MED 665P, and PBSCI 665P; postdoctoral medical trainees.

PEDS 501P Survey of Human Growth and Development (1½) AWSp *Baker* (Clinical Training Unit) Clinical observation and study of normal growth patterns in multiple areas of human development. Observation and increasing participation in patient interview, examination, and treatment plan. Survey of subjects covered in more detail in 502P-503P-504P. Credit not allowed for both 501P and 502P-503P-504P sequence.

PEDS 502P-503P-504P Human Growth and Development (1½-1½-1½) A,W,Sp *Bennett, Doan* Supervised intensive observation and discussion of an individual child over first nine months of life. Opportunity to observe individuality and maturational patterns and to follow physical, emotional, and intellectual growth. Focus on home and family background with opportunity to participate in doctor-patient relationship. Must take all three quarters.

PEDS 511P Pioneer Square Clinic (*, max. 3) AWSpS *Deisher* One night per week at free clinic in Pioneer Square area. Adolescent and young adult patients, generally poorly educated with low incomes and histories of inadequate health care. Seminars and interviews in conjunction with clinic focus on impact of nontraditional lifestyles and values on health status of individuals.

PEDS 512P Laboratory in Human Embryology and Teratology (3) W *Shepard* Teaches and stimulates interest in human teratology and helps the student understand congenital malformations. Informal seminars, laboratory demonstrations, patient presentations, and lectures. For medical or graduate students. Prerequisite: permission of instructor.

PEDS 530P Pioneer Square Adolescent Seminar (1) Clinic-based setting for seminar and interview practice with Pioneer Square adolescents; students learn how to deal with special health problems and other related problems of "street kids" through interviews and observations. Offered on credit/no credit basis only.

CONJ 550P Clinical Infectious Diseases (3) See Conjoint Courses.

PEDS 551P Pediatric Electrocardiography (2) W *Guntheroth* Brief review of the physiology and physics pertinent to clinical electrocardiography is followed by a presentation of terminology and methods in clinical use. Normal electrocardiograms are studied, followed by abnormal tracings, with emphasis on pediatric material, but including adult material such as myocardial infarction. Prerequisite: HUBIO 540P.

PEDS 665P Pediatric General Clerkship (*, max. 24) AWSpS *Robertson* General introductory pediatric clerkship. One-half in hospital setting; one-half in outpatient department, clinic, or private office. Location preferences are considered; twelve-week clerkship is broader, permits more individual selection of site. Open to all third- and fourth-year medical students. Prerequisite: HUBIO 563P. (Six or twelve weeks, full time. Limit: twenty-four students.)

PEDS 669P Neonatal Pediatrics—Clerkship (*, max. 24) AWSpS *Hodson* Participation in the activities in the newborn and premature divisions; ward rounds, seminars, conferences, and familiarization with certain laboratory techniques, particularly those relating to acid-base balance. Prerequisite: 665P.

PEDS 670P Pediatric Infectious Diseases (*, max. 24) AWSpS *A. Smith* Students see and work up clinic consultations and present in detail to attending physician. Daily rounds include problem-solving discussions and didactic presentations in broad category of infectious diseases. Opportunity for experience in clinical research and laboratory techniques. Prerequisites: 665P or permission; third- or fourth-year medical students. (Limit: one student.)

PEDS 673P Office Practice (*, max. 12) AWSpS *Robertson* Opportunity to observe and function in the private office settings of a number of clinical pediatric faculty and to accompany pediatricians as they pursue their daily activities in the community. Prerequisite: 665P.

PEDS 676P Pediatric Clerkship With the Mentally Handicapped (*, max. 12) AWSpS *Ruvalcaba* (Rainier School), *Hayden* (Fircrest School) Total care involvement with mentally handicapped patients, incorporating general pediatric knowledge of mental retardation and neurology, plus other specialties related to mental deficiencies. Additional information may be obtained from Dr. W. O. Robertson, Children's Orthopedic Hospital and Medical Center. Prerequisite: 665P. (Four or six weeks, full time.)

CONJ 677P Clinical Allergy (*, max. 12) See Conjoint Courses.

PEDS 679P Clinical Problems in Developmental Disabilities (*, max. 12) AWSpS *Holm* Experience in multidisciplinary evaluation and management of the handicapped child. Student performs pediatric evaluations, obtains appropriate consultations, observes additional professional assessments (e.g., psychological testing), and plans rehabilitation program. Opportunity to provide parent counseling. Prerequisite: 665P.

PEDS 680P Pediatric Clinics (*, max. 24) AWSpS *Robertson, Staff* One to ten half-day sessions may be elected each week for twelve weeks in the following areas: general pediatrics, endocrinology, neurology, immunology, arthritis, cardiology, congenital defects and retardation, well-child, teratology, adolescent medicine, allergy, cystic fibrosis, hematology, prematurity, neonatology, and poison control. Prerequisite: 665P.

PEDS 681P Pediatric Genetics (*, max. 24) AWSp *Pagon* Clinical focus on evaluation and management of children with genetic disorders. Exposure to genetic counseling, the evaluation of children with hereditary structural defects, and diagnosis and management of children with inborn errors of metabolism. Emphasis on genetic mechanisms that cause human disease. Prerequisite: 665P. (Four, six, or twelve weeks.)

PEDS 682P Congenital Defects—Clinical Experience (*, max. 24) AWSpS *Shurtleff* Advanced course in pediatrics providing experience in the clinical diagnosis and management of struc-

tural and metabolic congenital defects. Prerequisite: permission of instructor.

PEDS 684P Pediatric Pulmonary Medicine (8) AWSpS *Redding* Respiratory disorders, diagnostic techniques and treatments unique to children in the inpatient, intensive care, and outpatient settings. Application of principles of pulmonary physiology to clinical problems. Students conduct consultations under the supervision of the attending and present a topic of choice. Inpatient rounds and clinics. Prerequisite: 665P.

PEDS 685P Pediatric Hematology and Oncology (*, max. 24) AWSpS *Hartmann* One-on-one teaching plus four weekly didactic sessions. Specific training in techniques and interpretation of bone marrow aspirations, intravenous chemotherapy, transfusions, and laboratory techniques of hematologic evaluation. Self-learning programs available. Prerequisite: 665P. (Two, four, six, or twelve weeks, full time.)

PEDS 686P Pediatric Cardiology (*, max. 24) AWSpS *Guntheroth* Emphasis on physical diagnosis and electrocardiography and on clinical knowledge of diagnostic techniques and surgical possibilities for inpatients and outpatients with cardiovascular problems. Opportunity to observe catheterizations and cardiovascular operations. Weekly clinics and twice-daily inpatient rounds. Prerequisite: 665P.

PEDS 687P Advanced Clinical Clerkship in Child Neurology (*, max. 8) AWSpS *Milstein* Advanced course in neurology dealing with neurological disease in children. Both inpatient and outpatient experience are included. Prerequisite: 665P.

PEDS 688P Adolescent Clinic (*, max. 24) AWSp *Deisher* Advanced pediatric clerkship dealing with special problems of the adolescent. Medical students are offered an experience in a multidiscipline clinic. Prerequisite: 665P.

PEDS 691P Advanced Pediatric Clerkship (*, max. 24) AWSpS *Robertson, Staff* Inpatient and/or outpatient experience with responsibilities comparable to an intern for patient workup, diagnosis, and care. Available at any one, or combination, of affiliated hospitals, including WAMI units in Idaho, Montana, or Washington. Students interested in this option should make arrangements well in advance of registration. Prerequisite: 665P.

PEDS 697P Pediatric Special Electives (*, max. 24) AWSpS *Robertson* By specific arrangement, for qualified students, special clerkship externship or research opportunities at institutions other than University of Washington. The faculty can advise of possible opportunities. Obtain special assignment form from Dean's office at least one month before preregistration. Prerequisite: permission of instructor.

Pharmacology

E401 Health Sciences

Pharmacology is the science that deals with the nature of the interactions between drugs and the biological system, and with the application of these drugs to the treatment of disease. Courses in this field are given for medical, dental, pharmacy, nursing, and graduate students.

Graduate Program

The Department of Pharmacology offers programs leading to the Master of Science and Doctor of Philosophy degrees. The Master of Science degree is not required of all students, although it may be elected by the student or requested by the department.

Master of Science and Doctor of Philosophy Degrees

Admission Requirement: A baccalaureate degree with a major in any of the sciences, such as biochemistry, chemistry, pharmacy, physics, physiology, psychology, or zoology.

Graduation Requirements: Master of Science degree—PHCOL 511, 512, 513, and two 500-level pharmacology courses. Demonstration of competence in pharmacology and a related discipline, such as biochemistry or physiology, and a thesis. A foreign language is not required. Doctor of Philosophy degree—PHCOL 511, 512, 513, and five 500-level pharmacology courses. Passing a comprehensive examination covering general pharmacology and the allied disciplines of physiology and biochemistry. General Examination, dissertation, and Final Examination. A foreign language is not required.

In the first year of the program, students generally are expected to enroll in biochemistry, physiology, and pharmacology courses. For each of the academic quarters of the first year, a student may work with a different faculty member. The purpose of rotating among the faculty is to acquaint the student with the various areas of pharmacology and research under investigation within the department. With this insight, the student should be better able to decide on a thesis or dissertation topic.

In the second year, while becoming more involved with research, the student continues attending courses in pharmacology and supporting disciplines. Immediately after Spring Quarter of the second year, the student will be given a departmental qualifying examination. Following this examination, the pharmacology faculty will make one of four recommendations to the student: (1) choose a sponsor and form a Supervisory Committee for the Ph.D. degree, (2) choose a sponsor and work for a Master of Science degree, (3) undergo reexamination at a later date, (4) terminate the program. Six months after the qualifying examination, the student will take the General Examination.

Continued work in the department for a Ph.D. or M.S. degree usually involves taking advanced pharmacology, biochemistry, and physiology courses and research.

Financial Aid

A limited number of teaching assistantships, research assistantships and traineeships are available.

Correspondence and Information

Graduate Program Coordinator
Department of Pharmacology, SJ-30

Faculty

Chairperson

Catterall, William A.

Professors

Aagaard, George N.,* (Medicine),† M.D., 1936, Minnesota; clinical pharmacology.

Bowden, Douglas M.,*‡ (Psychiatry and Behavioral Sciences), M.D., 1965, Stanford; primate models of human neuropsychiatric disorders.

Camerman, Arthur* (Research), (Medicine),† Ph.D., 1964, British Columbia; x-ray crystallography.

Catterall, William A.,* Ph.D., 1972, Johns Hopkins; molecular pharmacology.

Dille, James M. (Emeritus), Ph.D., 1935, Georgetown, M.D., 1946, Illinois; psychopharmacology.

Horita, Akira,* Ph.D., 1954, Washington; biochemical and autonomic pharamacology.

Juchau, Mont R.,* Ph.D., 1966, Iowa; developmental pharmacology, drug metabolism.

Krebs, Edwin G.,* M.D., 1943, Washington (St. Louis); regulation of carbohydrate metabolism, mechanism of action of cyclic AMP, coupling of muscle contraction and glycogenolysis.

Loomis, Ted A.,* Ph.D., 1943, Buffalo, M.D., 1946, Yale; toxicology and neuromuscular pharmacology.

Storm, Daniel R.,* Ph.D., 1971, California (Berkeley); regulation of cyclic nucleotide metabolism, molecular pharmacology of membranes.

Vincenzi, Frank.,* Ph.D., 1965, Washington; cardiovascular pharmacology and transport.

Associate Professors

Beavo, Joseph A.,* Ph.D., 1970, Vanderbilt; metabolic regulation, cyclic nucleotides.

Dorsa, Daniel M.* (Research), (Medicine),† M.D., 1977, California (Davis); neuropharmacology, neurochemistry.

Halpern, Lawrence M.,* Ph.D., 1961, Albert Einstein; neuropharmacology.

McKnight, G. Stanley,* Ph.D., 1976, Stanford; hormonal regulation of gene expression.

Watson, Eileen L. (Research), (Oral Biology),† Ph.D., 1970, Utah; pharmacophysiology.

Assistant Professors

Hinds, Thomas R. (Research), Ph.D., 1972, Oregon State; molecular pharmacology of membranes.

Lai, Henry C. (Research), Ph.D., 1977, Washington; neuropsychopharmacy.

Nathanson, Neil M.,* Ph.D., 1975, Brandeis; regulation of neurotransmitter receptors.

Omiecinski, Curtis J.,*‡ (Environmental Health), Ph.D., 1980, Washington; molecular toxicology.

Course Descriptions

PHCOL 234 General Pharmacology (4) W *Loomis* Lectures and demonstrations concerning the action of drugs on physiological and pathological processes with special emphasis on agents of special importance in the practice of dentistry. For dental hygiene students.

PHCOL 401 General Pharmacology I (3) A *Catterall, Juchau* Principles governing drug-receptor interactions, dose-effect relationships, drug absorption, distribution, metabolism, and excretion. Drug toxicity, tolerance, allergy, and drug-induced mutagenesis and carcinogenesis. Prerequisites: organic chemistry, introductory anatomy, physiology, and biochemistry. For pharmacy students and other undergraduates.

PHCOL 402 General Pharmacology II (4) W *Nathanson* General pharmacology of drugs affecting the autonomic and central nervous systems. For pharmacy students and other undergraduates. Prerequisite: 401 or permission of instructor.

PHCOL 403 General Pharmacology III (4) Sp *Beavo, Storm* General pharmacology of drugs affecting the endocrine and cardiovascular systems and the kidney. Principles of chemotherapy for infectious and neoplastic disease. For pharmacy students and other undergraduates. Prerequisites: 401, 402, or permission of instructor.

PHCOL 434 General Pharmacology (4) Sp W *Loomis* Lectures and demonstrations concerning the action of drugs on physiological and pathological processes with special emphasis on agents of special importance in the practice of dentistry. For dental students.

PHCOL 498 Undergraduate Thesis (*) AWSpS For medical students. Prerequisite: permission of instructor.

PHCOL 499 Undergraduate Research (*) AWSpS Participation in departmental research projects. Open to medical students. Prerequisite: permission of instructor.

PHCOL 507 Pharmacology Seminar (1) AWSp Presentation of comprehensive reports on recent medical and scientific literature in fields of current importance. Research progress reports, and reports on results of completed research. Prerequisite: permission of instructor.

PHCOL 511 General Pharmacology I (3) A *Catterall, Juchau* Consideration of principles governing drug-receptor interactions, dose-effect relationships, drug absorption, distribution, metabolism, and excretion. Introduction to drug toxicity, tolerance, allergy, and drug-induced mutagenesis and carcinogenesis. Current research approaches to understanding the basic mechanism of drug action. Prerequisites: graduate standing, organic chemistry, biochemistry, and introductory anatomy and physiology.

PHCOL 512 General Pharmacology II (4) W *Nathanson* General pharmacology of drugs affecting the autonomic and central nervous systems. Emphasis on current research approaches to understanding the basic mechanisms of drug action. For graduate students. Prerequisite: 511 or permission of instructor.

PHCOL 513 General Pharmacology III (4) Sp *Beavo, Storm* General pharmacology of drugs affecting the endocrine and cardiovascular systems and the kidney. Principles of chemotherapy for infectious and neoplastic disease. Emphasis on current research approaches to understanding the basic mechanisms of drug action. For graduate students. Prerequisites: 511, 512, or permission of instructor.

PHCOL 514 Current Topics in Pharmacology (1) AWSp *McKnight* Current research related to the mechanisms of drug action presented in a seminar format. Presentations include relevant background material as well as detailed experimental results taken from current research articles. Open to medical and graduate students. Prerequisite: permission of instructor.

PHCOL 515 General Pharmacology Laboratory (3) W *Juchau* Selected laboratory experiments in pharmacology for demonstration of basic principles of drug actions. Autonomic nervous system, central nervous system, and cardiovascular drugs are employed in both intact and isolated mammalian systems. One lecture and one four-hour laboratory per week. Prerequisite: permission of instructor.

PHCOL 519 Introduction to Laboratory Research in Pharmacology (4) AWSpS *Krebs* Students become familiar with, and assist in, the performance of research on ongoing projects in designated laboratories. Emphasis on currently employed methodology and techniques. For first-year graduate students in pharmacology to provide a basis for future independent research.

PHCOL 525 Autonomic-Cardiovascular Pharmacology (2) W *Horita, Vincenzi* Advanced considerations of drug actions on the autonomic and cardiovascular systems. Cellular and membrane actions of drugs influencing synaptic transmission, cardiac automaticity, excitability, contractility, and interpretation of original research in these areas. Open to medical and graduate students. Prerequisite: permission of instructor. (Offered even-numbered years.)

PHCOL 527 Drug Metabolism (3) W *Juchau, Nelson* Considerations of the biochemical mechanisms for the biotransformation of drugs and foreign compounds. Open to medical and graduate students. Offered jointly with MEDCH 527. Prerequisite: one year graduate, medical, or dental biochemistry, or permission of instructor. (Offered odd-numbered years.)

PHCOL 528 Neuropsychopharmacology (2) A *Halpern* Review and discussion of laboratory approaches disclosing the pharmacology of the central nervous system. Prerequisites: 401, 402, 403, or 434 or 511, 512 or permission of instructor. Entry card required. (Offered even-numbered years.)

PHCOL 529 Membrane Pharmacology (2) Sp *Catterall, Nathanson* Advanced consideration of the fundamental properties of biological membranes and the mechanisms of drug and hormone action on enzymes, drug and hormone receptors, and ion transport systems in the plasma membrane of cells. Prerequisites: 511, 512, 513, BIOC 440, 441, or 531 or permission of instructor. (Offered even-numbered years.)

PHCOL 530 Cyclic Nucleotide Metabolism (2) W *Beavo, Storm* Advanced consideration of synthesis, degradation, and effects of cyclic nucleotides on physiological processes. Topics include adenylate cyclase and hormone receptors, cyclic nucleotide phosphodiesterases, and protein kinases. Open to medical and graduate students. Prerequisites: 511, 512, 513, or BIOC 440, 441, 531, or permission of instructor. (Offered even-numbered years.)

PHCOL 531 Steroid Hormone Action (2) Sp *McKnight* Advanced discussion of hormone-receptor interactions, structure of active genes, and molecular events leading to altered gene expression in target tissues. Major emphasis on current research with steroid hormones. Open to medical and graduate students. Prerequisite: permission of instructor. (Offered odd-numbered years.)

PHCOL 533 Advanced Toxicology (2) S *Loomis* Didactic consideration of chemical, physical, and biological methods involved in studies of harmful effects of chemicals on biological tissue. Prerequisites: 401, 402, 403, or 511, 512, 513, or permission of instructor. (Offered odd-numbered years.)

PHCOL 534 Neuropeptide Pharmacology (2) S *Dorsa, Horita* Advanced consideration of the pharmacology and neurochemistry of peptides in the central nervous system. Biosynthesis, distribution, and neurochemical and behavioral effects of neuropeptides with special emphasis on endogenous opiate and gut-brain peptides. Prerequisites: 401, 402, 403 or permission of instructor.

PHCOL 550 An Overview of Faculty Research (1) A Reviews research topics currently being studied in pharmacology. Student reads articles published on each topic. Offered on credit/no credit basis only. Prerequisite: first-year student standing in pharmacology.

PHCOL 600 Independent Study or Research (*) AWSpS

PHCOL 697P Pharmacology Special Electives (*) AWSpS By specific arrangement, for qualified students, special clerkship, externship, or research opportunities can at times be made available at institutions other than the University of Washington. The faculty can advise student of opportunities. Students electing this course should obtain from the Dean's office a special assignment form at least one month before preregistration.

PHCOL 700 Master's Thesis (*) AWSpS

PHCOL 800 Doctoral Dissertation (*) AWSpS

Physiology and Biophysics

G414 Health Sciences

Physiology deals with the processes, activities, and phenomena incidental to, and characteristic of, life and living organisms. Based upon zoology, physics, chemistry, and mathematics, physiology interlocks closely with the other basic medical sciences—biological structure, biochemistry, pharmacology, and pathology—and with psychology. For this reason, physiology appeals to students with diverse backgrounds and goals. Courses in this field are given for medical, dental, pharmacy, nursing, and graduate students.

Biophysics emphasizes the physical aspects of organs and control systems studied by the instruments and methods of thinking used by physicists.

Graduate Program

The Department of Physiology and Biophysics offers advanced instruction and training leading to both the Master of Science and Doctor of Philosophy degrees. Students aspiring only to the M.S. degree are rarely accepted. A separate degree is not offered in biophysics, although students entering the biophysics program pursue a somewhat different course, emphasizing more advanced mathematics and physics than those following the classical physiology pathway. Studies leading to the Ph.D. degree usually require four or five years. The first two years are spent mainly in acquiring a broad knowledge of the subject matter of physiology, the later years in pursuing an area in depth and in successfully completing an original research project.

For students wishing a program equally distributed between physiology and psychology, an interdisciplinary Ph.D. degree program in these subjects is administered by the Physiology-Psychology Group of the Graduate School (see Physiology-Psychology). The curriculum emphasizes the overlap areas between experimental psychology and physiology, especially neurophysiology.

Special Requirements

Applicants for the classical physiology program should have a baccalaureate degree in biology, physics, mathematics, psychology, engineering, or chemistry. Those accepted to the biophysics training program should have a baccalaureate degree in physics, mathematics, engineering, or physical chemistry.

Graduate Record Examination scores are required as part of the application.

Students are normally admitted to the graduate program in the Autumn Quarter. Initial review and selection takes place by March 15. Because the department is able to accept only a small number of students each year, often no additional students can be accepted after this initial review. Therefore, applications and all relevant material should be submitted by February 15 to ensure full consideration.

Research Facilities

The department is well equipped to provide instruction and research training in membrane physiology; neurophysiology; cardiovascular, respiratory, and renal physiology; endocrinology; and muscle physiology. The facilities of the Regional Primate Research Center, adjacent to the department, sometimes are available to qualified trainees who need to use primates in their research.

Correspondence and Information

Graduate Program Coordinator
Department of Physiology and Biophysics, SJ-40

Faculty

Chairperson

Wayne E. Crill

Professors

Almers, Wolfhard,* Ph.D., 1971, Rochester; skeletal muscle physiology.

Anderson, Marjorie E.,* (Rehabilitation Medicine),† Ph.D., 1969, Washington; physiology of basal ganglia and cerebellum.

Brengelmann, George L.,* Ph.D., 1967, Washington; temperature regulation, cutaneous blood flow.

Crill, Wayne E.,* (Medicine),† M.D., 1962, Washington; properties of spinal and cortical neurons, mechanism of repetitive firing of CNS neurons.

Feigl, Eric O.,* M.D., 1958, Minnesota; cardiovascular physiology, coronary and cerebral circulation.

Fetz, Eberhard E.,* Ph.D., 1966, Massachusetts Institute of Technology; cortical regulation of movement.

Fuchs, Albert F.,* Ph.D., 1966, Johns Hopkins; oculomotor physiology, vision.

Goodner, Charles J.,*‡ (Medicine), M.D., 1955, Utah; endocrinology, carbohydrate metabolism, diabetes.

Gordon, Albert M.,* Ph.D., 1961, Cornell; skeletal muscle physiology.

Hildebrandt, Jacob,* (Medicine),† Ph.D., 1966, Washington; respiratory physiology.

Hille, Bertil,* Ph.D., 1967, Rockefeller; receptors and channels of excitable membranes.

Hlastala, Michael P.,* (Medicine),† Ph.D., 1969, State University of New York (Buffalo); respiratory physiology, inert gas analysis of respiratory function.

Hornbein, Thomas F.,* (Anesthesiology),† M.D., 1956, Washington (St. Louis); respiratory physiology adaptive to high altitudes.

Kehl, Theodore H.,* (Computer Science),† Ph.D., 1961, Wisconsin; computer application in physiology.

Kennedy, Thelma T.,* Ph.D., 1955, Chicago; cerebellum, motor unit properties.

Koerker, Donna J.,* (Medicine),† Ph.D., 1970, Michigan; endocrinology, intermediate metabolism of carbohydrates.

Patton, Harry D. (Emeritus), Ph.D., 1943, M.D., 1946, Yale; neurophysiology, motor systems.

Rowell, Loring B.,* Ph.D., 1962, Minnesota; regulation of blood flow, exercise physiology.

Scher, Allen M.,* Ph.D., 1951, Yale; electrophysiology of heart, baroreceptor reflexes.

Smith, Orville A.,* Ph.D., 1950, Michigan State; central regulation of cardiovascular function.

Stahl, William L.,* (Medicine),† Ph.D., 1963, Pittsburgh; neurochemistry of brain ATPase systems.

Stirling, Charles E.,* Ph.D., 1966, State University of New York; epithelial transport mechanisms.

Teller, Davida Y.,* (Psychology),† Ph.D., 1965, California (Berkeley); vision, psychophysics, development of vision.

Towe, Arnold L.,* Ph.D., 1953, Washington; cerebral cortical networks.

Van Citters, Robert L.,* (Medicine),† M.D., 1953, Kansas; cardiovascular physiology.

Wiederhielm, Curt A. (Emeritus), Ph.D., 1961, Washington; microcirculation, capillary exchange.

Young, Allan C. (Emeritus), Ph.D., 1934, Toronto; control of respiration, blood gases.

Associate Professors

Berger, Albert J.,* Ph.D., 1967, Princeton, Ph.D., 1976, California (San Francisco); neural and chemical control of respiration.

Binder, Marc D.,* Ph.D., 1974, Southern California; organization of spinal reflexes.

Cunningham, Susanna L.,*‡ (Nursing), Ph.D., 1977, Washington; hormonal regulation of circulation, hypertension.

Detwiler, Peter B.,* Ph.D., 1970, Georgetown; physiology of sensory receptors, retina.

Freund, Peter R.,‡ (Anesthesiology), M.D., 1971, Columbia; temperature regulation, vasomotor control, physiology/biophysics.

Landau, Barbara B. (Emeritus), (Biological Structure),† Ph.D., 1970, Georgetown; physiology of hibernation.

Schwartzkroin, Philip A.,* (Neurological Surgery),† Ph.D., 1972, Stanford; properties of hippocampal neurons.

Schwindt, Peter C.,* (Medicine),† Ph.D., 1972, Washington; properties of spinal and cortical neurons, mechanisms of repetitive firing and convulsive activity.

Skahen, Julia G. (Emeritus), Ph.D., 1940, Chicago; endocrinology.

Steiner, Robert A.,* (Obstetrics and Gynecology),† Ph.D., 1975, Oregon; reproductive physiology.

Assistant Professors

Cook, Daniel L. (Research), (Medicine),† M.D., 1977, Ph.D., 1980, Washington; insulin secretion.

Wyss, Craig R. (Research), (Orthopaedics),† M.D., 1972, Ph.D., 1977, Washington; cardiovascular physiology.

Course Descriptions

CONJ 340-341-342 Human Anatomy and Physiology (4-4-4) See Conjoint Courses.

P BIO 360 General Human Physiology (5) *Conrad* Basic principles of physiology as they apply to the human being. Organ system approach used to illustrate the functions of the cardiovascular, renal, respiratory, reproductive, digestive, endocrine, and nervous systems. Prerequisites: general chemistry, elementary physics, or permission of instructor.

P BIO 401 Basic Human Physiology: Neurophysiology (3) A *Kennedy* The sequence 401, 402, 403 covers basic human physiology at an intermediate level. It is desirable to take the three parts in sequence. Covers nerve, muscle, synapse, reflex, general and special sensory systems, and motor systems of the brain. Prerequisites: general chemistry, elementary physics, graduate or senior standing, permission of instructor.

P BIO 402 Basic Human Physiology: Transport and Exchange Organ Systems (3) W *Brengelmann* Covers cardiovascular system, respiration, acid-base balance, renal system, temperature regulation. Prerequisites: general chemistry, elementary physics, graduate or senior standing, permission of instructor.

P BIO 403 Basic Human Physiology: Metabolism and Endocrinology (3) Sp *Koerker, Steiner* Covers energy metabolism, gastrointestinal system, endocrinology, and reproduction. Prerequisites: general chemistry, elementary physics, graduate or senior standing, permission of instructor.

P BIO 405-406 Human Physiology (3-3) A,W *Berger* Intensive coverage of advanced physiology through lectures and demonstrations. Autumn Quarter—Neurophysiology from basic properties of membranes through sensory and motor systems. Introduction to autonomic nervous system. Winter Quarter—Applied systems: cardiovascular, respiratory, renal, endocrine, and gastrointestinal. Required for first-year dental students; also offered for graduate students. Entry card required.

P BIO 424 Vision and its Physiological Basis (5) A *Buck, Teller* Phenomena of human vision, including spectral sensitivity, color vision, acuity and spatial vision, light and dark adaptation, and binocular vision. Emphasis on correlation of human visual functioning with known optical, biochemical, physiological, and anatomical substrates. Offered jointly with PSYCH 424. Recommended: background in some physical or biological science.

P BIO 498 Undergraduate Thesis (*) AWSpS For medical students. May be repeated for credit. Prerequisite: permission of instructor.

P BIO 499 Undergraduate Research (*) AWSpS For medical students. May be repeated for credit. Prerequisite: permission of instructor.

P BIO 503 Physiological Systems (4) A *Fetz* Introduction to linear systems and electronic circuits. Topics include basic circuit theory; step and sinusoidal response of first- and second-order linear systems (RLC circuits, mechanical and hydraulic systems); bode plots; Fourier analysis and Laplace transforms; kinetics; operational amplifier circuits. Associated laboratory exercises. Prerequisites: beginning calculus, permission of instructor.

P BIO 504 Physiological Instrumentation (3) W Principles of operation and discussion of practical aspects of basic instrumentation used in physiological experiments. Includes transduction, amplification, signal conditioning, recording and display devices, and use of digital logic in simple control applications. Uses principles developed in 503, but in an application context. Prerequisites: 503, permission of instructor.

P BIO 508 Physiology Laboratory (1) WSp Small-group experiments to complement the content of courses 509 through 514. Four or five different laboratories are scheduled for each quarter. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

P BIO 509 Physiology of Transport Organ Systems (3) A *Stirling* Detailed biophysical discussion of diffusion and active sodium-potassium transport provides a foundation for a subsequent presentation of transport phenomena of the alimentary canal and kidney. Emphasis on the transport mechanisms of these tissues. Prerequisite: permission of instructor.

CONJ 509 Neurochemistry (3) W See Conjoint Courses.

P BIO 510 Nerve-Muscle Physiology (4) A *Almers, Detwiler, Gordon* Detailed consideration of ion transport, nerve-impulse conduction, neuromuscular synaptic transmission, excitation-contraction coupling, and contraction coupling and contractile processes of vertebrates. Aim is to convey the concepts of excitable, synaptic, and contractile phenomena. Prerequisite: permission of instructor.

P BIO 511 Neurophysiology (4) W *Fuchs* An advanced course on functioning of the central nervous system (somatic and visceral); special senses (audition, vision, vestibular); descending systems (cortical and subcortical); cerebellum; hypothalamus; behavior and neurophysiology; comparative neurophysiology. Prerequisite: permission of instructor.

CONJ 511 Functional Neuroanatomy (4) See Conjoint Courses.

P BIO 512 Cardiovascular Physiology (3) Sp *Rowell* Considers the function of the heart and blood vessels from a cellular and organ point of view, including the regulation of flow to various organs. Integrates much of this material into a consideration of the cardiovascular system. Prerequisite: permission of instructor.

P BIO 513 Respiratory Physiology and Acid-Base Balance (3) Sp *Hlastala* Introduction covering, in moderate depth, metabolism, respiratory gas transport, lung mechanics, neural and chemical control, and acid-base regulation, primarily as related to humans. Prerequisites: elementary physics and biology, and permission of instructor.

P BIO 514 Physiology of Metabolic and Endocrine Regulation (3) Sp *Koerker* Control functions of endocrine system: pituitary, hypothalamus, target organs, thyroid, adrenal cortex and medulla; pancreas, parathyroid, reproduction physiology. Prerequisite: permission of instructor.

P BIO 516 Physiological Proseminar (7) W Guided survey of the experimental literature. Course conducted as seminar with oral analysis of assigned papers and topics. Prerequisite: permission of instructor.

P BIO 518 Research Topics in Cardiovascular Physiology (1) WSp *Feigl* Graduate students and faculty members present and discuss current literature and research. May be repeated for credit. Prerequisite: permission of instructor.

P BIO 519 Membrane and Muscle Biophysics Seminar (1) Sp *Almers* Detailed discussion and study of current topics in cell membrane function and muscle contraction. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

P BIO 520 Physiology Seminar (*) AWSpS Selected topics in physiology. May be repeated for credit. Prerequisite: permission of instructor.

P BIO 521 Biophysics Seminar (*) AWSpS Selected topics in biophysics. May be repeated for credit. Prerequisite: permission of instructor.

P BIO 522 Selected Topics in Respiratory Physiology (1-3) AWSpS *Hildebrandt* Advanced seminar on selected topics, including pulmonary mechanics, gas exchange, lung fluid balance and circulation, control of respiration. Prerequisite: permission of instructor.

P BIO 523 Heat Transfer and Temperature Regulation (2-5) S *Brengelmann* Thermal exchange between the body surface and the environment. Heat production and distribution within the body. Properties of cutaneous and deep temperature receptors. Neural integration and homeothermy. Prerequisite: permission of instructor. (Not offered every year.)

P BIO 525, 526, 527 Readings in Advanced Physiology and Biophysics (*, *, *) A,W,SpS Guided study of the experimental literature of physiology and biophysics. Essays are written and discussed with the staff. Emphasis is placed on critical analysis, accuracy of expression, bibliographical technique, and other factors of good scholarship. Each course may be repeated for credit. Prerequisite: permission of instructor.

P BIO 530 Synapse and Reflex Seminar (4) A *Binder* Guided survey of the literature pertaining to reflex and synaptic physiology. Course is conducted as seminar with students giving oral reports on assigned topics. Prerequisites: 515 and permission of instructor.

P BIO 532 Mathematical Methods of Physiology and Biophysics (3) Selected mathematical methods in physiology and biophysics. Solution of differential equations using the Laplace transform linear approximation of nonlinear systems, transfer function, and Green's function description of physiological systems. Prerequisite: permission of instructor. (Not offered every year.)

P BIO 533 Theory of Biological Control Systems (3) W Block and signal flow diagrams, description of response of feedback systems; roots and poles of linear systems; frequency response and Bode plots; s-plane description of feedback systems; synthesis of descriptive functions of experimental results; effect of nonlinearities on control system response. Prerequisite: permission of instructor. (Not offered every year.)

P BIO 534 Applications of Biological Control Systems (3) W Examples of biological control systems are discussed in detail. Problems in research on respiratory, cardiovascular, hormonal, metabolic, oculomotor, and other regulatory systems are presented. Prerequisite: permission of instructor. (Not offered every year.)

P BIO 535 Operative Techniques in Neurophysiology (2-5) S *Smith* Decerebration, laminectomy, cortical ablation, stereotaxic lesions, cardiovascular surgery, chronic electrode implants, anesthesiology. Aseptic procedures and animal care. Prerequisite: permission of instructor.

P BIO 539 Sensory Systems I (3) Sp *Binder* Reading and analysis of primary sources in sensory neurophysiology. Receptor mechanisms and the somatosensory system are covered. Prerequisite: 511 or equivalent. (Offered Spring quarters in rotation with 540.)

P BIO 540 Sensory Systems II (3) Sp *Fuchs* Neural processing of visual information and auditory information. Selected topic, such as visual acuity, is introduced by behavioral papers on infants and adults. Neural structures involved in elaborating the sensory property (visual acuity) examined in papers usng neurophysiological techniques.

P BIO 541 Motor Systems I: Peripheral Mechanisms (3) W *Binder* Critical reading and discussion of research papers on the current physiology of the motor unit, afferent inputs and segmental interneurons that control motor units. Prerequisites: 511 or equivalent and permission of instructor. (Offered Winter quarters, rotating with 542, 543.)

P BIO 542 Motor Systems II: Brainstem Mechanisms (3) W *Anderson, Fuchs* Critical discussion of research papers and resulting concepts regarding the role of various brainstem systems in controlling somatic and ocular movements. Prerequisites: 511 or equivalent and permission of instructor. (Offered Winter quarters, rotating with 541, 543.)

P BIO 543 Motor Systems III: Cerebral Cortex and Cerebellum (3) W *Fetz, Kennedy* Critical reading and discussion of classical and current papers on motor cortex, corticospinal, corticopontine, and corticobulbar systems; on cerebellar circuitry and function, and cerebrocerebellar relations. Prerequisites: 511 or equivalent and permission of instructor. (Offered Winter quarters, rotating with 541, 542.)

P BIO 544 Properties of Neurons (3) *Kaneko, Schwindt* Critical reading and discussion of papers on passive, active, and integrative properties of single invertebrate and mammalian neurons. Provides understanding of how a variety of cellular mechanisms contribute to neuronal discharge patterns. Prerequisites: 510 and 511 or equivalent and permission of instructor.

P BIO 545 Physiology of Vision (3) Sp *Teller* Selected readings from recent literature on vision and visual systems. Prerequisite: permission of instructor.

P BIO 546 Advanced Topics in Biophysics (1½, max. 8) *Hille* In-depth lectures by biophysics faculty members reviewing topics in membrane excitability, transport, and muscle contractility. Offered on credit/no credit basis only. Prerequisite: 510 or equivalent.

P BIO 547 Readings in Cell Physiology (2 or 3, max. 15) *Hille* Reading and discussion of research literature on excitable cells. Emphasis on membrane excitability, transport, and muscle contractility. A literature research paper may be written for additional credit. Prerequisite: 510 or equivalent.

P BIO 548 Predoctoral Presentations in Biophysics (1, max. 5) *Ruff* Student presentations of their own investigations or of a library research topic. Techniques to improve content and style of presentations. Offered on credit/no credit basis only. Prerequisite: student standing in pathobiology or permission of instructor.

P BIO 549 Plasticity in the Vertebrate Nervous System (1) Sp *Schwartzkroin* Emphasis on mammalian CNS. Examples of anatomical, pharmacological plasticity chosen from literature. Structure changes during development and in adult (hippocampus, spinal cord, nerve-muscle) studied and as correlates of learning. Students responsible for leading class discussion of one topic. Offered on credit/no credit basis only. Prerequisites: graduate-level courses in neurophysiology and neuroanatomy; understanding of basic neuronal mechanisms. (Offered alternate years.)

P BIO 550 Cortical Potentials (4) *Towe* Properties of continuous and evoked potentials and their interactions, including the biophysics of their cellular origin. Prerequisites: 515 and permission of instructor.

P BIO 551 Scientific Inference (4) WSpS *Binder* Lectures, discussions, reading, and exercises to illuminate principles of scientific inference and their use and misuse in scientific research. Formal analysis of inference and deduction, hypothesis structure and testing, applications of statistical inference, heuristic modeling, and experimental design. Prerequisite: 511 or HUBIO 512 or permission of instructor.

P BIO 552P Practicum in Scientific Inference (*, max. 6) *Binder* Library research leading to a manuscript tracing the scientific foundations and hypotheses underlying a contemporary medical procedure, treatment, or viewpoint. Prerequisite: 551 or HUBIO 512.

P BIO 559 Integrative Neurophysiology (3) Sp *Towe* Interpretation of neurophysiological phenomena from comparative, biophysical, and evolutionary standpoints. Prerequisite: permission of instructor.

P BIO 560 Contraction of Skeletal Muscle (*) W *Gordon* Selected topics on muscle contraction. Consideration of different types of muscle. Reading of original papers. Presentations by students and faculty. Prerequisite: permission of instructor. (Not offered every year.)

P BIO 594 Neurological Study Unit (2) AW *Crill* Faculty and student discussion of neurological topics illustrated with clinical cases or demonstrations include the following: physiology, neuroanatomy, neurology, neuropathology, neurosurgery, and psychiatry. May be repeated for credit. Offered on credit/no credit basis only. Prerequisite for medical students: HUBIO 532P.

P BIO 600 Independent Study or Research (*) AWSpS

P BIO 700 Master's Thesis (*) AWSpS

P BIO 800 Doctoral Dissertation (*) AWSpS

Psychiatry and Behavioral Sciences

BB1644 Health Sciences

The department offers course work, clinical training, and research opportunities for undergraduate students, medical students, graduate physicians, and graduate students in allied health programs such as psychology, social work, and psychiatric nursing.

A biobehavioral approach is emphasized, which incorporates intrapersonal, interpersonal, and sociocultural factors. Intrapersonal factors include emotion, perception, cognition, psychodynamics, neurochemistry, neuroanatomy, neurophysiology, and the developmental and aging processes. Interpersonal factors focus upon duadic, familial, and group interactions. Sociocultural factors include the cultural, social, institutional, and community systems as well as the environment and epidemiology of health and disease.

Undergraduate Program

A variety of courses in the behavioral sciences and psychiatry are available to students during their undergraduate years. Included among these are psychosocial growth and development, aging and adult development, preventive methods for mental health, cross-cultural mental health, clinical psychiatry, and behavioral medicine.

Graduate Program

The medical school curriculum is divided into a core (basic) curriculum and an elective curriculum. The Department of Psychiatry and Behavioral Sciences offers material covering learning theory, cognition, memory, perception, neuropharmacology, social growth and development, epidemiology of health and disease, psychopathology, and psychotherapy, as well as the development of interviewing skills and assessment techniques within the core curriculum. Its elective program includes a variety of clinical experiences and advanced didactics and seminars designed to further the knowledge and skills developed during the basic curriculum. In addition, the department encourages research and other scholarly pursuits by students in areas of interest to them. Stipends are available for research studies.

Residency Training in Psychiatry

A four-year residency for medical school graduates approved by the American Psychiatric Association prepares physicians for Specialty Board Certification in Psychiatry. Clinical rotations on various inpatient, outpatient, and consultation/liaison services are augmented by individual supervision and didactic lectures. With the program's eclectic emphasis, residents become proficient in areas of psychotherapy, psychopharmacology, and community liaison with patients of all ages. Fellowships in child, geriatric, and community psychiatry are available.

Clinical Psychology Residency Program

A one-year clinical residency in psychology approved by the American Psychological Association is offered as an interdepartmental program. This residency is open to candidates for the doctorate in clinical psychology from graduate programs approved by the American Psychological Association. Postdoctoral fellows with equivalent training can also be accepted.

Faculty

Acting Chairperson

John E. Carr

Professors

Becker, Joseph,* (Psychology),† Ph.D., 1958, Duke; psychology.
Bowden, Douglas M.,* (Pharmacology), M.D., 1965, Stanford.
Carr, John E.,* (Psychology),† Ph.D., 1963, Syracuse; clinical psychology.
Chapman, C. Richard,* (Anesthesiology),† Ph.D., 1969, Denver; psychology.
Croake, James W., Ph.D., 1966, Washington State; psychology.
Doerr, Hans O.,* (Psychology),† Ph.D., 1965, Florida State; clinical psychology.
Dunner, David L., M.D., 1965, Washington (St Louis).
Fellner, Carl H., M.D., 1952, Lausanne.
Hampson, John L., M.D., 1946, Johns Hopkins.
Holmes, Thomas H., M.D., 1943, Cornell.
Johnson, Merlin H., M.D., 1947, State University of Iowa.
Kogan, Kate L. (Emeritus), Ph.D., 1943, Columbia.
Martin, Joan C.,* Ph.D., 1965, Florida State; experimental psychology.
Reichler, Robert J., (Pediatrics), M.D., 1961, Albert Einstein.
Robinson, Nancy M.,* (Pediatrics, Psychology), Ph.D., 1958, Stanford; psychology.
Rothenberg, Michael B., M.D., 1954, Case Western Reserve.
Streissguth, Ann P., Ph.D., 1964, Washington; psychology.
Townes, Brenda D.,* (Anesthesiology, Psychology), Ph.D., 1970, Washington; psychology.

Associate Professors

Armstrong, Hubert E., Ph.D., 1963, Syracuse; clinical psychology.
Avery, David H., M.D., 1972, Washington (St. Louis).
Barnes, Robert F., M.D., 1973, Utah.
Carlin, Albert S., Ph.D., 1964, Syracuse; clinical psychology.
Chaney, Edmund F., Ph.D., 1976, Washington; clinical psychology.
Chiles, John A., M.D., 1966, Pennsylvania.
Cox, Gary B.* (Research), (Social Work), Ph.D., 1970, Duke; psychology.
Cmic, Keith A., Ph.D., 1976, Washington; clinical psychology.
Donovan, Dennis M., Ph.D., 1980, Washington; clinical psychology.
Dodrill, Carl B., (Neurological Surgery),† Ph.D., 1970, Purdue; clinical psychology.
Heiman, Julia R., Ph.D., 1975, State University of New York; clinical psychology.
Hunt, D. Daniel, M.D., 1973, Cornell.
Landesman-Dwyer, Sharon, Ph.D., 1974, Washington; developmental psychology.
Maxim, Peter E., M.D., Ph.D., 1966, Yale.
Preston, Caroline E., M.A., 1941, Colorado.
Prinz, Patricia N.,* (Nursing), Ph.D., 1969, Stanford; pharmacology.
Raskind, Murray A., M.D., 1968, Columbia.
Reifler, Burton V., M.D., 1969, Emory.
Scher, Maryonda, M.D., 1954, Washington.
Sulzbacher, Stephen I., (Pediatrics),† Ph.D., 1971, Washington; special education.
Trupin, Eric W., Ph.D., 1974, Wyoming; psychology.
Veith, Richard C., M.D., 1973, Washington.
Verhulst, Johan, M.D., 1964, Leuven.
Vitaliano, Peter P.,* (Psychology), Ph.D., 1975, Syracuse; psychology.
Walker, R. Dale, M.D., 1972, Oklahoma.
Ward, Nicholas G., M.D., 1973, Cornell.
Wilson, Lawrence G., M.D., 1966, Kansas.
Womack, William M., M.D., 1961, Virginia.

Assistant Professors

Beitman, Bernard D., M.D., 1968, Yale.
Bokan, John A. E., M.D., 1975, New Mexico.
Borson, Soo, M.D., 1969, Stanford.
Burke, Patrick M., M.D., 1970, Galway, Ph.D., 1976, Brown.
Calsyn, Donald A., Ph.D., 1979, Washington; educational psychology.
Cheah, Keong-Chye, M.D., 1967, Arkansas.
Chen, Andrew C. N. (Research), (Oral Medicine), Ph.D., 1980, Washington; neuropsychophysiology.
Chen, Stephen S., M.D., Ph.D., 1959, Taiwan.
Fehrenbach, Peter, Ph.D., 1981, Missouri; clinical psychology.
Gentry, Rex N., M.D., 1974, Indiana.
Hahn, Robert A. (Acting), Ph.D., 1976, Harvard; social anthropology.
Hyde, Thomas S. (Research), Ph.D., 1969, Minnesota; psychology.
Katon, Wayne J., M.D., 1976, Oregon.
Maiuro, Roland D., Ph.D., 1978, Washington (St. Louis); clinical psychology.
Malas, Kenneth L., M.D., 1976, Washington (St. Louis).
McCauley, Elizabeth A., Ph.D., 1973, State University of New York; clinical and development psychology.
Meltzoff, Andrew N. (Research), Ph.D., 1976, Oxford; psychology.
Mitchell, Jeffrey R., M.D., 1971, Maryland.
Pascualy, Ralph A. (Acting), M.D., 1978, State University of New York.
Ries, Richard K., M.D., 1975, Northwestern.
Romano, Joan, Ph.D., 1982, Pittsburgh; clinical psychology.
Roszell, Douglas K., M.D., 1966, Minnesota.
Speltz, Matthew L. (Acting), Ph.D., 1980, Missouri; clinical psychology.
Teri, Linda, Ph.D., 1980, Vermont; clinical psychology.
Turner, Judith A., (Rehabilitation Medicine),† Ph.D., 1979, California; clinical psychology.
Varley, Christopher K., M.D., 1973, Washington.
Vitiello, Michael V. (Research), Ph.D., 1980, Washington; psychology.
Waters, Robert N., M.D., 1975, Loma Linda.
Williamson, Penelope R., (Family Medicine),† Sc.D., 1969, Johns Hopkins; behavior and ecology.

Instructors

Dager, Stephen (Acting), M.D., 1978, Nebraska.
Ishiki, Dean M., Ph.D., 1968, Baylor.
Lampe, Thomas H., M.D., 1977, Indiana.
Londborg, Peter (Acting), M.D., 1979, Minnesota.
Moore, James E., Ph.D., 1983, Missouri; clinical psychology.
Murburg, M. Michele, M.D., 1978, Albert Einstein.
Phillips, Michael R. (Acting), M.D., 1974, McMaster.
Risse, Steven C., M.D., 1978, Wisconsin.
Sylvester, Carrie E. (Acting), M.D., 1970, Washington.

Lecturers

Backus, Frank I., M.D., 1962, Washington.
Brinkley, John R., M.D., 1973, Wisconsin.
Louks, John L., Ph.D., 1972, Minnesota; counseling and clinical psychology.
Mason, Jay C., M.D., 1966, Marquette.
Wilkie, Frances L., M.A., 1959, Mississippi; psychology.
Wright, Robert G., M.D., 1954, Rochester.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

PBSCI 451 Principles of Personality Development (2) Sp *Doerr* Development of the personality from infancy through advanced age traced to its physiologic, experiential, and cultural sources with emphasis on psychodynamic concepts and behavior.

PBSCI 452 Clinical Psychiatry (2 or 3) Sp *Gentry* Teaches the process of diagnosing psychiatric illness through learning psychiatric terminology and diagnostic criteria; practicing, identifying, and organizing data of observed interviews; becoming comfortable relating to people with psychiatric illness. Designed for students preparing for allied health and behavioral sciences careers. Prerequisite: permission of instructor.

CONJ 475 Alcoholism: A Course for Medical Students in the Allied Health Sciences (2) Sp See Conjoint Courses.

PBSCI 498 Undergraduate Thesis (*) AWSpS Opportunity to complete work on psychiatric research projects or to pursue a specific psychiatric topic in depth, for instance, through library research. May be repeated for credit. Prerequisite: permission of responsible faculty member. (Four or six weeks, full time, or equivalent part-time.) Entry card required.

PBSCI 499 Undergraduate Research (*, max. 15) AWSpS Opportunities are available for participation in a wide variety of ongoing research in the behavioral sciences and clinical psychiatry, or for the development of an individual investigative project under the supervision of a faculty sponsor. May be repeated for credit. Prerequisite: permission of faculty sponsor. (Two, four, six, or twelve weeks.) Entry card required.

PBSCI 525P Forensic Issues in Mental Illness (3) Sp *Goldenberg* Concentration on major areas in psychology and law (e.g., criminal, civil); several outside speakers from professional, legal, judicial, and psychiatric communities; lectures followed by discussion groups; and case presentations. Background in psychopathology and diagnosis recommended. For medical students, graduate students in the allied health sciences, and advanced law students.

PBSCI 530P Developmental Psychoanalytical Therapy (2) W *Nunn* Continuation of study of mental functioning from a developmental point of view. How failures of psychological development lead to various psychiatric pathological states and how psychoanalytic treatment reinstitutes normal development. Prerequisite: 535.

PBSCI 535P Basic Concepts of Modern Psychoanalysis (2) A *Schimmelbusch* Childhood developmental stages studied in light of inborn and environmental determinates. Correlating developmental phases with all aspects of adult personality functioning. A hierarchy of different models of the mind used to explicate personality functioning on a clinical case discussion level. Prerequisite: medical student standing.

PBSCI 539 Interviewing and Case Formulation (2, max. 6) *Becker, Carlin, Thorpe* Emphasis on learning interviewing skills and content to administer such recent psychodiagnostic procedures as DSM III and the Research Diagnostic Criteria. Case formulation and presentation and treatment planning receive secondary emphasis. Offered jointly with PSYCH 539. Offered on credit/no credit basis only. For graduate students in psychology, nursing, social work, and anthropology, and for advanced medical students.

PBSCI 540P Physiology of Emotions (*) AWSp *Holmes* Seminar based on discussion of selected readings or original articles from psychophysiologic and psychosociologic literature. Designed to orient and interest students for participation in current or future research projects and clinical medicine. For medical students; graduate students by permission of instructor. Entry card required.

PBSCI 544 Etiology and Epidemiology of Alcoholism (2) A *Ward* Intensive survey of case definition and etiological concepts pertaining to alcoholism; alcohol as a risk factor in disease and methods of measurement; unique problems of applying epidemiological research methodologies to study of alcohol and other drugs. Prerequisites: graduate standing in social, behavioral, or biological sciences and permission of instructor.

PBSCI 547P Families and Family Therapy (2) *Verhulst* Theoretical and practical seminar with review of literature and discussion of videotapes of families in therapy, including: family through history; what is a healthy family; the developmental stages; evaluation of families in distress; couple therapy; family therapy, nonspecific and specific systems of intervention; fourth-year medical students.

PBSCI 548P Aging and Adult Development (2) ASp *Preston* Aging in Western technologically advanced societies frequently involves losses in status, stamina, and economic and social supports: Consideration given to losses among the aged. Students select projects in the area of aging and work at their own levels of expertise and sophistication. Seminar format with guided reading.

PBSCI 549P Assessment of the Older Patient (1) W *Reifler, Wu* Seminar focuses on a special methodology for studying cognitive and affective dysfunction in the elderly and basic methods for diagnosis, management, and assessment of change during treatment. Open to medical students and graduate students in the allied health sciences. Prerequisites: HUBIO 563P and permission of instructor.

PBSCI 553 Dynamics of Psychopathology and Introduction to Psychotherapy (2) W *Hunt* Psychopathologic phenomena and defense structure traced to developmental history of individual with attention to constitutional and organic causes. Approaches to treatment via psychotherapy discussed in context of guest interviews of patients and videotaped segments of therapy.

PBSCI 555 Research Methods in Psychiatry and Behavioral Sciences (3) ASp *Vitaliano* Course includes four areas: scientific method (operationalism); psychometrics (reliability); design of psychiatric experiments/studies; psychiatric epidemiology. Prerequisite: standing as first- or second-year medical student or graduate student.

PBSCI 557 Behavioral Medicine (2) AWSp *Carr* Theory and technique of behavioral medicine and behavioral modification as applied to medical practice. Behavioral techniques in management of various chronic and acute disorders. Open to second-, third-, and fourth-year medical students and graduate students in clinical psychology; others by permission of instructor.

PBSCI 558P Psychosocial Growth and Development (2) A *Landesman-Dwyer* Current theories and research related to children's development, with emphasis on the interaction of biological, psychosocial, and cognitive factors. Open to medical students and to advanced undergraduate students.

PBSCI 562P Principles of Hypnosis (2) Sp *Dworkin* History and theory of hypnosis. Induction techniques. Application to the treatment of emotional and physical problems. Medical and dental students. Entry card required.

PBSCI 570P Integrated Psychobiology of Brain-Behavior Function (2) W *Chen* Biochemical, genetic, pharmacologic, and physiologic factors influencing behavior are studied in a seminar with guided reading. Emphasis on brain-behavior integration. Open to medical students and graduate students with permission of instructor.

PBSCI 575P Community Psychiatry Seminar (2) AWSp *Bergman, Turpin* Preparation for mental-health work in community agencies: cultural, social, and economic factors in mental illness and provision of services; history of community mental health; direct and indirect intervention; consultation and supervision; agency organization and leadership; psychiatric epidemiology; prevention; forensic psychiatry. Lectures, readings, case discussions.

PBSCI 578 Affective Disorders: Theory and Research (2) W *Becker* Causes, sustainers, correlates, and consequences of affective disorders, including biological and psychosocial factors. Offered jointly with PSYCH 578. Offered on credit/no credit basis only. Prerequisites: graduate or professional student standing or permission of instructor; graduate course in psychopathology and personality recommended. (Offered alternate years; offered 1984-85.)

PBSCI 579 Treatment of Affective Disorders: Methods and Evaluation (2) W *Becker* Differential diagnosis of depression and depressive subtypes; with emphasis on psychodynamic, cognitive-behavioral, and combined forms of psychological treatment of less severely incapacitated patients. Some discussion of biological approaches as alternative or adjunctive treatments in severe, psychotic, and endogenous-like depressions. Offered jointly with PSYCH 579. Prerequisites: same as 578. (Offered alternate years.)

PBSCI 591P Seminars and Conferences in Psychiatry (*) AWSpS *Hunt* Special seminars and conferences on a variety of topics can be arranged to accommodate the particular interests of students. Prerequisite: permission of responsible faculty member. Entry card required.

PBSCI 592P Behavioral Science Study Unit (*) AWSp *Heiman* A variety of topics is presented under the sponsorship of the Department of Psychiatry and Behavioral Sciences, with participation of faculty members from departments throughout the University. May be repeated for credit. Open to medical and graduate students. Entry card required.

PBSCI 664P Basic Clerkship in Ambulatory Services, HCMHC, or Clinic II (12) AWSpS *Brinkley* Opportunity to experience ambulatory services. Focus on improving interviewing skills and developing an interviewing style and content appropriate to patients with psychiatric dysfunction; gaining familiarity with psychopharmacology; exposure to problems seen in psychiatric emergency medicine. Six weeks full time or twelve weeks half time. (Limit: two students.)

PBSCI 665P Basic Clinical Clerkship (8, max. 24) AWSpS *Backus, Brinkley, Hunt, Loebel, Ries* Inpatient and outpatient clerkship in psychiatry. Students have primary responsibility under the direction of attending psychiatrists and residents for diagnosis and care of patients at University Hospital, Harborview Medical Center, or Veterans Administration Hospital. Emergency room, crisis intervention, and consultation service experiences appropriate to patients with psychiatric dysfunction, gaining familiarity with psychopharmacology; exposure to psychiatric emergency medicine. (Six weeks full time, twelve weeks half-time.)

PBSCI 666P WAMI Psychiatry and Behavioral Sciences Clerkship (12) AWSpS *Wreggit* Rotation aims to increase student's skills in basic psychiatry, social psychiatry, transcultural psychiatry, and office management. Orientation is around the diagnosis, treatment, and clinical management of White, Aleut, Indian, and Eskimo children and adults in outpatient and community settings. Third-, fourth-year medical students. Prerequisite: HUBIO 563P. (Limit: three students.)

PBSCI 670P Clerkship in Consultation-Liaison Psychiatry (*, max. 24) *Katon* Assessment of patients with major psychosocial problems associated with physical disease, including: problems stemming from the way the illness is perceived and experienced, liaison with other clinical disciplines on complex diagnosis and treatment of problems. Does not fulfill requirement for basic clerkship (664P, 665P, 666P) in psychiatry.

PBSCI 673P Outpatient Psychiatry Elective (*, max. 24) AWSpS Offered at HCMHC, the primary outpatient psychiatric facility for Harborview Medical Center. Students function as subinterns, conducting diagnostic interviews, initiating and managing pharmacotherapeutic treatment regimens, and providing crisis intervention, under the supervision of the full-time attending at Psychopharmacology Clinic. Prerequisite: 664P, 665P, or 666P.

PBSCI 675P Clerkship in Consultation/Liaison Psychiatry American Lake (8 or 12) *Ahbel, Harris* Assessment and treatment of patients with acute and chronic medical illness: COPD, cardiac disease, cancer, neurol diseases such as M.S., Huntington's chorea, and blindness. Psychosocial implications for patients, families, and impact on staff. Offered four to six weeks full time. Prerequisite: 664P, 665P, or 666P.

PBSCI 676P Inpatient Clerkship in Psychiatry at American Lake VA (8 or 12) *Cheah, Verhey* For medical students with a defined interest in psychiatry who wish to develop their knowledge and skills in the evaluation, management, and treatment of a wide range of acute and chronic psychiatric conditions requiring inpatient hospital treatment. Prerequisite: 664P, 665P, or 666P.

PBSCI 677P Alcohol and Drug Treatment Clerkship American Lake VA (8 or 12) Student assists in every phase of the substance-abuse treatment, including admission interviews, patient evaluation problem identification, group and individual psychotherapy, assertiveness training, anger control, human sexuality, medical evaluation and treatment, couples therapy, discharge and aftercare planning. Experience primarily clinical. Prerequisite: 664P, 665P, or 666P.

PBSCI 680P Clerkship in Emergency Psychiatry (*, max. 24) *Dagadakis* Emphasis on clinical evaluation, acute management, and treatment planning for individual patients. Experience in coordinating these activities with other emergency room personnel, and various hospital and community resources. Emphasis on skills useful to physicians in any specialty. Third- and fourth-year medical students only. Prerequisite: either 664P, 665P, or 666P.

CONJ 680P An Introduction to Detoxification and Rehabilitation Programs for Alcoholism (*, max. 16) See Conjoint Courses.

PBSCI 685 Geriatric Psychiatry Clerkship (*, max. 12) *Reifler* Two-, four-, or six-week elective. Participation in the evaluation and care of older persons with psychopathology, such as intellectual impairment and depression, in a variety of settings. Emphasis on improving clinical skills regarding diagnosis and treatment of common behavioral problems in the elderly. Prerequisite: 664P, 665P, or 666P.

PBSCI 690P Adult Development Program (*, max. 24) AWSpS *Dagadakis* Opportunity to acquire experience with a wide variety of behavior change techniques, including group experiences, role playing, couples workshops, fixed-role workshop. Third- and fourth-year medical students; second-year medical students with permission. Does not fulfill requirement for a basic clerkship in psychiatry. Prerequisite: HUBIO 563.

PBSCI 698P Advanced Clerkship in Child Psychiatry (12 or 24) AWSpS *Varleye* Provides students an opportunity to participate in evaluations and treatment in both outpatient and inpatient settings. Experiences in specialized clinics are also available. It is suggested that the student contact the instructor *prior* to enrollment. Prerequisite: 664P, 665P, or 666P. (Six or twelve weeks, full time. Limit: two students.)

PBSCI 697P Psychiatry Special Electives (*, max. 24) *Hunt* By special arrangement, clerkships, externships, and research opportunities can be made available at the University and other institutions. Students obtain permission from Dr. Hunt before obtaining a special assignment form from the Dean's office one month before advance registration. Students contact affiliating institutions. Does not fulfill the requirement for a basic clerkship in psychiatry. Entry card required.

Radiation Oncology

NN111 University Hospital

Radiation oncology is the branch of clinical medicine that utilizes high-energy radiation to treat disease, usually cancer. The department consists of three divisions: clinical oncology, medical radiation physics, and experimental cancer biology. Training programs are offered in all three divisions. Research programs in the Department of Radiation Oncology are aimed at the physical and biological mechanisms of interactions between ionizing radiations and normal and malignant tissues.

Faculty

Chairperson

Thomas W. Griffin

Professors

Bleyer, Werner A.,‡ (Pediatrics), M.D., 1969, Rochester; hematology, oncology.

Griffin, Thomas W., M.D., 1970, Nebraska (Omaha); therapeutic radiology.

Rasey, Janet S., Ph.D., 1970, Oregon; radiation biology.

Wootton, Peter,* B.Sc. (Hon.), 1944, Birmingham (England); medical radiation physics.

Associate Professors

Eenmaa, Juri,* Ph.D., 1972, Washington; medical radiation physics.

Groudine, Mark T.,* M.D., 1975, Ph.D., 1976, Pennsylvania; molecular biology.

Laramore, George E., Ph.D., 1969, Illinois (Urbana), M.D., 1976, Miami; therapeutic radiology.

Luk, Kenneth H., M.D., 1971, California (Los Angeles); therapeutic radiology.

Assistant Professors

Kalet, Ira J.,* Ph.D., 1968, Princeton; particle physics.

Mahler, Peter A. (Acting), Ph.D., 1979, Rochester; radiation biology.

Russell, Anthony H. (Acting), M.D., 1974, Harvard; therapeutic radiology.

Scott, Ronald S., Ph.D., 1969, Illinois (Urbana), M.D., 1976, State University of New York (Buffalo); physics, therapeutic radiology.

Instructor

Del Rowe, John (Acting), M.D., 1979, Hahnemann; therapeutic radiology.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

R ONC 499 Undergraduate Research (*, max. 24) *Griffin, Laramore, Luk, Russell, Scott* Opportunities in clinical or laboratory investigation in radiation oncology. Participation of medical students in ongoing projects or new projects designed for the students. Offered on credit/no credit basis only. Prerequisites: medical student standing, permission of Dr. Griffin.

R ONC 505, 506 Radiological Physics I, II (3,3) *Wootton, Staff* Application of physical concepts, methodology, and instrumentation in the study, production, and mensuration of ionizing radiations and their interactions with biological materials. Offered jointly with RAD S 505, 506. Prerequisite: permission of instructor.

R ONC 517 Radiation Dosimetry (3) A *Wootton, Staff* Examines the interactions of ionizing radiations with matter and the physical principles involved in their measurement in greater depth than does 505. For students contemplating a career in research concerned with ionizing radiation; assumes a sound background in physics. Offered jointly with RAD S 517. Prerequisite: permission of instructor.

R ONC 695P Clinical Cancer Management (*, max. 8) AWSpS *Griffin* Supervised participation in clinical management of the patient with cancer. Includes clinical evaluation, planning of treatment and follow-up examination of patients. Daily teaching conferences. Prerequisite: MED 665P or permission of instructor. (Two and/or four weeks.)

Radiology

RR215 University Hospital

Diagnostic radiology is the branch of clinical medicine that employs various imaging modalities in the detection of disease. In diagnostic radiology, x-rays and high-frequency sound waves are used for creating images of body structures. In nuclear medicine, radionuclides are employed for both diagnosis and treatment. Computerized digital images are assuming a very important role in the development of improved imaging systems. Future developments will include other energy sources for making images, such as nuclear magnetic resonance and positron emission tomography. The Department of Radiology consists of three divisions: diagnostic radiology, nuclear medicine, and radiation physics. Instruction is provided for medical students, residents, and other physicians. The staff and its teaching and research activities are represented in each of the hospitals affiliated with the University.

Faculty

Chairperson

Albert A. Moss

Professors

Chesnut, Charles H. III, (Medicine),† M.D., 1966, Florida; nuclear medicine.

Figley, Melvin M.,* (Medicine),† M.D., 1944, Harvard; general and chest radiology.

Graham, C. Benjamin, (Pediatrics),† M.D., 1958, Washington; pediatric, neonatal radiology.

Loop, John W., M.D., 1952, Harvard; general radiology and neuroradiology.

Moss, Albert A., M.D., 1967, Syracuse; neuroradiology.

Nelp, Wil B.,* (Medicine),† M.D., 1955, Johns Hopkins; nuclear medicine.

Rohrmann, Charles A., M.D., 1966, Washington; gastrointestional radiology.

Associate Professors

Blumhagen, Joel D., (Pediatrics), M.D., 1973, Washington (St. Louis); pediatric radiology, ultrasound, nuclear medicine.

Cromwell, Laurence D., M.D., 1971, Stanford; neuroradiology and computed tomography.

Griep, Robert J., (Medicine),† M.D., 1958, Texas; nuclear medicine.

Harley, John D., M.D., 1966, Washington (St. Louis); general radiology and angiography.

Kilcoyne, Raphael F., M.D., 1964, Marquette; general and musculoskeletal radiology.

Krohn, Kenneth A., Ph.D., 1971, California (Davis); radiochemistry.

Lewellen, Thomas K., Ph.D., 1971, Washington; radiation physics.

Mack, Laurence A., M.D., 1971, Illinois; ultrasonography, computed tomography.

Phillips, Leon A., M.D., 1952, Yale; general radiology, uroradiology.

Ricketts, Howard J., M.D., 1958, Harvard; angiography, interventional radiology.

Rudd, Thomas G., M.D., 1963, Michigan; nuclear medicine, general radiology.

Williams, David L., Ph.D., 1971, Washington; radiation physics.

Assistant Professors

Bolender, Nicole F., M.D., 1968, Lausanne; neuroradiology, computed tomography, mammography.

Brewer, David K., (Pediatrics), M.D., 1972, Harvard; pediatric radiology, angiography, computed tomography.

Cerqueira, Manuel, M.D., 1976; New York; nuclear medicine.

Graham, Michael M., M.D., 1979, California (San Francisco); nuclear medicine.

Hanson, James A., Ph.D., 1979, Wisconsin; radiation physics.

Marglin, Stephen I., M.D., 1968, Yale; chest and oncologic radiology.

Olson, Dana O. (Acting), M.D., 1973, Texas; nuclear medicine.

Rosenbaum, David M, M.D., 1977, Albert Einstein; pediatrics.

Rowberg, Alan H., M.D., 1970, Washington; medical imaging and computing.

Shuman, William P., M.D., 1973, New York (Upstate); ultrasound and computed tomography.

Instructors

Livingston, Robert R., M.D., 1976, Pennsylvania; general radiology.

Mercker, Janis P. (Acting), M.D., 1976, Washington; pediatric radiology.

Lecturers

Christie, David P., M.D., 1944, Nebraska; general radiology.

Murano, Robert, M.Sc., 1963, Washington; radiation physics.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

RADGY 498 Undergraduate Thesis (*) AWSp *Marglin* Supervised clinical and/or laboratory research in the broad field of medical imaging, culminating in a thesis suitable for recognition.

RADGY 499 Undergraduate Research (*) AWSpS *Marglin* Opportunity to gain research experience and direct participation in either clinical or basic sciences investigation in diagnostic radiology and/or nuclear medicine. Written exposition of the results of this experience required.

RADGY 508 Physical Aspects of Medical Imaging (2) A *Hanson* Quantitative physical principles of medical imaging are presented for electromagnetic and sonic radiation. X-ray imaging; sources, image formation, and information extraction, for CT as well as conventional systems; theory of ultrasound and resonance imaging. Offered jointly with RAD S 508. Prerequisites: RAD S 505, 506.

RADGY 570P, 571P, 572P Physical Basis of Diagnostic Radiology (1,1,1) AWSp *Hanson* Introduction to the basic physics involved with medical imaging. Topics covered are production of X rays, interactions of X rays with matter, intensifying screens, X-ray film characteristics and processing, fluorography, cineradiology, conventional tomography, xerography, ultrasound, and nuclear magnetic resonance.

RADGY 580P Nuclear Medicine Technique, Physics, and Instrumentation (2½) S *Lewellen* Provides familiarization with basic nuclear phenomena and with the instrumentation used in the practice of nuclear medicine. There are discussions and laboratory exercises. Practical experience in instrument operation and sample counting are provided. Prerequisite: permission of instructor.

RADGY 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

RADGY 693 Introduction to Clinical Radiology (8) AWSpS *Marglin* Introduction to the field of medical imaging. Emphasis on gaining in-depth understanding of criteria recommended for selection of radiologic examination and the perceptual skills needed for preliminary interpretation of the more commonly encountered studies. Includes lectures, film reading, case related conferences, and independent study. Prerequisite: completion of Human Biology series.

RADGY 694 Advanced Clinical Clerkship (8) AWSpS *Marglin* For students who have completed 693 or its equivalent and who wish to obtain more comprehensive and/or more specialized experience in the field of medical imaging. Prerequisites: 693 and permission of instructor.

RADGY 698P Nuclear Medicine Clerkship (*, max. 12) *Nelp* Daily participation at University Hospital nuclear medicine clinic emphasizing technical performance, diagnostic interpretation, and clinical relevance of nuclear imaging. Daily clinical teaching conferences of the division. Four- and six-week clerkships can be preplanned in areas such as pulmonary, cardiovascular, renal, bone, computer analysis. Prerequisite: permission of instructor.

RADGY 697 Radiology Special Electives (*, max. 24) Radiologic training in a nonaffiliated institution. Permission and arrangements must be made at the time of registration through direct communication between the student and the education coordinator in radiology. A written outline from a preceptor at the intended site is also required. Prerequisite: permission of radiology education coordinator.

Rehabilitation Medicine

BB938 Health Sciences

The Department of Rehabilitation Medicine provides instruction for medical students, interns, and residents in a comprehensive approach to rehabilitation problems. This includes special diagnostic and evaluative procedures; methods and rationale in the application of principles of occupational therapy, physical therapy, prosthetics and orthotics, and other health professions; and advanced investigation of special problems encountered in the field. In addition, the department conducts a residency training program for the specialty of physical medicine and rehabilitation.

The department offers curricula leading to the following degrees: Bachelor of Science in Occupational Therapy, Master of Science in Occupational Therapy, Bachelor of Science in Physical Therapy, Master of Physical Therapy, Bachelor of Science in the field of prosthetics and orthotics, and a Master of Science for residents in physical medicine and rehabilitation who wish to enter the academic field.

Occupational Therapy

Head

Elizabeth M. Kanny

The occupational therapist is a vital member of the health-care team, providing service to those individuals whose abilities to cope with tasks of living are threatened or impaired by physical illness or injury, congenital or developmental disability, psychosocial dysfunction, or the aging process. Occupational therapists provide evaluation, diagnosis, and treatment of problems that interfere with functional performance. Services may consist of self-care activities, sensorimotor activities, emotional/social interactions, fabrication and application of splints or adaptive equipment, functional therapeutic activities, and prevocational evaluation and training.

The program in occupational therapy leading to a Bachelor of Science degree awarded by the School of Medicine is accredited by the American Occupational Therapy Association. The program includes two years of professional course work and six months of field experience. Graduates are eligible to become registered occupational therapists by passing the National Certification Examination for occupational therapists.

Admission Requirements: Preprofessional requirements prior to admission include completion of the proficiency and distribution requirements established by the College of Arts and Sciences and completion of the following prerequisite courses: B STR 301; CHEM 101 or 140; PHYS 114, 117; PSYCH 101, 305, 306; SOC 110; ZOOL 118. The student must have achieved a cumulative grade-point average of 2.50 in all course work, as well as a grade-point average of 2.50 in the prerequisite courses.

Graduation Requirements: The following courses must be taken in the scheduled sequence, beginning in Autumn Quarter only: REHAB 320, 321, 322, 380, 414, 435, 442, 444, 445, 446, 447, 448, 468, 469, 473, 477, 481, 482, 483, 484, 485, 488, 499; B STR 331; PBSCI 452 and REHAB 494 (six months of field experience).

Student Evaluation: The University grade-point system is used, with the exception that a grade below 2.0 in any required professional course is not acceptable. Satisfactory scholarship requires the maintenance of a cumulative grade-point average of 2.50, which is the basis for promotion and graduation.

Certification of Occupational Therapists

To provide occupational therapy services to any public educational program in the state of Washington, registered occupational therapists must be certified by the State Superintendent of Public Instruction as educational staff associates.

Candidates for certification must demonstrate knowledge and competencies at acceptable levels of professional practice. They must be graduates from state, regionally, or nationally approved/accredited programs for the preparation of occupational therapists and registered by the American Occupational Therapy Association. In Washington State, the programs approved by the Board of Education for the preparation of occupational therapists are those of the University of Washington and the University of Puget Sound.

Application materials and information packets may be purchased for $5 from the University Book Store, 4326 University Way Northeast, Seattle, Washington 98105.

Physical Therapy

Head

JoAnn McMillan

Physical therapy is a direct form of professional patient care that can be applied in most disciplines of medicine, especially neurology, orthopedics, pediatrics, geriatrics, and sports medicine. Principal objective of physical therapy is to restore or improve function in muscles that, for one reason or another, do not perform as they should. Muscle restoration is only part of the work of physical therapy. Equally important is the rebuilding of self-confidence and creating the desire to return to a normal active life. Other primary objectives of physical therapy are the preventing of disability and pain and the aiding of those who must adapt to permanent disability.

As a consequence of the scope of the profession, physical therapists function in a variety of settings, the most familiar being the hospital. Physical therapists also plan, provide, and supervise evaluation and direct patient care in outpatient clinics, rehabilitation centers, home-care agencies, schools, extended-care facilities for the elderly, voluntary health agencies, and private practices. The physical therapist may be found anywhere that quality health care is needed. Increasingly, physical therapists are becoming involved in basic and clinical research; the academic community, either as full-time faculty members or as supervisors of clinical education; and in local, state, and federal health-planning activities as consultants.

Physical therapists function in compliance with the licensing laws and ethical principles that govern the practice of physical therapy. The steps to licensure as a physical therapist vary slightly from state to state, but all physical therapists have in common graduation from an accredited curriculum of physical therapy that included a specific period of clinical training. As physical therapy relates to twenty-four of the twenty-seven medical specialties, the education program is broad in scope, including a heavy dose of physical and social sciences. The physical therapist will evaluate the patient's problem by testing such things as joint range of motion, muscle strength, posture and gait, pulmonary function, sensation and sensory perception, orthotic and prosthetic fit, reflexes and muscle tone, and functional skills. The results of these evaluations are reported to the patient's physician, with whose approval the physical therapist will plan, provide, and monitor an appropriate patient-care program. Some of the procedures used may include short-wave diathermy, ultrasound, cold, electrical stimulation, massage, traction, joint mobilization, biofeedback, therapeutic exercise, and training in the use of orthotic, prosthetic, and other assistive devices, such as crutches, canes, and wheelchairs.

As with all professionals in health fields, physical therapists are responsible for subscribing to a program of continuing education. Some therapists also develop the knowledge and skills of a specialist via continuing education and concentrated practice in one area, such as cardiopulmonary disease. A formalized mechanism for certifying specialists is being studied by the national professional association, the American Physical Therapy Association.

The University baccalaureate program in physical therapy is fully approved by the American Physical Therapy Association Committee on Accreditation in Education.

Admission Requirements: Students are admitted to the baccalaureate program at the junior level. Detailed program requirements and selection process information may be obtained from the curriculum office. Students are urged to request this information early, because the deadline for receipt of applications is February 15. At the time of entrance to the program (Autumn Quarter), applicants must be legal residents of Washington (as defined by the University administration code) or of Idaho, Alaska, Montana, Oregon, Hawaii, Wyoming, or Nevada. Requirements prior to entrance include completion of the College of Arts and Sciences proficiency and distribution requirements with a minimum of 20 credits each in the humanities, natural sciences, and social sciences, and completion of the following prerequisite course work, which may be counted toward distribution requirements:

Physical Sciences: CHEM 140, 150, General Chemistry (4, 4 credits); or CHEM 101, General Chemistry (5), CHEM 102, General and Organic Chemistry (5). PHYS 114, 115, 117, 118, General Physics and Laboratory (10).

Biological Sciences: B STR 301, General Anatomy (6 credits); ZOOL 118, Survey of Physiology (5); MICRO 301, General Microbiology (3); MICRO 302, General Microbiology Laboratory (2).

Social Sciences: PSYCH 101, General Psychology (5 credits); plus one additional psychology or psychiatry course (only 2 credits from the additional course may be counted toward the prerequisite grade-point average).

Students must have earned a minimum grade-point average of 3.00 on a minimum of 28 credits of the preceding courses and have a cumulative grade-point average of 2.70 in order to be eligible to apply. Admission is competitive, based on a demonstrated academic ability and apparent aptitude for physical therapy. Returning students who previously dropped out of the program must reapply and are subject to the same review process as that used for all other applicants.

Graduation Requirements: The following courses must be completed satisfactorily in the scheduled sequence, beginning Autumn Quarter only, at the University: REHAB 320, 321, 322, 332, 404, 405, 413, 414, 415, 416, 442, 443, 444-445; 451, 452, 460, 461, 462, 463, 466-467, 471, 472, 475, 476, 490, 495; PATH 410; B STR 431.

Student Evaluation

The University grade-point system is used. A student in the professional phase of the curriculum must maintain a cumulative grade-point average of 2.50 in all required courses for satisfactory standing and for graduation from the curriculum. At the end of any academic quarter in which a student's performance falls below that point, he or she is placed on academic probation. Once on academic probation, a student is allowed two additional consecutive quarters to bring his or her curriculum grade-point average to 2.50. A student not meeting the above standard is dropped from the curriculum and is advised to transfer to an alternate major within the University or to withdraw from the University.

Any grade of less than 2.0 in a professional curriculum course will necessitate repetition of that course if recommended by the physical therapy faculty and approved by the Advisory and Evaluation Committee.

Prosthetics and Orthotics

Head

Alan J. Dralle

The prosthetist-orthotist is a part of a professional medical team devoted to the evaluation and treatment of the physically handicapped. He or she is responsible for the designing and fabricating of prosthetic and orthotic devices (artificial limbs and braces) and for helping handicapped patients of all ages to enjoy more functional and independent lives.

Bachelor of Science Degree

Admission Requirements: Students are admitted to this curriculum at the junior level. Preprofessional requirements prior to admission include completion of the College of Arts and Sciences proficiency requirements, as well as the distribution requirements with a minimum of 20 credits each in the humanities, natural sciences, and social sciences with a 2.00 cumulative grade-point average on a 4.00 scale, and completion by the end of Autumn Quarter or semester of the year prior to expected admission into the program of a minimum of 22 quarter credits of the 36-41 credits in the following prerequisite courses (or their equivalent for transfer students) with a minimum grade-point average of 2.50:

BIOL 101-102 (10 credits) *or* MICRO 301, 302 (3, 2); note that CHEM 102 is prerequisite for microbiology; PHYS 114, 115, 117, 118 (10); B STR 301 (6); ZOOL 118 (5); PSYCH 101 (5).

At the time of application, a student must submit a reasonable plan for completion before the date of expected entry into the program of the balance of the prerequisite courses listed above. If, by the time of expected entry into the program, the student has not completed all prerequisite courses with a minimum grade-point average of 2.50 as well as a total grade-point average of 2.00, that student will not be admitted to the program.

Graduation Requirements: The following courses must be taken in the scheduled sequence, beginning Autumn Quarter only, at the University of Washington: REHAB 320, 321, 332, 340, 341, 342, 343, 414, 420, 421, 423, 427, 428, 429, 430, 442, 443, 444-445, 451, 452.

Student Evaluation: The University grade-point system is used with the exception that a grade below 2.0 in any required professional course is not acceptable. Satisfactory scholarship requires the maintenance of a cumulative grade-point average of 2.50 in the required courses, which is the basis for promotion and graduation.

Graduate Program

The graduate programs in Rehabilitation Medicine lead to the following degrees: Master of Rehabilitation Medicine, Master of Science (Rehabilitation Medicine, Occupational Therapy or Physical Therapy), and Master of Physical Therapy.

Master of Rehabilitation Medicine Degree

An applicant for the Master of Rehabilitation Medicine program must be currently enrolled or have completed residency training in the specialty of physical medicine and rehabilitation. The purpose of the program leading to the Master of Rehabilitation Medicine degree is to train academicians in the field of physical medicine and rehabilitation. Students must earn a minimum of 36 credits. A minor is taken in one of the related medical sciences: general medical science, biophysics-physiology, or psychology. A special, in-depth project will be required as part of the master's degree program.

Master of Science Degree (Rehabilitation Medicine)

The Master of Science degree (rehabilitation medicine pathway) requirements include all of those stated above for a Master of Rehabilitation Medicine degree. In addition to those requirements, more extensive research together with a formal thesis are required.

Special Requirements: Requirements for admission to the program leading to the Master of Science degree (rehabilitation medicine pathway), in addition to the requirements of the Graduate School, include an M.D. degree from an approved medical school. Students must be concurrently enrolled, or have completed an approved residency program, in physical medicine and rehabilitation, or, in exceptional cases, students who have successfully finished a three-year residency program in a related specialty can be accepted into the program.

Master of Science Degree (Occupational Therapy)

The Master of Science degree in occupational therapy is designed for registered occupational therapists. Core courses focus on the development of research, teaching, and administrative competencies. Independent study options and electives offer flexibility that allows students to meet individual objectives. Completion of a data-based thesis is required. Full-time students generally complete the course work in three to four quarters. The additional time to complete the thesis requirement varies.

Special Requirements: The applicant for admission to the program leading to the degree of Master of Science (occupational therapy pathway) must be a graduate of an approved occupational therapy program. A year of professional experience is desirable. Detailed information on the program and admission requirements is available.

Graduation Requirements: All students must meet the minimum requirements for a master's degree as outlined in the Graduate School section of this catalog. In addition, students must satisfactorily complete core courses required by the occupational therapy program and a data-based thesis.

Master of Science Degree (Physical Therapy)

The program of study leading to the degree of Master of Science (physical therapy pathway) has been designed to prepare physical therapists to assume a career in teaching and administration within the field. An emphasis of the curriculum is preparation for research and contribution to the professional literature; therefore, a thesis is a requirement of this plan. Opportunities are provided to enhance specialized knowledge and skill in selected content areas of physical therapy practice. Depending upon the student's educational goals and prior accomplishments, the program should require one to two calendar years for completion.

Special Requirements: Selection for admission to the Master of Science degree programs (physical therapy pathway) is based on an assessment of intellectual capacity, basic professional competence, and promise for future contributions to the field. Students must have completed a baccalaureate degree and an accredited physical therapy program, with a minimum cumulative grade-point average of 3.00, based on a 4-point scale, on all college work. Detailed information on program and admission requirements is available from the department.

Graduation Requirements (Master of Science degree): Minimum of 45 credits, including specified core course work and approved individual curriculum program. Completion of an approved thesis and Graduate School requirements for a master's degree.

Master of Physical Therapy Degree

The purpose of the Master of Physical Therapy program is to provide opportunities to pursue in-depth study in an area of interest related to a clinical specialty and to strengthen general evaluation and management skills for practice as an entry-level health-care practitioner. Preparation in statistics and research design and completion of a major project are requirements of this plan. Focus of this curriculum is on work related to future clinical practice in positions of responsibility, and participation in clinical teaching, research, and administration. A special option exists for highly-qualified students currently enrolled in the University's baccalaureate curriculum in physical therapy. Students in this program may apply for admission to a combined B.S./M.P.T. plan, in which they may integrate course work for both degree requirements, thus reducing total time required for attainment of the Master of Physical Therapy degree.

Special Requirements: Selection for admission to the Master of Physical Therapy degree program is based on assessment of intellectual capacity, basic professional achievement in undergraduate

physical therapy course work, and promise for future contributions to the field. Students must have completed a baccalaureate degree and an accredited physical therapy program, with a minimum cumulative grade-point average of 3.00, based on a 4-point scale, on all college work. Detailed information on program and admission requirements is available from the department.

Graduation Requirements (Master of Physical Therapy degree): A minimum of 45 credits, including specified core course work and approved individual curriculum program. Completion of an approved project and Graduate School requirements for a master's degree.

Faculty

Chairperson

Justus F. Lehmann

Professors

Anderson, Marjorie E.,* (Physiology and Biophysics),† Ph.D., 1969, Washington; physiology.

deLateur, Barbara J.,* M.D., 1963, Washington; physiatry.

Fordyce, Wilbert E.,* Ph.D., 1953, Washington; psychology.

Guy, Arthur W.,* (Bioengineering),† Ph.D., 1966, Washington; electrical engineering.

Kraft, George H.,* M.D., 1963, Ohio State, physiatry.

Lehmann, Justus F.,* M.D., 1945, Frankfurt; physiatry.

Stolov, Walter C.,* M.D., 1956, Minnesota; physiatry.

Associate Professors

Berni, Rosemarian (Emeritus), M.N., 1973, Washington; rehabilitation nursing.

Beukelman, David R.,* (Speech and Hearing Sciences), Ph.D., 1971, Wisconsin; speech and hearing.

Chou, Chung-Kwang* (Research), (Bioengineering),† Ph.D., 1975, Washington; bioengineering.

DeLisa, Joel A.,* M.D., 1968, Washington; physiatry.

Dikmen, Sureyya S.,* (Neurological Surgery), Ph.D., 1973, Washington; neuropsychology.

Halar, Eugen M.,* M.D., 1959, Zagreb (Yugoslavia); physiatry.

McMillan, JoAnn,* M.S.Ed., 1968, Southern California; physical therapy.

Yorkston, Kathryn M.,* Ph.D., 1975, Oregon; speech and hearing.

Assistant Professors

Brockway, JoAnn,* Ph.D., 1975, Iowa; psychology.

Cardenas, Diana D.,* M.D., 1973, Texas; physiatry.

Deitz, Jean C., Ph.D., 1967, Puget Sound; occupational therapy.

Egan, Kelly (Acting), Ph.D., 1981, Seattle; clinical psychology.

Fraser, Robert T., (Neurological Surgery),† Ph.D., 1976, Wisconsin; psychology.

Hays, Ross M. (Acting), M.D., 1978, Washington; physiatry, pediatrics.

Jaffe, Kenneth M., (Pediatrics), M.D., 1975, Harvard; physiatry.

McLean, Alvin, Jr., Ph.D., 1981, Wisconsin; clinical psychology.

Questad, Kent A. (Acting), Ph.D., 1982, Wisconsin; rehabilitation counseling, psychology.

Slimp, Jefferson C. (Research), Ph.D., 1976, Wisconsin; psychology.

Trotter, Martha J., B.S., 1957, East Tennessee, physical therapy.

Turner, Judith A., (Psychiatry and Behavioral Sciences),† Ph.D., 1979, California (Los Angeles); psychology.

Instructors

Frankel, Donna L., M.D., 1977, Maryland; therapy.

Greenberg, Sharon L., M.O.T., 1968, Washington (St. Louis); occupational therapy.

Guthrie, Mark R. (Acting), M.P.T., 1980, Washington; physical therapy.

Hager, Mary L., B.S., 1957, Puget Sound; occupational therapy.

Hammond, Margaret C., M.D., 1979, Wisconsin; physiatry.

McGourty, Linda K. (Acting), M.O.T., 1978, Washington; occupational therapy.

Spicer, Martha M. (Acting), M.S., 1983, Washington; occupational therapy.

Stuberg, Wayne A. (Acting), M.S., 1980, Nebraska; physical therapy.

Yamane, Ann, B.S., 1976, Washington; prosthetics and orthotics.

Lecturers

Crowe, Terry K., M.S., 1979, Boston; occupational therapy.

Daly, Wayne K., B.S., 1975, Washington; prosthetics and orthotics.

Dralle, Alan J., B.S.P.T., 1968, Washington; prosthetics and orthotics.

Hertling, Darlene M., B.S., 1956, California (Berkeley); physical therapy.

Kanny, Elizabeth M., M.A., 1977, Washington; occupational therapy.

Swanson, Marcia W., B.A., 1971, Maine; physical therapy, pediatrics.

Tada, Wendy L., M.A., 1975, California; physical therapy.

Course Descriptions

Courses numbered with a P suffix are not graduate courses and are restricted to medical student enrollment only.

REHAB 320, 321 Medical Science (4,4) W,Sp Lectures in fields related to: general surgery, obstetrics and gynecology, internal medicine, neurology, rehabilitation medicine, orthopaedics, psychiatry and behavioral sciences, rheumatology, and pediatrics. Required for occupational therapy, prosthetics and orthotics, and physical therapy students, and for rehabilitation counseling students. Offered on credit/no credit basis only.

REHAB 322 Medical Science Laboratory (1) WSp *Dralle, Greenberg, McMillan* To introduce students to the role of allied health professionals in the treatment of disabilities present in 320, 321 lectures. Offered on credit/no credit basis only. Prerequisite: 320, 321.

REHAB 332 Pathologic Physiology for Physical Therapists and Occupational Therapists (5) A *Anderson* Emphasis on normal and pathologic physiology of the circulatory, respiratory, central nervous, and musculoskeletal systems as basis for treatment in occupational therapy, physical therapy, and prosthetics-orthotics. Required for students in these fields. Others by permission. Prerequisites: B STR 301, ZOOL 208 or 118, and permission of instructor.

REHAB 340 Spinal Orthotics (3) *Dralle* Instruction in, and experience with, the use of orthotic components and materials, including layout, measurement, and fitting of orthoses for management of spinal pathology. Each student plans, fabricates, and fits orthoses for lumbar, dorsolumbar, thoracic, and cervical regions. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 341 Upper-Limb Prosthetics (4) W *Daly* Instruction in, and experience with, the use of prosthetic components and materials, including preprosthetic care, prosthetic components, principles of fabrication and harnessing, and techniques of checkout and prosthetic training for all amputation types. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 342 Upper-Limb Prosthetics II (4) Sp *Daly* Instruction and experience in use of prosthetic components and materials, including preprosthetic care, principles of fabrication and harnessing, and techniques of checkout and prosthetic training, review of anatomy, biomechanics, locomotion, and motor disability as they pertain to upper-limb prosthetics, as well as medical management and prescription considerations. Immediate postsurgical fitting techniques.

REHAB 343 Upper-Limb Orthotics (6) *Daly* Instruction in, and experience with, the use of orthotic components and materials. Students evaluate and fabricate therapeutic and functional orthoses, including externally powered devices. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 380 Occupational Therapy in the Health-Care System (2) *McCourty* Acquisition of an understanding of the role of occupational therapy within the American health-care delivery system. Covers factors including national health, use of health-care services, regulation and reimbursement of services and health-care trends affecting occupational therapy services.

REHAB 404, 405 PT Management Musculoskeletal Disorders: I, II (5,5) A,W *Hertling* Functional anatomy, biomechanics, clinical assessment and management as they relate to patients with common musculoskeletal disorders who have been referred to physical therapy services. Development of appropriate therapeutic strategies for management of extremity joints (404) and spine (405). Prerequisite: physical therapy major standing.

REHAB 413 Special Studies in Physical Therapy (1-15, max. 24) AWSpS Series of courses on theory and practice in specialized areas of physical therapy. Includes organization and administration of specialized programs, advanced evaluation and treatment techniques, role of the consultant. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

REHAB 414 Psychological Aspects of Disability (3) AW *Fordyce* Psychological processes underlying adjustment to disability; application of behavioral analysis systems in patient therapy management; effects of intellectual and perceptual deficit on patient performance and treatment strategies. Required for physical therapy students; others by permission of instructor.

REHAB 415 Undergraduate Seminar for Physical Therapy Students (1-3, max. 5) AWSp *McMillan* Basic principles of medical ethics; history, scope of physical therapy; relationships of physical therapy, occupational therapy, nursing, rehabilitation counseling, social service, and other allied services. Required for physical therapy students. Offered on credit/no credit basis only.

REHAB 416 Principles of Physical Therapy Administration (3) *McMillan* The nature of administration, economic trends, operational policy, aspects of supervision, ethical and legal influences applicable to a physical therapy department. Required for physical therapy students.

REHAB 420 Lower-Limb Prosthetics I (8) *Dralle* Instruction in fabrication, fitting, and alignment of the patellar-tendon-bearing prosthesis. Emphasis is placed on the biomechanics of below-knee fit and alignment, dynamic alignment, and the use of the below-knee adjustable leg and duplication devices, as well as methods of suspension. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 421 Lower-Limb Prosthetics II (11) *Dralle* Instruction in stump casting, cast modification, socket fabrication, static and dynamic alignment, alignment duplication, and suspension system. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 423 Lower-Limb Orthotics (8) *Dralle* Instruction in, and experience with, the use of orthotic components and material, including measurement and fitting of lower-limb orthoses and shoe modifications to patients. Each student evaluates patients and plans, fabricates, fits, and checks out several orthoses. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 427, 428 Applied Prosthetics and Orthotics I, II (1-1-1; 5) *Dralle* Further clinical experience in patient evaluation, planning, fabricating, and fitting of prosthetic and orthotic devices, and attendance at prosthetics and orthotics clinics at University Hospital and University-affiliated Seattle hospitals. Experience in immediate postoperative prosthetics. Required for prosthetics and orthotics majors; others by permission of instructor.

REHAB 429 Immediate Post-Operative and Early Fitting (3) *Daly, Dralle* Lecture and laboratory designed to introduce the student to the principles of immediate postsurgical prosthetic fitting, including patient management for both upper and lower extremities.

REHAB 430 Advanced Limb Prosthetics and Engineering Concepts (4) S *Daly, Dralle* Use of prosthetic components and materials, including casting techniques and alignment procedures for hip disarticulation and Symes prostheses. Anatomy, biomechanics, locomotion, and motor disability pertaining to hip disarticulation and Symes prosthetics. Principles underlying modern prosthetic/orthotic devices and practices. Hydraulic control, material behavior, force analysis, and basic electronics.

REHAB 432 Woodworking for Occupational Therapists (1) *Hager* Hand-tool processes, elementary machine operations, safety practices, problem solving and planning, methods of assembling and fastening, simple wood finishing as prerequisite skills to the learning of occupational therapy treatment activity applications and analyses. Prerequisite: occupational therapy major standing.

REHAB 435 Professional and Therapeutic Communication in Occupational Therapy (3) A *Kanny* Provides knowledge and understanding of communication skills, enabling student to apply practically these skills in areas of oral and written professional communications, dyadic therapeutic communications, and public relations directed to health professionals and health consumers. Prerequisite: occupational therapy major standing.

REHAB 442 Advanced Clinical Kinesiology and Biomechanics (6) Sp *Lehmann* Study of joint motion and muscle function in relation to both the normal and abnormal state. Specific techniques employed in the field of rehabilitation medicine are analyzed. Required for occupational therapy and physical therapy students; others by permission.

REHAB 443 Kinesiology Laboratory (2) Sp Laboratory practice and clinical problem-solving sessions related to joint motion, muscle function, and gait evaluations in the normal and abnormal state. Required for students in physical therapy and in prosthetics and orthotics.

REHAB 444-445 Function of the Locomotor System (4-4) A;W *Hammond* Functions of musculoskeletal system as applied to patterns of motion. Anatomy of peripheral-vascular and peripheral-nervous system. Required for occupational therapy students and physical therapy students; others by permission of instructor. Prerequisites: B STR 301, ZOOL 208 or 118.

REHAB 446, 447 Anatomy Laboratory for Occupational Therapists (1,1) A,W *Hager* Guided self-study of musculoskeletal, peripheral-vascular, and peripheral-nervous systems from prosected material. Required for occupational therapy students.

REHAB 448 Applied Kinesiology for Occupational Therapists (2) S *Wittmeyer* Instruction and laboratory focus on practical experience and clinical problem solving related to muscle and joint motion testing procedures, gait, prosthetic and orthotic devices, environmental controls, and assistive devices utilized in occupational therapy treatment strategies. Required for occupational therapy students.

REHAB 451, 452 Functional Anatomy Laboratory (1,1) A,W Study of musculoskeletal, peripheral-vascular, and peripheral-nervous systems from prosected material. Required for physical therapy students.

REHAB 458 Communication Augmentation for Nonspeaking Individuals (3) WS *Beukelman, Wilson* Communication needs of nonspeaking individuals. Interdisciplinary approaches to evaluation, selection, and implementation of aided and unaided communication augmentation systems. Offered jointly with SPHSC 453. Prerequisite: basic course work in either physical therapy, occupational therapy, speech and hearing sciences, or engineering, or permission of instructor.

REHAB 460 Physical Therapy Procedures II (2) A Introductory principles and concepts related to clinical physical therapy. Laboratory and clinical practice of basic physical therapy procedures in hydrotherapy, thermotherapy, and cryotherapy. Application of physiological principles to clinical procedures. Required for physical therapy students.

REHAB 461 Physical Therapy Procedures III (3) W *Trotter* Exercises commonly used for treatment purposes in physical therapy. Motor learning, physiological effects, safe and effective utilization of selected equipment, and development of appropriate exercise programs. Laboratory. Required for physical therapy students.

REHAB 463 Application of Physical Therapy Modalities (2) *Trotter* Theory and techniques of application of physical agents commonly used by physical therapists (e.g., electricity, EMG biofeedback, ultraviolet, shortwave diathermy, ultrasound, and microwaves). Practice with a wide variety of machines. Required for physical therapy students.

REHAB 466-467 Advanced Biophysical and Physiological Effects of Modalities (2-2) A,W *Lehmann* Biophysical principles of equipment employed in physical therapy, physiological effects produced. Required for physical therapy students; others by permission of instructor.

REHAB 468 Therapeutic Modalities: Activities and Analysis (1-4) AWSp *Spicer* Lectures and laboratory practice to develop skills in the analysis, adaptation, and teaching-learning processes of therapeutic activities. Specifically designed crafts, self-care activities, prevocational assessment and training, and specific pediatric techniques. Prerequisite: occupational therapy major standing.

REHAB 469 Therapeutic Modality: Facilitating Movements (1-3) *Greenberg* Lectures and laboratory practice of special skills in occupational therapy directed toward facilitation of movements as applied to the treatment of the physically disabled. Emphasis on evaluation skills and treatment techniques in mobility, activities of daily living, muscle, reeducation, and upper-extremity prosthetics and orthotics. Prerequisite: occupational therapy major.

REHAB 470 Vocational Assessment and Training (3) Provides knowledge and skill competencies relevant to vocational/work evaluation and training for individuals with physical, psychosocial, and developmental disabilities. A clinical component provides experience in work assessment/training.

REHAB 471 PT Management of Neurological Dysfunction (5) Physiologic and therapeutic effects of several physical therapy procedures used for treatment of neurological dysfunction. Methods of application. Correlation of techniques to appropriate age level and handicap. Simulations of patient management. New developments from field. Prerequisite: physical therapy major standing.

REHAB 472 PT Management of Selected Therapeutic Problems (3) Physical therapy treatment of persons suffering from such problems as burns, pulmonary or cardiac disorders, or cancer. Unit on prepared childbirth. Prerequisite: physical therapy major standing.

REHAB 473 Administration of Occupational Therapy Services (3) Organizational structure, administrative techniques, and communicative processes; principles of cost accounting, personnel management, marketing services, and funding and accountability mechanisms. Practice in developing applicable skills.

REHAB 475 Physical Restoration (4) Sp *Hertling* Lectures and laboratory practice to develop special skills in physical therapy directed toward facilitation of movement as applied to treatment of neurological and musculoskeletal dysfunction. Treatment techniques in mobility, activities of daily living, self-care, transfers, and ambulation activities. Required for physical therapy students.

REHAB 477 Group Techniques (3) A *Kanny* Principles and concepts of small-group interaction and dynamics. Development of group participatory and leadership skills through class learning experiences and leadership of patient groups. Prerequisite: occupational therapy major standing.

REHAB 481, 482, 483, 484, 485 The Dynamics of Occupational Therapy (4,4,4,4,4) *Hager* Interrelated courses examining development and integration of skills, life tasks, and roles essential to productive living from birth through old age. Dynamics of occupational therapy in facilitating functional, physical, social, emotional, work, and leisure performance of persons dysfunctional in one or more of these areas. Assessment methods, selection and use of modalities, and effects of cultural and environmental factors on treatment planning. Laboratory sessions in clinical settings for observation and limited participation in application of treatment principles. Prerequisite: occupational therapy major standing.

REHAB 490 Clinical Clerkships in Physical Therapy (2, max. 4) AWSpS *Trotter* Observation, instruction, and supervised practice in treatment of patients in diverse clinical settings. Emphasis is given to the application of previously learned material and skills to specific clinical problems. Required for physical therapy students. Offered on credit/no credit basis only.

REHAB 492 Pathways in Occupational Therapy (*, max. 3) WSp *Deitz, Greenberg* Provides the opportunity for continued study in specific areas of interest under preceptorship of selected faculty members with guided readings and clinical experiences. Oral presentation of completed projects to students and faculty. Offered on credit/no credit basis only. Prerequisite: occupational therapy major standing.

REHAB 494 Field Experience (14) *Spicer* A minimum of six months of directed and supervised occupational therapy fieldwork experience at the University-affiliated hospitals and other approved centers. Required for occupational therapy major. Offered on credit/no credit basis only.

REHAB 495 Clinical Affiliation in Physical Therapy (2-12, max. 18) AWSpS *Trotter* Six to twelve weeks with two hundred minimum working hours. Clinical application of physical therapy techniques under supervision in affiliated hospitals. Offered on credit/no credit basis only. Prerequisite: physical therapy major standing.

REHAB 496 Special Topics in Rehabilitation (1-9, max. 14) AWSpS Guided opportunity for in-depth study in specific areas of rehabilitation. Topics vary. Prerequisite: permission of instructor.

REHAB 498 Undergraduate Thesis (*) Prerequisite: permission of instructor.

REHAB 499 Undergraduate Research (*) AWSpS Opportunity to design, perform, and analyze research investigation in problem areas in rehabilitation medicine. These include clinical and basic research problems in, for example, head and spinal injury, chronic disease, pain neurophysiology, electrodiagnosis, communication, and bioengineering. Prerequisite: permission of instructor.

REHAB 500 Specialized Clinical Experience in Physical Therapy (1-5, max. 15) AWSpS *Trotter* Student is assigned to an affiliated clinical facility. Activities focus on a variety of processes. These might include acquisition of an advanced and/or specialized treatment skill to be used in patient care; the development and presentation of an inservice training program; the analysis and assessment of existing supervisory problems. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

REHAB 501 Physical Therapy Management of Selected Motor Problems (2-5, max. 7) ASp *Trotter* Study of mechanisms involved in the control of posture and movement. Critical examination of selected literature and techniques dealing with the evaluation or modification of motor behavior. Prerequisite: physical therapy graduate student standing.

REHAB 502 Management of the Child With a Developmental Disability (3) Practical management of child with a physical handicap or other developmental disability. Developmental motor assessment, developing therapy goals and objectives, and an introduction to NDT handling and feeding techniques. Completion of a practicum project with a handicapped child is required. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

REHAB 504 Physical Therapy Approach to Common Orthopaedic Problems (4) Sp *Hertling* Discussion of common disorders affecting the musculoskeletal system, with emphasis on evaluation and physical therapy management of patients with such disorders. Prerequisite: permission of instructor.

REHAB 510 Somatopsychology: Psychological Aspects of Disability (3) Processes and management methods for assimilation of disability, enhancing patient participation in rehabilitation process, and for helping in maintenance of performance; behavioral management and case conference strategies; rehearsal of contingency management techniques. Required for residents; others by permission of instructor.

REHAB 513 Special Studies in Physical Therapy (1-5, max. 15) AWSpS Series of courses on theory and practice in specialized areas of physical therapy. Includes organization and administration of specialized programs, advanced evaluation and treatment techniques, role of the consultant. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

REHAB 516 Medical Information and Rehabilitation Counselors (4) Sp Lectures in medical science field regarding the etiology, prognosis, and physical restoration of common disabling conditions. Case studies are used extensively, and major emphasis is placed on vocational implications of physical disability. Required for rehabilitation counseling students; others by permission of instructor.

REHAB 520 Seminar (1-5) AWSp *Deitz, Greenberg, Hager, Kanny, Lehmann, McGourty, Spicer* Conferences, seminars, discussions of advanced physical medicine and rehabilitation topics for residents and postdoctoral fellows in rehabilitation medicine. Lectures, discussion, and laboratory work in selected aspects of occupational therapy appropriate to elected area of study for applicants for Master of Science in Occupational Therapy degree. May be repeated for credit.

REHAB 522 Neurophysiological Basis for Neuromuscular Reeducation (3) Review of traditional neurophysiological concepts and an exposition of recent advances in neurophysiological research related to the practice of rehabilitation medicine. Mechanisms underlying facilitation techniques and other techniques used in neuromuscular reeducation; various techniques compared and evaluated.

REHAB 530 Medical Aspects of Vocational Counseling (3) A *Jamero* Introduction to vocational implications of physical and emotional disabilities. Methods, counseling techniques, therapeutic modalities, community resources used in producing vocational assistance for the handicapped. Prerequisite: resident standing in rehabilitation medicine.

REHAB 532 Clinical Affiliation for Rehabilitation Counselors (5-6) A Under preceptorship of rehabilitation counseling staff, students counsel and evaluate patients with severe physical, emotional, or social problems; administer vocational testing; obtain placement on job stations; work with community resources for vocational/educational placement; and develop activity-oriented schedules. Prerequisite: permission of instructor.

REHAB 535 Administration (3) W *Lossing* Introduction to administration, management, and supervision of services in health care. Management theory, specific administrative techniques, formal organizational structure, and the practical application of this knowledge to occupational therapy. Strategies for activating constructive change in the health-care system identified and investigated.

REHAB 539 Communication Disorders in Rehabilitation Medicine (2) S *Beukelman* Overview of communication disorders secondary to central and peripheral nervous system impairment. Emphasis on facilitating identification of speech/language disorders with discussion of implications for rehabilitation. Prerequisite: graduate student status (postdoctoral fellow).

REHAB 540 Application of Measurement Systems (3) Sp *Deitz* Introduction to reliability, validity, norms, the test development process, statistics relevant to tests and measurements, and ethical implications of testing. Prerequisite: permission of instructor.

REHAB 542 Advanced Pediatric Occupational Therapy (3) W Provides opportunity to integrate information pertinent to pediatric occupational therapy research, theory, and practice as it relates to developmental disabilities, cerebral palsy, and learning disabilities; and to develop a personal theoretical framework of occupational therapy practice. Prerequisite: permission of instructor.

REHAB 555P Neuromuscular Electrodiagnosis (2½) AWS *Kraft* Demonstration of fundamentals of electromyography and peripheral nerve stimulation followed by participation in clinical electrodiagnosis examinations. Develops awareness of the usefulness of knowing when such procedures are indicated for patients and interpret results rather than develop proficiency in performing these examinations. Prerequisites: HUBIO 564P and permission of instructor.

REHAB 566 Special Topics in Rehabilitation (3) Philosophy and concepts in the interdisciplinary rehabilitation of persons with major disabilities, including advanced content in the rehabilitation theory and process of selected categories: post-CVA, post-spinal cord injury, and chronic back pain.

REHAB 568 Biophysics as Applied to Physical Medicine (2) A *Lehmann* Propagation and absorption characteristics of physical forms of energy used for treatment in physical medicine. Physiologic effects basic to prescription of the physical therapy modalities. Prerequisite: resident standing in rehabilitation medicine; others by permission of instructor.

REHAB 598 Electromyography and Clinical Neurophysiology (4) S *Kraft* Didactic course covering electromyography and clinical neurophysiology. First part covers basic neurophysiology

and second covers electromyography, nerve conduction studies, somatosensory evoked potentials, residual and auditory evoked potentials, single fiber EMG, late response, quantitative analysis, and macro EMG. Prerequisite: residency in rehabilitation medicine; others by permission of instructor.

REHAB 597-598-599 Electromyography and Electrodiagnosis Laboratory (1-1-1) A,W,Sp *Kraft* Elective work in clinical electromyography and other electrodiagnostic methods. Prerequisite: residency in rehabilitation medicine; others by permission of instructor.

REHAB 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

REHAB 654P Second-Year Clinical Elective in Physical Medicine and Rehabilitation (8) S *Hammond, Stolov* Alternative to 685 to meet chronic-care requirement. Explores the same goals recognizing the limited skills of the first-year student. Structured contacts permit understanding of disability problems in patients with chronic disease. Treatment methods and psychosocial consequences explored. Prerequisite: completion of one year of medical school.

REHAB 685P Chronic Disease and Disability (4) AWSpS *Hammond, Stolov* Meets chronic-care requirement for medical students. Structured clinical experience on rehabilitation medicine services. Differences between acute and chronic medicine, identification of disability problems, and therapeutic techniques for removing disability. Hospitals are within University system, local area, WAMI area, and Hawaii. Prerequisite: third-year medical student standing.

REHAB 686P Rehabilitation Medicine Clerkship—Pediatrics (8 or 12) AWSpS *Jaffa, Stolov* Meets chronic-care requirement for medical students. Incorporates material of 685 and expands into disabling pediatric disease. School planning, family counseling, community support services included. Six-week package permits inpatient, outpatient, and consultation experience. Recommended for students contemplating pediatrics. Prerequisite: third-year medical student standing.

REHAB 687P Rehabilitation Medicine Clerkship—Medical (8 or 12) AWSpS *Stolov* Meets chronic-care requirement for medical students. Incorporates material of 685 and expands into disability problems associated with "nonsurgical" disease. Six-week package permits inpatient, outpatient, and consultation experience. Recommended for careers in family medicine, internal medicine, rheumatology, cardiology, neurology, and geriatrics. Prerequisite: third-year medical student standing.

REHAB 688P Rehabilitation Medicine Clerkship—Surgical (8 or 12) AWSpS *Stolov* Meets chronic-care requirement for medical students. Incorporates material of 685 and expands into disability problems associated with surgically related disease. Six-week package permits inpatient, outpatient, and consultation experience. Recommended for careers in orthopedic surgery, neurosurgery, cardiovascular surgery, and urology. Prerequisite: third-year medical student standing.

REHAB 697P Rehabilitation Medicine Special Electives (*, max. 24) AWSpS *Stolov* Equivalent to 686, 687, or 688. Satisfies requirements in Rehabilitation Medicine/Chronic Care. Student arranges with another university, *outside* the WAMI and Hawaii areas, using the "Special Assignment Form" from the Dean's Office. Available outside Seattle area with one-quarter lead time in Everett, Puyallup, Tacoma, Spokane, Walla Walla, Missoula, Billings, Great Falls, and Anchorage. Students can qualify, after review, similar experience at another university. Prerequisite: permission of instructor.

REHAB 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

Surgery

BB487 University Hospital

In the Department of Surgery, instruction is carried on during all four years of the student's training and is integrated with that of the other departments in the School of Medicine.

Faculty

Chairperson

C. James Carrico

Professors

Carrico, C. James, M.D., 1961, Texas Southwestern; trauma and general surgery.

Dillard, David H., M.D., 1950, Johns Hopkins; thoracic surgery.

Helmbach, David M., M.D., 1964, Cornell; burn and general surgery.

Herman, Clifford M., M.D., 1959, Vermont; general surgery.

Jones, Robert F., M.D., 1952, Texas Southwestern; oncology and general surgery.

Marchioro, Thomas L., M.D., 1955, St. Louis; transplant surgery.

Merendino, K. Alvin (Emeritus), M.D., 1940, Yale, Ph.D., 1946, Minnesota; cardiothoracic surgery.

Schilling, John A., M.D., 1941, Harvard; general surgery.

Stevenson, John K., M.D., 1949, Rochester; general and pediatric surgery.

Strandness, D. Eugene, Jr., M.D., 1954, Washington; vascular surgery.

Tapper, David., M.D., 1970, Maryland; pediatric surgery.

Winterscheld, Loren C., M.D., 1954, Pennsylvania; general and thoracic surgery.

Associate Professors

Beach, Kirk W. (Research), Ph.D., 1971, California (Berkeley), M.D., 1976, Washington; vascular-Doppler ultrasonic techniques.

Copass, Michael K.,‡ (Medicine), M.D., 1964, Northwestern; neurology/surgery.

Dellinger, E. Patchen, M.D., 1970, Harvard; general surgery.

Engrav, Loren H., M.D., 1969, California (Los Angeles); plastic and reconstructive surgery.

Ivey, Tom D., M.D., 1970, Wisconsin; cardiothoracic surgery.

Johansen, Kaj H., M.D., 1970, Washington, Ph.D., 1977, California (San Diego); general and vascular surgery.

Lennard, E. Stan, M.D., 1968, Texas Southwestern, D.S.S., 1976, Cincinnati; general surgery.

Maier, Ronald V., M.D., 1973, Duke; general surgery.

Marvin, Janet A. (Physiology Nursing),† M.N., 1969, Washington; burn nursing.

Moe, Roger E., M.D., 1959, Washington; oncology and general surgery.

Oreskovich, Michael R., M.D., 1974, Washington; general surgery.

Radke, Hubert M., M.D., 1954, Texas; general and thoracic surgery.

Assistant Professors

Buehler, Peter K., M.D., 1970, Rochester; plastic and reconstructive surgery.

Clowes, Alexander W., M.D., 1972, Harvard; general and vascular surgery.

Hatch, Edwin L., Jr., M.D., 1967, Emory; pediatric surgery.

Kohler, Ted R., M.D., 1976, Harvard; general and vascular surgery.

Misbach, Gregory, M.D., 1973, California (Los Angeles); cardiothoracic surgery.

Phillips, David J. (Research), (Bioengineering), Ph.D., 1975, Duke; ultrasound diagnostic instrumentation.

Rusch, Valerie W., M.D., 1975, Columbia; thoracic surgery.

Sikkema, Wesley W., M.D., 1957, Michigan; general surgery.

Walkinshaw, Marcus D., M.D., 1974, California (Irvine); plastic and reconstructive surgery.

Zierler, R. Eugene, M.D., 1976, John Hopkins; general and vascular surgery.

Course Descriptions

Courses numbered with a **P** *suffix are not graduate courses and are restricted to medical student enrollment only.*

SURG 498 Undergraduate Thesis (*) AWSpS *Lennard* Offered to those students who have engaged in undergraduate research in general surgery. (Full or part time.)

SURG 499 Undergraduate Research (*) AWSpS *Lennard* Provides an opportunity to participate in ongoing research projects in general surgery being carried out by Department of Surgery faculty or to carry out an independent research project under supervision. Practical experience in experimental design and execution is provided under direct supervision of selected faculty members. (Full or part time.)

CONJ 585 Surgical Anatomy (1-3, max. 12) See Conjoint Courses.

SURG 600 Independent Study or Research (*) AWSpS

SURG 665P Clinical Clerkship (*, max. 24) AWSpS *Lennard* (Veterans Administration Hospital, Harborview Medical Center, Pacific Medical Center, Providence Medical Center) Diagnosis and management of problems amenable to surgical therapy. Physiological basis of surgical care, differential diagnosis and decision making, and the basic principles of surgical management. Care of inpatients and outpatients, including participation in the operating rooms. Prerequisite: HUBIO 563P. (Six weeks. Limit: twenty-five students.)

SURG 681P Peripheral Vascular Disease (4 or 8) AWSp *Strandness* (Veterans Administration Hospital, University Hospital) Peripheral arterial and venous problems, including methods of clinical evaluation; new diagnostic procedures; and the available methods of treatment. Patient workup, performance of diagnostic studies, and presentation of case material to the staff. Prerequisites: 665P, HUBIO 563P. (Two or four weeks. Limit: two students.)

SURG 682P Externship in General Surgery or Clinical Burn Care (*, max. 12) AWSpS *Helmbach, Lennard* Offered on the general surgery wards of the University-affiliated hospitals or the burn unit of Harborview Medical Center. Diagnosis, preoperative care, and postoperative care; management of surgical diseases and emergencies and outpatient follow-up of discharged patients. Prerequisite: 665P. (Four or six weeks, full time. Limit: seven students.)

SURG 683P Pediatric Surgery Externship (8 or 12) AWSpS *Tapper* Children's Orthopedic Hospital and Medical Center. Surgical conditions peculiar to the particular age group with a preponderance of congenital and neoplastic conditions that are amenable to surgical treatment. A reasonable background of knowledge in human embryology and genetics is recommended. Prerequisite: 665P. (Four or six weeks, full time. Limit: two students.)

SURG 684P Trauma and Emergency Care (*, max. 16) AWSpS *Copass, Eisenberg* Register for one or both segments of this course. Segment 1: emergency medicine and trauma at Harborview Medical Center with assignment to the emergency department. Emphasis on management of critical medical emergencies and trauma. Segment 2: acute medicine at University Hospital. Evaluate and treat ambulatory emergencies. Prerequisites: 665P, MED 665P. (Four weeks, fourth-year students. Limit: twelve students at Harborview Medical Center; three students at University Hospital.)

SURG 685P Cardiothoracic Surgery Externship (*, max. 12) AWSpS *Ivey* Serve as subintern, participate in patient care while learning cardiopulmonary hemodynamics of cardiac surgery. Wide variety of both cardiac and thoracic disease entities. Participate in the open-heart procedures in the operating room. Opportunity to gain additional understanding of physiology of cardiopulmonary bypass.

SURG 686P Plastic Surgery Clerkship and Preceptorship (*, max. 12) AWSp *Engrav* Plastic surgery service at University-affiliated hospitals; includes patient workups and operating room experience with emphasis on learning the fundamentals of plastic surgery; wound management on animal specimens and in the emergency room. Includes wounds, burns, facial trauma, head and neck cancer, cosmetic surgery, skin tumors, hand surgery, and reconstructive surgery. Prerequisite: 665P. (Four or six weeks. Limit: one student.)

SURG 697P Surgery Special Electives (*, max. 24) AWSpS *Lennard* Special clerkship, externship, or research opportunities can at times be made available at institutions other than the University of Washington. Students wishing to elect this course should obtain from the Dean's office a special assignment form at least one month before preregistration. Prerequisites: 665P and departmental permission. (Four, six, or twelve weeks.)

Urology

BB1115 Health Sciences

Urology is the surgical discipline concerned with diseases of the male genitourinary organs and the female urinary tract. Training for medical students starts in the second year and continues through the third and fourth years.

Training is also provided for interns, nurses, and physical medicine technologists and allied specialists.

An approved urology residency program is available.

Faculty

Chairperson

Julian S. Ansell

Professors

Ansell, Julian S., M.D., 1951, Tufts; congenital defects and pediatric urology.

Barnes, Glover W.,* (Microbiology),† Ph.D., 1962, State University of New York (Buffalo); tissue, organ immunology.

Chapman, Warren H., M.D., 1952, Chicago; oncology and microsurgery.

Associate Professors

Berger, Richard E., M.D., 1973, Chicago; infertility and infectious diseases.

Mayo, Michael E., M.B., B.S., 1962, St. Thomas Hospital (London); urodynamics.

Assistant Professor

Krieger, John N., M.D., 1974, Cornell; infectious diseases.

Course Descriptions

Courses numbered with a P *suffix are not graduate courses and are restricted to medical student enrollment only.*

UROL 498 Undergraduate Thesis (*) AWSpS *Berger* Provides an opportunity for medical students to write theses in the area of urology. Prerequisite: permission of sponsor and department.

UROL 499 Undergraduate Research (*) AWSpS *Berger* The student participates in current urologic research projects under supervision of full-time staff. Certain specific problems may be elected by the student. Elective for medical students. Prerequisite: permission of sponsor and department.

UROL 675P Urology Preceptorship (*, max. 8) AWSpS *Berger* Student follows a preceptor in all of his or her work. Becomes acquainted with the office management of urological problems. Prerequisites: 680P, HUBIO 562P. (Two or four weeks.)

UROL 680P Urology Clerkship (*, max. 8) AWSpS *Ansell, Berger, Chapman, Krieger, Mayo* Full activities of clinical service. Basic principles of urology emphasized. Prerequisite: HUBIO 562P. (Two or four weeks.)

UROL 685P Urology Subinternship (*, max. 12) AWSpS *Ansell, Berger, Chapman, Krieger, Mayo* Subintern is responsible for patient workups and for preoperative and postoperative care and participates in the operating room. Prerequisite: MED 665P or PEDS 665P or permission of instructor.

UROL 697P Urology Special Electives (*, max. 24) AWSpS *Berger* Special clerkship, externship, or research opportunities can at times be made available at institutions other than the University of Washington. Students wishing to elect this course should obtain from the Dean's office a special assignment form at least one month before preregistration. Prerequisite: permission of instructor. (Six or twelve weeks.)

School of Nursing

Dean

Rheba de Tornyay
T318 Health Sciences

Associate Deans

Sandra J. Eyres, Graduate Program

Sally M. O'Neil, Undergraduate Program

Alice M. Kuramoto, Continuing Nursing Education

The School of Nursing offers programs leading to baccalaureate, master's, and doctoral degrees.

Undergraduate Program

The School of Nursing prepares its graduates to function as generalists in professional nursing practice and to collaborate with other health-care providers. The nine-quarter undergraduate curriculum emphasizes theory and clinical practice to ensure critical thinking and clinical expertise. Clinical experiences are provided in institutional and community settings. Completion of the curriculum leads to a Bachelor of Science in Nursing degree and eligibility to take the licensure examination to become a registered nurse.

Students may be admitted to the School of Nursing as premajors or as nursing majors. Courses required for admission to the nursing major include: inorganic and organic chemistry, a selected mathematics course, microbiology, behavioral science, English composition, and electives to achieve a minimum of 45 credits. The four required natural science courses must have been taken within five years of admission. There is no time limit for the other courses.

A six-quarter modification of the basic curriculum is available for the registered nurse who is able to validate selected nursing courses through written examination.

Admission to the nursing major occurs once a year, in Autumn Quarter, with an application deadline in the previous February. Selection is competitive. For information on admission criteria, specific prerequisites, and deadlines, as well as application forms, contact the Office of the Undergraduate Program, School of Nursing.

Graduate Program

The School of Nursing offers graduate study leading to the degrees of Master of Nursing, Master of Science, and Doctor of Philosophy. At the master's level, programs are designed to provide opportunity for advanced study and research in nursing and to assist in the development of increased competence in selected areas of clinical specialization: community health-care systems, parent and child nursing, physiological nursing, and psychosocial nursing. Research is an integral part of all programs, and a thesis is required of all master's degree program students. Opportunities for functional preparation in teaching, administration, and clinical practice are available.

At the doctoral level, the aim of the program is to prepare scholars and researchers to expand the body of knowledge upon which the practice of nursing rests. The program provides for rigorous research training related to five fields of nursing science: (1) individual adaptations to health and illness; (2) family adaptations to health and illness; (3) environments: supporting and nonsupporting; (4) clinical therapeutics: interpersonal; and (5) clinical therapeutics: physical. The Ph.D. in Nursing Science program is appropriate preparation for nurses interested in careers in academia or for other types of leadership positions in health service agencies in which the ability to design, plan, and implement research in nursing is a critical requirement.

Special Requirements

In addition to the basic requirements for graduate status in the University, admission to premaster's status in the School of Nursing requires baccalaureate preparation with an upper-division major in nursing, a basic course in statistics, a Graduate Record Examination within the past five years, a statement of goals, and three references. Admission is normally Autumn Quarter, except for the Nursing Administration pathway, which begins Summer Quarter. The deadline for application to the Nursing Administration pathway is December 1. Application deadlines for all other master's degree pathways vary from February 1 to April 1. Additional information may be obtained from the School of Nursing Graduate Programs Office.

Admission requirements for the doctoral program, in addition to the above, include Graduate Record Examination scores within the past three years, five references, a statement of goals for doctoral study, a description of area of research interest, and evidence of scholarly work. A personal interview may be required. The deadline for application to the doctoral program is February 1.

Financial Aid

A limited number of nurse traineeships are available for premaster's study. Special pre- and post-master's traineeships are also available to a limited number of students for specific specialties. Additional information may be obtained from the School of Nursing.

Teaching assistantships and research assistantships are available to a limited number of students. Priority for these appointments is given to predoctoral students.

Faculty

Chairpersons

Community Health Care Systems: Barbara J. Horn
Parent and Child Nursing: Marion H. Rose (acting)
Physiological Nursing: Maxine L. Patrick
Psychosocial Nursing: Vivian C. Wolf-Wilets

Professors

Barnard, Kathryn E.,* Ph.D., 1972, Washington; ecological factors of child development.

Batey, Marjorie V.,* Ph.D., 1968, Colorado; sociological factors in health-care systems.

Benoliel, Jeanne Q.,* D.N.Sc., 1969, California (San Francisco); psychosocial consequences of life-threatening illnesses, process of identity change, environments and health.

Chrisman, Noel J.,* (Anthropology, Family Medicine), Ph.D., 1966, California (Berkeley); health beliefs and practices, social networks and social support.

deTornyay, Rheba,* Ed.D., 1967, Stanford; health services, nursing education.

Disbrow, Mildred A. (Emeritus), Ph.D., 1968, Washington; maternal-infant interaction, child abuse.

Eyers, Sandra J.,* Ph.D., 1972, North Carolina; environmental resources promoting adaptation and health.

Giblin, Elizabeth C. (Emeritus), Ed.D., 1959, Colorado; nursing assessment and nursing therapies, pathophysiological bases.

Heinemann, Edith M.,* M.A., 1954, Washington; alcohol and substance-abuse nursing.

Horn, Barbara J.,* (Health Services Administration), Ph.D., 1971, Michigan; effective organization of nursing resources.

Lewis, Frances Marcus,* Ph.D., 1977, Stanford; complex organizational analysis, evaluation research, psychosocial factors in chronic illness.

Little, Dolores E.,* M.N., 1957, Washington; leadership, emerging nursing roles.

Mansfield, Louise W. (Emeritus), M.A., 1951, Columbia; physiological nursing.

Mitchell, Pamela,* M.S., 1965, California (San Francisco); neuroscience nursing, diagnostic strategies.

Nakagawa-Kogan, Helen,* Ph.D., 1968, California; stress response: cognitive/physiologic interface in chronic dysfunctions and self-management teaching.

O'Neil, Sally M.,* Ph.D., 1971, Kansas; behavior analysis and modification in child development and handicapping conditions.

Osborne, Oliver H.,* (Anthropology), Ph.D., 1968, Michigan State; ideology, policy and health-care systems; transcultural health; mental health.

Patrick, Maxine L.,* Dr.P.H., 1970, California (Los Angeles); gerontology, geriatrics.

Wolf-Wilets, Vivian C.,* Ph.D., 1969, Chicago; curriculum development, instruction, stress management.

Woods, Nancy Fugate,* Ph.D., 1978, North Carolina; women's health.

Associate Professors

Beaton, Randal D.* (Research), Ph.D., 1972, Washington; evaluation of clinical outcomes in health-care programs.

Blainey, Carol A.,* M.N., 1967, Washington; clinical teaching and problems of patients with diabetes mellitus.

Boozer, Mary,* M.S., 1955, Washington; physiological nursing, care of patients.

Brandt, Edna M. (Emeritus), M.N., 1953, Washington; physiological nursing.

Bruno, Pauline M.,* D.N.S., 1971, California (San Francisco); problems associated with restrictions of mobility, skin care.

Burke, A. Evelyn (Emeritus), M.A., 1941, Case Western Reserve; community health-care systems.

Carnevali, Doris L. (Emeritus), M.N., 1961, Washington; planning nursing care.

Cobb, Marguerite (Emeritus), M.N., 1957, Washington; community and school health problems.

Cunningham, Susanna L.,* (Physiology and Biophysics), Ph.D., 1978, Washington; cardiovascular and sympathetic nervous system control of renin release, community blood pressure programs.

Ellison, Edythe S.,* Ed.D., 1978, California (Los Angeles); psychosocial development of school-age children, programs and services for chronically mentally ill.

Estes, Nada J.,* M.S., 1958, Colorado; counseling, people with substance-use disorder, depression.

Fine, Ruth B.,* M.N., 1957, Washington; organization and structure as it influences behavior.

Gallucci, Betty B.,* Ph.D., 1973, North Carolina State; oncology, nutritional assessment, pathophysiology of stomatitis, and graft *vs.* host disease.

Gray, Florence I. (Emeritus), M.S., 1950, Washington; undergraduate nursing education.

Hammond, Mary A.* (Research), Ph.D., 1971, Wisconsin; child development, longitudinal research methods.

Hay, Stella (Emeritus), M.A., 1951, Minnesota; physiological nursing.

Horn, Beverly M.,* (Anthropology), Ph.D., 1975, Washington; cross-cultural research in maternal-child nursing.

Jackson, Nancy E.* (Research), Ph.D., 1975, Washington; intellectual development and individual differences in intellectual functioning.

Killien, Marcia Gruis,* Ph.D., 1982, Washington; women's health, reproductive decision making, evaluation research, perinatal nursing.

Kotchek, Lydia D.,* Ph.D., 1975, Washington; individual and family development; cultural influences on family, aging, death, health care.

Kuramoto, Alice M.,* Ph.D., 1975, Michigan; nursing education and evaluation.

Leitch, Cynthia Jo,* Ph.D., 1973, Utah; educational research and research studies of care-finding nature.

Loustau, Anne,* Ph.D., 1975, Washington; clinical decision making, patient teaching, patient compliance with therapeutic regimens.

Marvin, Janet A.,* (Surgery),† M.N., 1969, Washington; burns, trauma, nutrition, infection control.

McCorkle, M. Ruth,* Ph.D., 1975, Iowa; psychosocial responses to chronic illness, communication strategies.

Mitchell, Sandra K.,* Ph.D., 1976, Washington; observational methodology, parent-child interaction, social skills and social support.

Molbo, Doris M.,* M.A., 1964, Washington; The American Cancer Society Clinical Professor of Oncology; oncology: prevention and screening, therapeutic care and rehabilitation.

Olcott, Virginia (Emeritus), M.A., 1931, Washington; public health nursing.

Pesznecker, Betty L.,* M.N., 1957, Washington; life change; life strain, impact on health, low-income women, and social support.

Pittman, Rosemary J. (Emeritus), M.S., 1947, Chicago; family nurse practitioner.

Prinz, Patricia N.,*‡ (Psychiatry and Behavioral Sciences), Ph.D., 1969, Stanford; sleep.

Rosa, Marion H.,* Ph.D., 1972, Chicago; coping, vulnerability and stress in children.

Smith, Harriet H. (Emeritus), M.N., 1957, Washington; nursing.

Spratlen, Lois P.,* Ph.D., 1976, Washington; urban and ethnic factors in health and illness.

Webster-Stratton, Carolyn H.,* Ph.D., 1980, Washington; parent intervention programs for behaviorally disturbed children.

Woods, Susan L.,* M.N., 1975, Washington; cardiovascular clinical specialist, pulmonary artery catheter measurement.

Assistant Professors

Blackburn, Susan T.,* Ph.D., 1979, Washington; high-risk infants and their families, infant care-giving actions and environments.

Booth, Cathryn L.* (Research), Ph.D., 1974, Ohio State; mother-infant interaction, observational methodology, childbirth experiences and attachment.

Bowers, Joan E.,* Ed.D., 1978, Teachers College, Columbia; family systems: structure and function; adaptations and coping behaviors; family therapy.

Brandt, Patricia A.,* Ph.D., 1981, Washington; influence of family functioning on early child development.

Brown, Marie A.,* Ph.D., 1983, Washington; perimenstrual distress (premenstrual syndrome and dysmenorrhea), psychosocial aspects of pregnancy.

Bush, James P., M.N., 1973, Washington; pain management.

Catanzaro, Marci,* Ph.D., 1980, Union Graduate School—West (San Francisco); symptom management and chronic illness.

Cowan, Marie J.,* (Pathology),† Ph.D., 1979, Washington; estimation of infarct size by electrocardiography; sudden cardiac death.

Craven, Ruth F., M.N., 1968, Washington; gerontological nursing.

Draye, Mary Ann, M.P.H., 1968, Michigan; FNP practice, infertility, computer-aided instruction, risk appraisal.

Goertzen, Irma E., M.N., 1968, Washington; nursing organization in hospitals, finance.

Heitkemper, Margaret,* Ph.D., 1981, Illinois; physiological nursing, gastroenterology, enteral nutrition, gerontology.

Hoffman, Agnes K.,* Ph.D., 1977, Kansas; substance-use disorders and mental-health care of the elderly.

Holland, Jeanne M., M.S., 1973, Boston; prescribing practices of nurse practitioners, compliance in hypertension.

Jones, Mary C.,* M.S., 1962, Boston; occupational health nursing, health promotion, self-care practice.

Larson, M. Linn,* M.N., 1967, Washington; cross-cultural variables in mental illness, nursing interventions in disturbed behaviors.

Magyary, Diane L., Ph.D., 1981, Washington; parent interactions with high-risk infants and children.

Muecke, Marjorie A.,* Ph.D., (Anthropology), 1976, Washington; medical anthropology, women's health, refugee health, Southeast Asia.

Shaver, Joan,* Ph.D., 1976, Washington; women's health and female reproductive physiology.

Snyder, B. Charlene (Research), M.N., 1972, Washington; nursing intervention with high-risk families, especially mothers with newborns.

Spietz, Anita L. (Research), M.N., 1970, Washington; nursing interventions with high-risk families.

Tyler, Martha L.,* M.N., 1977, Washington; oxygenation during chest physiotherapy, suctioning, control of dyspnea, breathing patterns in disease.

Virden, Susan, D.N.S., 1981, California (San Francisco); nursing interventions that promote adaptations to parenting.

Wilkinson, William, Dr.P.H., 1982, Texas; occupational epidemiology and surveillance, occupational health service delivery.

Williams, Susan A., M.S.N., 1972, Catholic University of America; respiratory nursing.

Worthy, Elizabeth J. (Emeritus), M.N., 1964, Washington; mother-infant interactions, handicapped child.

Lecturers

Abrums, Mary, M.N., 1979, Washington; parent and child nursing.

Bourget, Jeanne, M.N., 1983, Washington; parent and child nursing.

Dye, Bernice J., M.A., 1974, Washington; community health-care systems.

Fast, Gail P., M.N., 1979, Washington; parent and child nursing.

Gregersen, Ruth A., M.N., 1983, Washington; physiological nursing.

Griffin, Jane, M.N.A., 1961, Minnesota; community health-care systems.

Hancock, Lois A., M.S.N., 1978, Yale; parent and child nursing.

Herriott, Martha J., Ph.D., 1978, Washington; community health-care systems.

Hoehn, Robert E., Ed.D., 1970, Arizona; Director, Center for Educational Resources.

Lobenstein, Alice L., M.N., 1970, Washington; parent and child nursing.

Slade, Carol L., M.N., 1975, Washington; parent and child nursing.

Stengel, Gretchen B., M.N., 1980, Washington; physiological nursing, gerontology.

Underhill, Sandra L.,* M.N., 1976, Washington; cardiovascular nursing, angina.

Course Descriptions

Community Health Care Systems

CHCS 290 History of Nursing (2) AWSp History of nursing from antiquity to the present. Examines forces that shaped nursing, including the social, cultural, economic, and scientific. Role of woman and its influence on nursing, with special emphasis on past and present leaders of nursing and their unique contribution to nursing. Reviews the present role of the nurse. Elective course open to all interested students.

CHCS 301 The Discipline and Profession of Nursing (3) A Conceptual organization of the discipline of nursing and the scope of its professional practice. Nursing's historical development and current trends influencing the contributions of nursing in health-care delivery. Prerequisite: admission to School of Nursing.

CHCS 350 Diagnostic Reasoning and Therapeutics in Nursing (3) A Nursing domain and diagnostic reasoning process in nursing diagnosis and management. Organization of nursing knowledge for diagnostic and therapeutic decision making. Examines values in relationship to professional nursing practice. Prerequisites: admission to registered nurse major and CONJ 340, which may be taken concurrently.

CHCS 361 Cultural Variation and Nursing Practice (2) W Importance in nursing practice of ethnomedical beliefs, values, practices pertaining to wellness-illness, care seeking, and healing. Comparative approach emphasizes cross-cultural similarities and differences. Value orientations influencing the effectiveness of nurses working with culturally diverse populations. Prerequisite: upper-division standing.

CHCS 402 Strategies in Community Health Nursing (8) WSp Community health nursing process at levels of family and other small groups, community and aggregate populations. Formulation of community health diagnoses as basis for interventions to promote disease prevention, wellness, and self-care within community. Prerequisite: senior standing in nursing or permission of instructor.

CHCS 406 Introduction to Research in Nursing (3) Organization of the structure of nursing knowledge through research. Concepts and processes of research utilized in the investigation of nursing science. Prerequisite: one introductory statistics course.

CHCS 408 Legal and Ethical Issues in Clinical Practice (2) Identification of ethical and legal issues and the ensuing dilemmas relevant to the profession of nursing and nurses as health professionals and citizens. Selected problems and dilemmas affecting nurses, nursing, and the delivery of health care analyzed using specific moral-ethical perspectives. Prerequisite: upper-division standing or permission of instructor.

CHCS 410 Gerontological Nursing (2) WSp Major physiological, psychological, and sociocultural changes associated with aging and their impact on individuals within the context of their families and environments. Nursing assessments and interventions utilizing strengths and capabilities of the elderly and aimed at maintaining optimum health status. Prerequisites: senior standing, nursing major standing.

CHCS 420 Nursing Leadership and Health-Care Systems Analysis (3) WSp Analysis of selected leadership theories and their relationship to leadership role required of professional nurse. Comparative analysis of past, current, and emerging health-care systems in United States and other countries. Factors influencing health-delivery systems (e.g., political, technological, socioeconomic, cultural). Prerequisite: senior standing or permission of instructor.

CHCS 423 Senior Practicum in Community Health Nursing (7) Sp Theoretical depth and practice as offered in areas of leadership, health promotion, health education, community organization, and application of research influencing the quality of health-care delivery as applied in primary community health-care settings. Prerequisite: 402 or permission of instructor.

CHCS 450 Advanced Fieldwork Community Health Nursing (2) W Guided experience in delineating nursing roles in community settings. Development of a philosophy of community health nursing. Application of core concepts pertaining to health, ethics, care, and community. A minimum of four hours of guided experience weekly. Prerequisites: graduate standing, concurrent registration in 550, and 571, 578.

CHCS 452 Health Assessment of Adults and Children (3) A Provides framework for systematic data collection, organization, precise recording, and accurate communication of health status data on individuals of all ages. Demonstrations of, and experiences with, the processes of symptom analysis and health screening with basically healthy individuals. Prerequisite: permission of instructor.

CHCS 458 Practice Teaching Community Health Nursing (3) Sp Guided experience in selected teaching-learning situations in community health nursing. Identification, analysis, and solution of teaching-learning problems. A minimum of seven hours of guided experience weekly. Prerequisite: 450.

CHCS 467 Evaluation of Performance in Nursing (3) S Philosophy and rationale of evaluation for nurses with administrative, teaching, and supervisory responsibility in various health agencies. The purposes of evaluation as they relate to guidance of students or staff toward personal satisfaction and growth, and toward improved patient care.

CHCS 492 Anthropology of Refugees (3) W The refugee phenomenon, its emergence in postcolonial world, and structure of life history of refugees. Ethnic change, involuntary deculturation, and acculturation as they occur in refugee life histories. Offered jointly with ANTH 492. Prerequisite: ANTH 202 or permission of instructor.

CHCS 495 Child Rearing, Culture, and Health (3) Sp Cross-cultural study of the child-rearing practices, cultural norms, and health behavior of children and adolescents in different societies. Comparative approaches, diverse theoretical postures, and empirical research findings are used. Offered jointly with ANTH 440. Prerequisite: permission of departmental adviser.

CHCS 499 Undergraduate Research (1-5, max. 5) AWSpS Supervised individual research on a specific nursing problem. Prerequisites: junior year standing in the School of Nursing, cumulative grade-point average of 3.00 or better, and permission of undergraduate advising office.

CHCS 508 Seminar in Nursing Administration (3) Sp Critical analyses of problems affecting the administration of nursing. Intensive directed study of the conditions that influence human behavior in nursing work environments. Prerequisites: graduate standing, ADMIN 510, and permission of departmental adviser.

CHCS 520 Methods of Research in Nursing (3) A Research process as it applies to nursing. Use of the literature in building theoretical rationale. Selection of appropriate methods. Presentation of findings. Minimum of two laboratory hours weekly. Prerequisite: a course in statistics.

CHCS 521 Methods of Research in Nursing (2) W Continuation of 520, with emphasis on methods of research applied to the solution of problems in all fields of nursing.

CHCS 522 Family-Focused Health Care (2-3) W Foundation for integrating principles of family-focused health care into primary care. Theories of family development and functioning examined in context of primary care. Study and evaluation of research and clinical decision making related to family assessment, health status determinations of individuals in family context, and selection of strategies of care.

CHCS 524 Seminar in Nursing Leadership Processes (3) ASp Considers the dynamic processes involved in leadership roles assumed by nurses in a variety of settings. Included in the course is

an explanation of the complex human relationships integral to leader functions in the attainment of health goals. Minimum of two laboratory hours weekly.

CHCS 550 Advanced Community Health Nursing (3) W Systematic inquiry into the nature and foundations of community health nursing. Analytic and theoretical perspectives on health risk assessment and nursing interventions in the community. Implications for community health nursing services. Prerequisites: 571 and 578 or permission of instructor and graduate standing.

CHCS 551 Theoretical Foundations of Primary Care I (3) A Presentation and interpretation of theoretical bases of family-focused primary care, mutual responsibility and participation, clinical decision making, professional leadership, and research. Provides students with conceptual foundation upon which to base their development as family nurse practitioners. Prerequisites: family nurse practitioner students to take 452 concurrently; permission of instructor.

CHCS 552 Theoretical Foundations of Primary Care II: Health Promotion and Maintenance (3) W Clinical analysis of health promotion and maintenance methodologies in primary care. Focus on wellness of individuals through the life span, and families and communities seeking to maintain or improve health. Emphasis on prospective health care and strategies for changing behavior. Prerequisites: 551, 452, or permission of instructor; Family Nurse Practitioner students must register for 553 concurrently.

CHCS 553 Seminar in Primary Care I: Clinical Decision Making in Health and Wellness (2) W Weekly seminars with supervised field study within selected primary-care and wellness settings. Emphasis on health assessment and strategies related to improving health in people of all ages. Analysis of, and counseling on, life-styles, nutrition, physical fitness, stress management, self-care, and prevention. Offered on credit/no credit basis only. Prerequisite: 551; Family Nurse Practitioner students must register concurrently for 552.

CHCS 554, 555 Theoretical Foundations of Primary Care III and IV: Acute and Chronic Illness (3,3) Sp,S Differential diagnosis and selection of health-care strategies within the scope of practice of family nurse practitioners. Includes clinical decision making in common acute or stable chronic health problems. Stresses concepts of health promotion, maintenance, and restoration and the development of advanced assessment and management. Prerequisites: 452, 520-522; 551-553 or permission of instructor.

CHCS 556, 557 Seminar in Primary Care II and III: Decision Making in Acute and Chronic Illness (3,4) Sp,S Focus on research questions, patient presentations, and group discussions drawn from field study. Supervised clinical field study within selected primary health-care settings and weekly seminar discussions related to theory presented in 554, 555. Offered on credit/no credit basis only. Prerequisites: concurrent registration in 554 for 556; 555 for 557.

CHCS 558 Advanced Occupational Health Nursing (5) A Integration of occupational health and community health nursing principles into a framework for occupational health nursing. Students synthesize concepts and explore in depth selected occupational health problems. Includes evaluation and application of theories and research findings. Prerequisites: 550, 450, 458, ENVH 571, 453 and permission of instructor.

CHCS 559 Theoretical Foundations of Primary Care V: Complex Clinical Problems (3) A Integration of theoretical and methodological approaches to clinical decision making and research as applied to complex clinical problems in primary care. Examination of clinical phenomena, formulation of hypotheses, and integration of research into primary care. Prerequisites: 452, 522, 551-557, 572, or permission of instructor; concurrent registration in 560.

CHCS 560 Seminar in Primary Care IV: Decision Making in Complex Clinical Problems (4) A Seminar with associated field study. Synthesis of advanced knowledge base and clinical family nurse practitioner skills with effective management of complex clinical problems. Offered on credit/no credit basis only. Prerequisites: 452, 522, 551-557, 572, or permission of instructor; concurrent registration in 559.

CHCS 561 Systems Analysis in Nursing Administration (3) W Examines concepts and techniques in industrial engineering, system analysis, and operations research applicable to decision making, control and monitoring functions in nursing administration. Student demonstrates application and critical appraisal of concepts and techniques. Prerequisites: ADMIN 510, or equivalent, and permission of instructor.

CHCS 562 Clinically Applied Anthropology (3) Sp Anthropology as it relates to interdisciplinary delivery of culturally relevant health care. Cultural variation in illness beliefs and behavior, types of healing practices, illness prevention, social support networks. Prerequisites: graduate standing, permission of instructor.

CHCS 564 Nursing Administration (3) W Elements of the administrative process as applied to organized nursing service. Exploration of concepts related to organizational structure, administrative behavior, personnel management, and the technology of administration. Prerequisites: ADMIN 510, graduate standing, and permission of instructor.

CHCS 566 Program Development in Clinical Areas (3) A Application of administrative theory in the development of a program in a selected clinical area of practice. The program will be developed on consumer need, community and agency resources and constraints; two-hour seminar; three hours field study each week. Prerequisites: graduate standing, 561, 564, ADMIN 510, or permission of instructor.

CHCS 567 Evaluation and Quality Assurance in Nursing (3) A Examines the framework for the evaluation and quality assurance of nursing practice in health-care and educational settings. The multiprofessional responsibility for review of health care is incorporated into the legal and professional mechanisms of peer review practices. Prerequisites: graduate standing, 520, 521.

CHCS 568 Field Study in Nursing Administration (6) S Field study provides opportunities to study and analyze the relationships between espoused theories and theories in action under real-time conditions and to make a comparative analysis of structure and behavior of management systems. Minimum of sixteen hours of field study and a two-hour seminar weekly. Prerequisites: equivalency of 506, 520, 521, 564, and ADMIN 510.

CHCS 571 Seminar in Nursing and the Social Order (3, max. 9) AWS Changing patterns of nursing service and education in contemporary society. Implications of personal value systems. Prerequisite: permission of instructor.

CHCS 572 Theories of Illness (3) W Presents a conceptual view of illness by examining the sociocultural, physiological, psychological, and environmental processes involved in the disruption of physical and psychological integrity of individuals, and subsequent human response to those disruptions. Prerequisites: 452, 520, and 551, or permission of instructor.

CHCS 574 Selected Topics in Comparative Nursing Care Systems (2 or 3, max. 10) ASp In-depth examination of the literature pertinent to major theoretical issues in cross-cultural nursing and health-care systems. Seminar with analysis and discussion of selected topics and readings. Implications for research and health care stressed.

CHCS 576 Death Influence in Clinical Practice (4) WS Analysis and study of social, cultural, and psychological conditions that influence human death in modern society. Research findings, selected readings, and direct experience provide direction for examination of philosophic, theoretical, and pragmatic issues underlying choices and decisions in clinical practice. Open to graduate students with permission of instructor. (Limit: sixteen students.)

CHCS 578 Health, Care, and Community (3) A Analysis of health care in community from nursing and behavioral science perspectives. Sociocultural influences on health beliefs and practices, natural-care units, and community life patterns analyzed. Community as both context and target of change explored in relation to nursing approaches in health promotion and maintenance. Prerequisite: graduate standing.

CHCS 580 Populations at Risk in the Community (3) Sp Health needs and risks of selected populations in the community and theoretical and analytical perspectives on assessment and intervention strategies in community health nursing practice with groups and populations whose health is at risk. Prerequisites: 450, 550, 571, 578, and graduate standing.

CHCS 581 Seminar in Advanced Community Health Nursing (4) Construction and analysis of research questions, presentation of individual and community problems and intervention/evaluation strategies in community health nursing. Individual and community assessment and nursing strategies related to health promotion and prevention of illness. Field study in community health settings. Prerequisites: 580 and graduate standing.

CHCS 583 Transcultural Nursing Practices (3) WS Study of nursing practices in different cultures. Seminar focus is on theoretical formulations and comparative analysis of values, patterns, techniques, and practices of nursing care in many societies. Rituals, myths, taboos, and beliefs are studied in relation to the subculture(s) of caring and nursing practices.

CHCS 600 Independent Study or Research (*) Offered on credit/no credit basis only.

CHCS 700 Master's Thesis (*) Offered on credit/no credit basis only.

Parent and Child Nursing

PCN 300 Human Growth and Development Through the Life Span (5) A Processes of, and theories about, human growth and development; examination of relevant research; relationship of research and theory to working with clients of various ages. Prerequisite: admission to School of Nursing or permission of instructor.

PCN 328 Family Centered Nursing of Children (7) AWSp Holistic assessment and optimizing wellness of pediatric clients and their families. Clinical experiences include care of children and families at various positions along the wellness continuum. Prerequisite: junior standing with nursing major standing.

PCN 400 Nursing Care of the Childbearing Family (5) AWSp Nursing care of families through pregnancy, childbirth,and early parenting. Reproductive health care issues, including human sexuality, family planning, and sexually transmitted diseases. Clinical experiences in community and hospital settings. Prerequisites: PN 323, 324, PSN 305.

PCN 425 Senior Practicum in Parent-Child Nursing (7) WSp Further development, critical examination, and synthesis of nursing care in a specialized parent-child setting. Increasing depth of clinical practice, including care to groups of clients, applying leadership skills, assessing problems affecting quality health-care delivery, and applying research findings. Prerequisite: senior standing in nursing.

PCN 438 Practice Teaching in Maternal and Child Nursing (3) S Guided experience in selected teaching-learning situations in clinical nursing. Identification, analysis, and solution of teaching-learning problems in clinical nursing. A minimum of seven hours of guided experience weekly. Prerequisites: 530, 531, 532.

PCN 499 Undergraduate Research (1-5, max. 5) AWSpS Supervised individual research on a specific nursing problem. Prerequisites: junior-year standing in the School of Nursing, cumulative grade-point average of 3.00 or better, and permission of undergraduate advising office.

PCN 501 Pediatric Health Assessment and Promotion (5) A Gives experience in obtaining a health history and performing a physical assessment of infants, children, and adolescents. Interviewing techniques, problem-oriented medical record recording, and a systems approach to the physical examination. Emphasis on screening principles, health promotion, and wellness care for children/families. Prerequisite: permission of instructor.

PCN 502, 503 Primary Care: Common Pediatric Problems, Part I, II (5,4) Sp,A Process of assessment, integration of current research findings into clinical decision making, and management of common pediatric problems. Concepts of health promotion, maintenance, and anticipatory guidance are emphasized. Clinical experiences are provided with selected patient problems and illnesses. Prerequisite: 501.

PCN 504 Common Child Behavioral Problems, Part III (4) A Process of assessment and management of common pediatric behavioral and psychological problems. Concepts of prevention, self-care, anticipatory guidance, and family involvement are included in formulating management strategies. Relationship between medical and psychological aspects of pediatric illness in families emphasized. Prerequisite: permission of instructor.

PCN 505 Seminar: Counseling and Educational Approaches in Child Health Care (3) W Focuses on theory, practice, and issues involved in conducting health-related groups. Special emphasis on counseling process. Alternative approaches to educating communities about health-care issues. Clinical experiences designed to assist students in developing and conducting health-related groups in various settings in the community. Prerequisite: permission of instructor.

PCN 506 Primary Care: Common Adolescent Problems, Part IV (3) W Process of assessment, clinical decision making, and management of common adolescent problems. Covers both biomedical and psychosocial aspects of adolescent health care. Clinical experiences designed for students to work with adolescents in a variety of settings. Prerequisite: permission of instructor.

PCN 507 Seminar: Advanced Pediatric Primary Care (6) Sp Intensive, supervised field study within pediatric primary-care settings. Focus on assessment, diagnosis, and selection of strategies of care for children with acute or chronic problems. Emphasis on synthesizing advanced knowledge of clinical judgment and current research findings into clinical practice. Prerequisites: 501, 502, 503, 504, 506.

PCN 508 Family Adaptations During the Perinatal Period (2 or 4) A Theories, concepts, and issues related to family development during the perinatal period. Emphasis on analysis of family responses and adaptations in normal and at-risk situations, relevant research, early parent and infant interactions, and expansion of health education and counseling skills. Prerequisite: 509, 532 or permission of instructor.

PCN 509 Perinatal Nursing I: The Prenatal Period (2 or 4) A Theories and issues related to health care of childbearing families during the prenatal period. Examination of physiological and psychosocial processes and analysis of individual and family adaptations in normal and at-risk situations occurring during pregnancy with implications for health promotion, research, and advanced nursing practice. Prerequisite: permission of instructor.

PCN 510 Perinatal Nursing II: The Intrapartum and Postpartum Periods (2 or 4) W Theories and issues related to health care of families during the birth process and early puerperium; physiological changes, psychosocial processes, and individual and family adaptations in normal and at-risk situations. Implications for health promotion, research, and nursing practice. Prerequisite: 509 or permission of instructor.

PCN 511 Perinatal Nursing III: Health Care of Newborns and Young Infants (2 or 4) W Health care of infants during the neonatal period and early infancy, including exploration and analysis of biological and behavioral adaptations to extrauterine life, adaptations of infants and families to acute and chronic health problems during this period, and examination of environmental influences on the neonate. Prerequisite: 509 or permission of instructor.

PCN 512 Issues in Perinatal Nursing (3) Sp Exploration and analysis of political, economic, social, and ethical issues as they relate to the practice of perinatal nursing and delivery of health-care services to families during childbearing and early childrearing. Professional nursing roles and responsibilities in meeting identified needs and issues. Prerequisite: permission of instructor.

PCN 513 Advanced Clinical Seminar in Perinatal Nursing (6) Sp Integration of nursing theory and research in providing care to a caseload of families on a continuum from childbearing through stabilization of the new family unit. Opportunities for synthesis and application of knowledge, refinement of intervention strategies, clinical decision making, and collaborative health-care management. Prerequisites: 508, 509, 510, 511.

PCN 514 Coping Strategies of Well and Sick Children (3) A Gaining knowledge and skill in helping well and sick children cope in supportive and nonsupportive environments. Fit between coping strategies and environment, adaptation to environment, adjustment of environment to child's needs. Prerequisites: completion of first year of program, course in growth and development, or permission of instructor.

PCN 515 Nursing Management of Well Children and Their Environments (1 or 3) A Concepts and issues related to wellness, health maintenance, and prevention of illness. Various conceptual approaches. Focus on progress toward health goals in selected environments, utilizing a variety of intervention strategies. Prerequisites: core courses or permission of instructor.

PCN 516 Nursing Management of Ill Children and Their Environments (2 or 5) W Nursing management of children with acute, long-term, and fatal illnesses within family and community. Achieving optimal level of health. Behavioral and physiological concepts as basis for understanding impact of illness on children and their families. Prerequisites: core courses and 514 and 515 or permission of instructor.

PCN 517 Advanced Clinical Seminar in the Nursing of Children (5) Sp Synthesis and evaluation of scientific principles and research findings for care-collaboration with other health professionals. Development of specialist role. Social and environmental issues. Prerequisites: core courses, 515, 516 or permission of instructor.

PCN 520 Methods of Research in Nursing (3) W Research process as it applies to nursing. Use of the literature in building theoretical rationale. Selection of appropriate methods. Presentation of findings. Minimum of two laboratory hours weekly. Prerequisite: course in statistics.

PCN 521 Methods of Research in Nursing (2) Sp Continuation of 520, with emphasis on methods of research applied to the solution of problems in all fields of nursing.

PCN 530 Conceptual Frameworks for Parent-Child Nursing (3) A Designed to assist graduate students in exploration, criticism, and analysis of selected concepts, frameworks, and models relevant to parent-child nursing practice. Group seminar work focuses on the discussion of issues influencing the roles and practice of clinical nurse specialists in parent-child nursing. Skills necessary for developing a conceptual framework for practice.

PCN 531 Nursing Process in Parent-Child Nursing (4) W Includes lecture, seminar, and laboratory instruction designed to assist the student with knowledge and skill acquisition related to nursing care of individuals and families with regard to childbearing and child rearing. Prerequisite: 530.

PCN 532 Advanced Parent and Child Nursing: Provision of Health Services (3) Sp Focus on the aggregate of parents and children and their health-care needs. Selected strategies suitable for providing services to groups of parents/children emphasized. Role of the clinical nurse specialist in planning, implementing, and evaluating services. Prerequisites: 530, 531.

PCN 533 Family Growth and Development (2) Includes consideration of developmental, interactional, and family systems theory; theories of change; developmental tasks; and health belief systems. A paper based on one aspect of the major course objectives is expected.

PCN 534 Cultural Influences Upon Parenting (3) Sp Comparison of cross-cultural similarities and differences in: definitions of ideal parenting; socializations into a parent role; social support for, and controls upon, parenting. Analysis of additional effect of changes in ideology, technology, and demography upon cultural parenting roles. Offered jointly with ANTH 534. Prerequisite: permission of instructor.

PCN 535 Nursing of Children With Handicaps: Assessment and Diagnosis (3) A Students assess a wide range of handicapped children from infancy through adolescence. The goal is to gain skill in making nursing diagnoses related to a variety of handicapping conditions and family situations. Prerequisite: completion of parent-child nursing graduate core courses or permission of instructor.

PCN 536 Nursing Children With Handicaps: Behavior Analysis and Management Strategies (3) A Principles of behavior and their application to problems of child development. Analysis of behavior patterns of handicapped children in terms of environmental mechanisms of control. Data-based decision making. Ethical issues related to use of behavioral techniques. Prerequisites: 530, 531, 532, or permission of instructor.

PCN 537 Nursing of Children With Handicaps: Concepts and Process (2 or 4) W Systematic analysis of nursing process, selected behavioral concepts, and interpersonal process operating between professional nurses and families with handicapped children. Behavioral concepts analyzed include empathy, stigma, alienation, attachment/separation, dependence/independence. Synthesizes cognitive and affective learning to formulate a philosophy of care. Prerequisite: permission of instructor.

PCN 538 Nursing of Children With Handicaps: Family Adaptations (3) A Provides conceptual frameworks where students can develop skills for more effective nursing practice with families of handicapped children. Family interaction and adaptation. Parenting functions and interrelational support systems in families where there are handicapped or chronically ill children. Prerequisite: permission of instructor.

PCN 539 Nursing of Children With Handicaps: Community Programs and Social Issues (2-3) W Professional nursing responsibility for assessment, evaluation, improvement, and development of resources for the care of the handicapped child and the family. Factors in community that support or detract from adaptation of child and the family. Role of nursing in evaluating effective practice and providing program leadership. Prerequisite: permission of instructor.

PCN 540 Nursing of Children with Handicaps: Common Health Problems (2) W Nursing assessment and intervention relative to health and physiological problems common to the child with handicapping conditions. Factors (sensory deficits, deviations in muscle tone, specific medical diagnoses) that may seriously affect the handicapped child's socialization, adjustment to his environment, and achievement of independent self-help skills. Prerequisite: permission of instructor.

PCN 573 Selected Topics in Parent and Child Nursing (2-5, max. 12) In-depth examination of the literature pertinent to major theoretical issues in parent and child nursing. Seminar with analysis and discussion of selected topics and readings. Implications for research, prevention, and health care stressed. Prerequisite: permission of instructor.

PCN 600 Independent Study or Research (*) Offered on credit/no credit basis only.

PCN 700 Master's Thesis (*) Offered on credit/no credit basis only.

Physiological Nursing

PN 302 Clinical Decision Making and Therapeutics (5) W Clinical decision making and management of individuals experiencing common health concerns. Commonly occuring alterations producing broad pathological changes considered as basis for comprehensive nursing interventions. Theory underlying basic communication and patient-teaching activities. Prerequisites: CHCS 301, CONJ 340, NUTR 301, PCN 300, concurrently with 304, permission of instructor.

PN 304 Clinical Decision Making and Therapeutics, Laboratory (4) W Clinical therapeutic decision making in the nursing care of ill adults. Instruction and supervision of basic nursing procedures in a clinical setting. Infection control in the hospital. Prerequisites: CHCS 301, PCN 300, CONJ 340, NUTR 301, concurrently with 302, permission of instructor.

PN 321 Care of Ill Adults I (5) Sp Alterations in function of specific systems through pathophysiological concepts. Application of knowledge underlying critical thinking, sound judgment, and evaluation in the nursing process. Prerequisites: 302, 304, concurrently with 322, CONJ 340, 341, PHARM 315.

PN 322 Care of Ill Adults I, Laboratory (6) Sp Application of scientific principles to decision making in nursing of ill adults. Emphasizes increasing skill in systematic patient assessment, in developing competency with selected nursing therapies, in nursing care of adults with physiological alteration. Includes two weeks operating room. Prerequisites: 302, 304, CONJ 340, 341; PHARM 315; concurrent registration in 321.

PN 323 Care of Ill Adults II (3) A Alterations in function of specific systems through pathophysiological concepts. Application of knowledge underlying critical thinking, sound judgment, and evaluation in the nursing process. Prerequisites: 321, 322, concurrently with 324, CONJ 340, 341, 342.

PN 324 Nursing Care of Ill Adults II, Laboratory (4) A Alterations in function of specific systems based on pathophysiological concepts. Application of knowledge underlying critical thinking, evaluation in the nursing process. May include operating room experience. Prerequisites: 321, 322, concurrently with 323, CONJ 340, 341, 342.

PN 426 Senior Practicum in Advanced Medical-Surgical Nursing (7) WSp Further development, critical examination, and synthesis of nursing care of the hospitalized ill adult. Clinical practice, problem solving, organizing, setting priorities, and other elements of leadership. Selected theoretical concepts and research findings. Prerequisites: senior standing in nursing, permission of instructor.

PN 429 Nursing Functions in Gerontology (2) Aging as a normal developmental process; the problems of the aged; the community resources available; and the derivation of implications for nursing care of aged persons from gerontological concepts. Prerequisite: permission of instructor.

PN 466 Continuing Education in Nursing (3) ASp Planning, developing, and evaluating continuing education programs in various institutions and agencies. Includes the application of adult learning principles to a variety of situations, such as workshops, in-service and staff development programs. Prerequisite: graduate standing.

PN 499 Undergraduate Research (1-5, max. 5) AWSp Supervised individual research on a specific nursing problem. Prerequisites: junior-year standing in the School of Nursing, cumulative grade-point average of 3.00 or better, and permission of undergraduate advising office.

PN 509 Practice Teaching in Physiological Nursing (3) A Guided experience in selected teaching-learning situations in nursing, in both classroom and clinical situations. Identification, analysis, and solution of teaching-learning problems in clinical nursing. Minimum of seven hours of guided experience weekly. Prerequisite: 540.

PN 510 Curriculum Development in Nursing Education (3 or 5) WS Theoretical rationale for curriculum development, study of curricular problems in nursing in relation to the elements of the curriculum as described in a curricular design. The 5-credit plan includes the development of a curricular plan in a simulated faculty group.

PN 511 Evaluation of Clinical Performance in Nursing (3) S For graduate students preparing for faculty or staff development positions in nursing. Theory and principles of evaluation. Instruments to appraise clinical nursing performance developed as part of course requirements. Prerequisite: graduate standing or permission of instructor.

PN 520 Methods of Research in Nursing (3) A Research process as it applies to nursing. Use of the literature in building theoretical rationale. Selection of appropriate methods. Presentation of findings. Minimum of two laboratory hours weekly. Prerequisite: course in statistics.

PN 521 Methods of Research in Nursing (2) A Continuation of 520, with emphasis on methods of research applied to the solution of problems in all fields of nursing.

PN 523 Seminar in Therapeutic Nursing Process I (3) AS Analysis and synthesis of concepts relevant to therapeutic nursing based on consideration of the dignity of man and selected aspects of theories related to the interaction process in nurse-patient relationships. Library research, field study, and minimum of two laboratory hours weekly.

PN 525 Seminar in Therapeutic Nursing Process II (3) WS Analysis and synthesis of concepts relevant to therapeutic nursing based upon a consideration of responses to crises and factors in health and illness. Library research, field study, and minimum of two laboratory hours weekly.

PN 540 Core Concepts in Physiological Nursing (3) W Focus on selected physical health problems that occur in many disease states. Relates physiology to pathophysiology and compensatory mechanisms. Major emphasis on interrelationships between problems and multiple effects of therapies. Implications for nursing diagnosis and therapy. Assumes basic knowledge of anatomy and physiology.

PN 541 Clinical Physiological Nursing Seminar I (3) Sp Guided experience in nursing practice with selected individuals in a specialized field of nursing. Synthesis and application of relevant principles and theories from biological, behavioral, and pathological sciences; proficiency in comprehensive nursing assessments, interventions, and evaluations; effective collaborative functioning as a member of the health team. Prerequisite: 540.

PN 542 Seminar in Cardiovascular Nursing (3) W Systematic inquiry into the influence of physical and emotional factors on pathophysiology underlying selected cardiovascular conditions; group study of current therapies with emphasis on prevention and rehabilitation. Individual study of topic of interest. Prerequisite: 540 or permission of departmental adviser.

PN 543 Seminar in Nursing in Gerontology (3) W Gerontological research findings applied to complex nursing problems in maintenance of health and maximum functioning in the aged.

PN 544 Clinical Physiological Nursing Seminar II (3) S Continuation of 541. Guided experience in selected situations in area of clinical interest. Minimum of seven hours of guided experience weekly. Prerequisites: 540, 541, and permission of departmental adviser.

PN 545 Special Topics in Physiological Nursing (3, max. 9) AWSpS Guided survey of the experimental literature of major topics in physiological nursing, including cardiopulmonary, biology of aging, neuromuscular, cancer, and endocrine. Course conducted as a seminar with analysis and discussion of selected topics and readings. Implications for future research and health care are emphasized.

PN 546 Rehabilitation Nursing Seminar I (3) S Analysis of selected theoretical components underlying rehabilitation and utilization of scientific rationale in clinical nursing studies, with emphasis on prevention and maintenance. Library research and field study (minimum of seven hours weekly) are required. Prerequisite: permission of departmental adviser.

PN 547 Neurological Basis for Human Responses in Health and Illness (3) A Systematic inquiry into the neurological mechanisms underlying physiological and psychological responses to selected life situations. Implications for nursing management in maintaining health and coping with illness. Prerequisite: P BIO 401 or 402, or equivalent neurophysiology, or permission of departmental adviser.

PN 548 Management of Adults With Respiratory Dysfunction (3) S In-depth examination of problems such as abnormal secretions and shortness of breath associated with respiratory dysfunction due to pulmonary diseases and other pathophysiological states. Prerequisite: 540 or comparable preparation, or permission of departmental adviser.

PN 549 Seminar in Critical-Care Nursing (3, max. 9) W Systematic inquiry into pathophysiology, initial nursing management, and systems of care for the critically ill adult or child. Prerequisite: P BIO 401 or equivalent, or permission of instructor.

PN 565 Implications From Microbiology for Nursing (2) W Examination of selected major fields in microbiology. Exploration of particular aspects of those fields and of current research progress in microbiology. Prerequisite: permission of departmental adviser.

PN 570 Seminar in Clinical Research in Nursing (3) Sp Philosophy, problems of design; use of criterion measures in terms of patient care. Prerequisite: permission of departmental adviser.

PN 600 Independent Study or Research (*) Offered on credit/no credit basis only.

PN 700 Master's Thesis (*) Offered on credit/no credit basis only.

Psychosocial Nursing

PSN 303 Psychosocial Dimensions of Health and Illness (3) Surveys the psychobiosocial responses of persons to their environments. Stress response, crisis, and selected factors that affect dyadic and multiperson relationships. Psychosocial assessment and intervention practiced in seminars, using a variety of mechanisms. Prerequisite: junior standing or permission of instructor.

PSN 305 The Family in Health and Illness (2) A Basic theories (general systems, role) useful in family nursing care. Assessment and intervention issues with emphasis on family life-span development, social support, and adaptation. Nursing role and the family-health-care systems interface. Prerequisite: junior standing or permission of instructor.

PSN 407 Psychosocial Nursing Theory and Practice (8) AWSp Study and application of selected theories relevant to the practice of psychosocial nursing. Severely psychosocially disabled persons, both adults and children. Theoretically based psychosocial nursing interventions tested in acute and long-term treatment settings. Prerequisite: 303.

PSN 424 Senior Practicum in Psychosocial Nursing (7) AWSp Synthesis and application of psychosocial nursing theories in the care of psychosocially disabled persons. Analysis of factors supporting or impeding quality care within the mental-health-delivery system. Use of research findings and application of theories of leadership and psychosocial nursing. Prerequisite: senior standing in nursing or permission of instructor.

PSN 488 Effects of Alcohol and Its Relation to Health and Disease (3) ASpS Intensive inquiry into the effects of alcohol on the total person, emphasizing physiological effects, utilizing case studies, research reports, and audiovisual materials. Focus on methods used in the assessment of patients, in patient management, and in evaluation of therapeutic intervention. Open to students in other disciplines. Prerequisite: permission of Alcoholism Office.

PSN 489 Alcohol Problems in Family and Society (3) WS Analysis of family problems associated with alcoholism. Emphasis on psychological, cultural, and social implications; examination of various counseling practices employed and theories of prevention. Open to upper-division and graduate students. Prerequisite: permission of Alcoholism Office.

UCONJ 490 Social Sensitivity in Health Care (3) AWSp For course description, see Interschool or Intercollege Programs.

PSN 499 Undergraduate Research (1-5, max. 5) AWSpS Supervised individual research on a specific nursing problem. Prerequisites: junior-year standing in the School of Nursing, cumulative grade-point average of 3.00 or better, and permission of undergraduate advising office.

PSN 500 Theories in Interpersonal Systems in Psychosocial Nursing (3) W Empirical and theoretical literature on etiology and treatment of chronic mental illness in a sociocultural framework. Social networks and personality development, adaptation to stress, and chronic mental illness. Implications for research and implementation of nursing intervention strategies and mental health programs.

PSN 503 Seminar in Psychosocial Family Theory (4) W Examination of theories relevant to psychosocial family intervention into problems of children, adults, and the aged. Analysis of appropriateness of theories for nursing theory development, practice, and research.

PSN 504 Theories of Intervention and Process in Family and Child Treatment (3) Sp Critical review of the family assessment and intervention process. Analysis of existing treatment methods regarding adaptation to psychosocial nursing practice. Prerequisite: 503.

PSN 505 Selected Topics in Psychosocial Nursing (2-10, max. 10) AWSpS In-depth exploration of the major theoretical issues in psychosocial nursing. Seminar with analysis and discussion of selected topics and readings and implications for research and health care.

PSN 506 Theoretical Models of Family Analysis and Intervention (3) Sp Selected theoretical models of family analysis and intervention evaluated in relation to: models of intervention; nursing theories, psychosocial nursing practice. Assessment of family unit and family as context of individual dysfunction. Interventions in various crises and chronic dysfunction. Prerequisite: 550 or equivalent or permission of faculty.

PSN 513 Seminar in Group Treatment (2) Sp Seminar on the theoretical basis for working with various treatment groups. Analysis of selected approaches to group treatment. Analysis of leader responsibilities and functions in the development of therapeutic group experiences.

PSN 520 Methods of Research in Nursing (3) A Research process as it applies to nursing. Use of the literature in building theoretical rationale. Selection of appropriate methods. Presentation of findings. Minimum of two laboratory hours weekly. Prerequisite: course in statistics.

PSN 521 Methods of Research in Nursing (2) W Continuation of 520, with emphasis on methods of research applied to the solution of problems in all fields of nursing.

PSN 526 Program Planning and Program Evaluation in Health Service Delivery (3) S Analysis of selected theories and methods of program planning and program evaluation in the design, organization, and development of health services for defined populations in the community. Prerequisite: graduate standing or permission of instructor.

PSN 527 Practicum in Family Treatment (2-6) AWSp Supervised experience as a cotherapist within a family. Long-term therapy for primary and secondary intervention in family crises. Treatment of all family members, including extended family as appropriate. Offered on credit/no credit basis only. Prerequisites: 503, 504, which may be taken concurrently, or equivalent, and permission of departmental adviser.

PSN 528 Field Study in Evaluative Analysis for Health Care Programs (3, max. 6) WSp Field study in evaluation. Experiences include preevaluation studies; consultation with community members and agency personnel to operationalize health-care program objectives in terms of goals; construction of evaluation protocols; and assessment of program functioning. Offered on credit/no credit basis only. Prerequisite: 526.

PSN 529 Practicum in Group Treatment (2-6) SpS Supervised experience working as primary therapist or cotherapist in a group. Opportunity is provided to practice selected therapeutic techniques in therapy groups. Supervision is provided by nursing faculty member. Offered on credit/no credit basis only. Prerequisites: 502, 513, or equivalent, which may be taken concurrently, and permission of departmental adviser.

PSN 550 Interpersonal Aspects of Behavior (3) A Selected theories in relation to psychosocial development and adaptation across life span for individuals, families, and small groups and as explanatory models of major psychosocial disabilities. General and psychosocial nursing models evaluated for heuristic value for research and practice. Prerequisite: graduate standing in nursing or permission of instructor.

PSN 551 Biologic Aspects of Psychosocial Disabilities (3) A Analysis of biological processes influencing psychosocial behavior in response to internal and external stimuli. Research and theory of neuroendocrine mechanisms in psychosocial disabilities. Analysis of nursing management and evaluation of biopsychosocial modalities used in modification of behavior. Prerequisite: graduate standing in nursing or permission of instructor.

PSN 552 Socioecological Dimensions of Community Mental Health (3) W Socioecological and sociocultural theories of mental health disablements analyzed. Conceptual trends and intervention strategies evaluated with community and client-centered emphasis on mental health service delivery to high-risk and underserved populations, including the moderately and severely mentally disabled. Prerequisite: graduate standing in nursing or permission of instructor.

PSN 553 Assessment in Psychosocial Nursing (3) W Concepts, methods, and clinical approaches to psychosocial nursing assessment. Basic principles of measurement as they apply to psychosocial nursing assessment diagnosis and intervention. Knowledge synthesized from psychosocial nursing and allied disciplines tested. Clinical assessment laboratory included. Prerequisite: graduate standing in nursing or permission of instructor.

PSN 554 Clinical Therapeutics Theory (3) Sp Introduces conceptual foundation for clinical practice in psychosocial nursing with moderate to severe mentally disabled. Opportunities to synthesize selected theories and research contributions to generic psychosocial nursing interventions. Offered on credit/no credit basis only. Prerequisites: 550, 551, 553, or permission of instructor, concurrently with 555.

PSN 555 Advanced Clinical Therapeutics Seminar (4) Sp Opportunities to test and evaluate selected theories presented in 554. Faculty and preceptor supervision in clinical agencies guide students' therapeutic skills in working with individuals, groups, and families. Collaborative interactions with interdisciplinary team members. Prerequisite: concurrent registration in 554.

PSN 556 Theories of Substance Use Disorders: Psychosocial and Biological Aspects (3) W Psychosocial and pathophysiological aspects of substance use examined for their effects on individuals and families throughout life span. Theories and empirical findings serve as basis for evaluating preventive and therapeutic nursing approaches to substance use disorders, including those related to target populations. Prerequisite: basic course in biological sciences.

PSN 557 Clinical Seminar in Substance Use Disorders I (4) Treatment of individuals and families with substance use-related disorders. Students function as primary or cotherapists in application and evaluation of selected therapeutic interventions. Weekly seminars analyze student/client interactions. Offered on credit/no credit basis only. Prerequisite: prior or concurrent registration in 556.

PSN 558 Advanced Clinical Seminar in Substance Use Disorders II (4) A Practicum with opportunities for advancement of skills in therapeutic interventions and involvement in community-linked substance-use-disorder issues. Students engage in therapeutic interventions, coordinate community health-care resources, and design a prevention program for target populations within context of regional laws and policies. Prerequisites: 556, 557.

PSN 559 Theories of Psychiatric Disabilities (3) W Theories from psychosocial nursing, psychiatry, and behavioral sciences explanatory of psychiatric disabilities provide basis for identifying psychosocial problems and developing nursing diagnosis and interventions. Structure and functions of mental health organizations and social networks analyzed for more effective system management by nurses. Prerequisites: 500 and 551 or permission of instructor.

PSN 560 Clinical Seminar in Psychiatric Disabilities I: Community (4) S Supervised psychosocial nursing experience with clients in psychiatric treatment programs. Treatment settings, such as community mental health centers, partial hospitalization, and congregate care facilities viewed as social systems. Weekly seminars provide analysis of client/student interaction. Prerequisite: prior or concurrent registration in 559, or permission of instructor.

PSN 561 Advanced Clinical Seminar in Psychiatric Disabilities II: Institutions (4) A Mental hospital and psychiatric unit viewed as social systems. Clinical practice in institutional setting focuses on planning and evaluating psychosocial nursing care programs. Effects of organizational dynamics on client populations analyzed and intervention theories tested. Analyzes client/student interaction. Prerequisite: prior or concurrent registration in 559, or permission of instructor.

PSN 562 Theoretical Basis of Management of Stress Response (3) W Theories of physiologic responses linked to theories of cognitive/affective and behavioral responses to stressors. Conceptual basis of self-management techniques. Research findings relevant to these theories and techniques examined and analyzed. Prerequisites: course in human physiology or physiologic psychology, permission of instructor.

PSN 563 Clinical Seminar in Management of Stress Response I (4) S Theory and application of self-management training for dysfunctional stress responses. Demonstration/training in relaxation, biofeedback instrumentation, and supervision of self-management program conducted by students. Prerequisites: 562, PN 547 or equivalent human physiology course.

PSN 564 Advanced Clinical Seminar in Management of Stress Response II (4) A Supervised field experience in self-management techniques for clients with dysfunctional stress responses such as headache and hypertension. Supervised clinical application of biofeedback and stress counseling for selected psychophysiologic disorders. Prerequisite: 562, 563, or permission of instructor.

PSN 565 Self-Management Strategies and Techniques in Patient Care (3) ASp Theories underlying cognitive/behavioral self-management strategies and techniques in patient care. Evaluation of the clinical appropriateness and utility for nursing. Application to such clinical problems as abstinence in the recovering alcoholic, depression, and eating disorders. Prerequisite: graduate standing or permission of faculty.

PSN 569 Consultation in Human Service Systems (3) S Exploration of theoretical perspectives and concepts relevant to consultation in human service systems. Models for intervention evaluated. Students design consultation projects, implementation determined through negotiation with faculty and agency representatives. Prerequisites: fourth-quarter placement or faculty permission; access to consultee system.

PSN 600 Independent Study or Research (*) Offered on credit/no credit basis only.

PSN 700 Master's Thesis (*) Offered on credit/no credit basis only.

Nursing Science

NURS 580 Theory Building in Nursing I (3) Sp Exploration and analysis of nursing theory, types, techniques of construction, problems in evaluation and testing, and implications for nursing science. Prerequisite: permission of instructor.

NURS 581 Theory Building in Nursing II (3) S Continuation of 580 with emphasis on evaluation of existing nursing theories, student construction and presentation of a theory for nursing, and critiques of the students' theories. Prerequisite: 580.

NURS 582 Environments, Supporting and Nonsupporting (3) A Analysis and study of environments as complex multidimensional systems that support or do not support human health. Emphasis on the influence of different conceptualizations of human-environmental interactions. Prerequisites: graduate standing, a minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 584 Clinical Therapeutics: Physical (3) S Analysis and study of current theories and knowledge regarding physical therapeutic measures and nursing interventions that promote, maintain, or restore health status for humans throughout the life span. Prerequisites: graduate standing and a minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 585 Individual Adaptations to Wellness and Illness (3) W Survey and analysis of current theory and research in health and illness awareness, in health-seeking and -maintaining behaviors, and in coping responses to illness and disability. Prerequisites: graduate standing and a minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 586 Family Adaptations to Wellness and Illness (3) W Current theory and research in family functioning in health and illness. Family developmental tasks, separation, divorce, major and minor disablements, social cultural processes, and other events that strengthen or weaken the family. Prerequisites: graduate standing and a minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 587 Clinical Therapeutics: Interpersonal (3) Sp Analysis of care/cure orientations in patient care and their impacts on nursing intervention programs. Dynamics of change, interpersonal aspects of planned change, and measurement of clinical outcomes. Prerequisites: minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 588-589 Advanced Problems in Nursing Research (3-3) W,Sp Examination of alternative methodological decisions for their direct and indirect consequences at different points in nursing research process. Prerequisites: inferential statistics; minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 590 Special Topics in Nursing Research (2-3, max. 9) AWSpS Examination of a specific research method, with evaluation of appropriateness, efficiency, rigor of measurement, and potential for inference for nursing research. Prerequisites: minimum of 5 credits of basic nursing research methodology at graduate level and permission of instructor.

NURS 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only. Prerequisite: permission of Supervisory Committee chairperson or graduate program adviser.

College of Ocean and Fishery Sciences

Dean

Norbert Untersteiner
3731 University Way Northeast

Associate Dean

Marsha L. Landolt
217 Fisheries Center

The marine environment has been a dominant factor in the history of the Pacific Northwest from the time of the first Indian settlements to the modern day of container ships and waterfront condominiums. It is, therefore, not surprising that the University of Washington has a long tradition of commitment to teaching, research, and public service in the marine and freshwater area.

The College of Ocean and Fishery Sciences, newest college at the University, comprises five major units in the marine and freshwater sciences. Established in September, 1981, the college consists of the Applied Physics Laboratory, Institute for Marine Studies, and schools of Fisheries and Oceanography and administers the Washington Sea Grant Program.

The college offers both undergraduate and graduate instructional programs; its faculty, staff, and students carry out research in oceans and freshwater lakes and rivers all over the world. Facilities range from oceangoing vessels to well-equipped laboratories and classrooms.

Each of the units in the college focuses on a different aspect of the aquatic environment, but much overlap exists. Established in 1919, the School of Fisheries is concerned with searching for ways to use stocks of fish and shellfish more effectively, making better use of all waters to produce more food from living organisms, and culturing aquatic plants and animals more effectively. It is also concerned with impacts of pollution, industry, and human population pressures on the environment. It offers both undergraduate and graduate degrees.

Established in 1930, the School of Oceanography carries out basic research and teaching on the physical, chemical, and biological processes in the ocean and on the interactions of the ocean with the earth, the biosphere, and the atmosphere. It is concerned with study of seawater in motion, life in the sea, the chemical composition and properties of seawater, the sediments and rocks beneath the sea, and the geophysics of the seafloor. It offers both undergraduate and graduate degrees.

The Applied Physics Laboratory, established in 1943, is a research and development unit with strong capabilities in ocean sciences, engineering, acoustic sensors and sound propagation, marine and geophysical instrumentation, and polar science and technology. No degrees are offered, but special short courses and seminars are taught and student employment is available.

Established in 1972, the Institute for Marine Studies is interested in policy and institutional problems of the ocean. It combines natural sciences and engineering with law, economics, international affairs, and public administration. The Institute's teaching and research programs include marine affairs, coastal zone management, atmospheric and marine policy, living marine resources, and international law of the sea. The Master of Marine Affairs degree is offered.

Also part of the new college is the Washington Sea Grant Program, established in 1969. Congress established the Sea Grant program to enhance the wise use and protection of the nation's marine resources through coordinated efforts in education, training, research, development, and advisory services. The Sea Grant program does not offer degrees, but presents workshops, short courses, lectures, and publications, and supports research and advisory services.

One of the major achievements in this area was the designation of the University in 1971 as a Sea Grant College by the U.S. Secretary of Commerce. Along with the University of Rhode Island, Texas A&M University, and Oregon State University, the University of Washington was one of the first four universities so designated in recognition of outstanding sustained programs in research, education, and advisory services in the marine area.

In 1980, the college had a total of 303 undergraduate and 374 graduate students enrolled, a faculty of 93, and a total budget of $24 million, making it one of the largest institutions of its kind in the nation.

Fisheries

In its research and training, the School of Fisheries in the College of Ocean and Fishery Sciences is concerned with the investigation of the most effective uses of fish and shellfish, both in products for consumption, especially as food, and for other purposes, such as recreation.

The school is also concerned with the impact of pollution, of industry, and of human population pressure on the aquatic environment as these affect fisheries and other uses of our waters. In general, the program of the school provides opportunity for training, not only in fisheries but also in the management of natural resources and in the understanding and use of the aquatic environment.

Fishing and fish products are an important part of the total food industry. The school's Institute of Food Science and Technology offers undergraduate and graduate curricula to train food scientists for industry, government, and academia. The undergraduate program provides a broad coverage of all phases of food technology, while offering some additional specialization in fisheries technology.

The School of Fisheries has four major divisions:

Aquaculture and Invertebrate Fisheries

Chairperson

Kenneth K. Chew
211 Fisheries Center

This unit provides training in finfish and shellfish culture, disease and pathology, nutrition, and biochemistry and physiology of fish and shellfish, as well as training in basic biology and resource management of commercially important invertebrate species.

Quantitative Science in Fisheries

Chairperson

Vincent F. Gallucci
301 Center for Quantitative Science

The Center for Quantitative Science in Forestry, Fisheries, and Wildlife offers a comprehensive program of study in mathematical and statistical methods applied to problems in natural resource management. The faculty at the center comprises members of the College of Forest Resources and the School of Fisheries faculties. Most are also members of the Biomathematics Group and are active in the Quantitative Ecology and Resource Management Option. Students may enroll in the School of Fisheries, the College of Forest Resources, or in the Biomathematics Group. The core of any of these programs is the development of capability in a quantitative area and the application of it in a thesis or dissertation in quantitative ecology or resource management.

Food Science and Technology

Chairperson

John Liston
209 Marine Studies

The program provides general courses and those courses necessary for the food science major and the fish industry option, including courses in food technology, food microbiology, food chemistry, food engineering, and fish technology.

Fisheries Science and Aquatic Ecology

Chairperson

Bruce S. Miller
464 Fisheries Center

The Division of Fisheries Science and Aquatic Ecology is concerned with teaching both undergraduate- and graduate-level courses in fisheries resource management, aquatic ecology, and ichthyology. Emphasis is on the biological and ecological processes that must be understood for successful management of living aquatic resources.

Fisheries Research Institute

Director

Robert L. Burgner
260 Fisheries Center

The Fisheries Research Institute is the primary research unit of the School of Fisheries, conducting and coordinating the major portion of research by faculty and staff members and graduate students on fisheries management, biology and ecology, resource assessment and enhancement, productivity and food chain dynamics, and the effects of man's impact on the aquatic environment and its resources.

The Washington Cooperative Fishery Unit, supported by the U.S. Department of Interior and Washington State departments of Fisheries and Game, is a part of the Fisheries Science and Aquatic Ecology Division.

Related Programs

Programs in the School of Fisheries benefit from the presence in Seattle of a regional office and laboratories of the National Marine Fisheries Service and the laboratories of the U.S. Fish and Wildlife Service. In addition, the headquarters and research staff of the International Pacific Halibut Commission are located on the campus. The Washington State Department of Fisheries maintains offices in the Fisheries Center, and close contacts exist between the school and the research staff of both the Department of Fisheries and the Department of Game in Olympia.

School Facilities and Services

The Fisheries Center on the Lake Washington Ship Canal contains classrooms, laboratories and general facilities, as well as several research organizations. The Fisheries-Oceanography Library, a branch library offering research materials in fisheries, food science, oceanography, and wildlife science, is located in the Oceanography Teaching Building nearby. The collections of fishes and invertebrates now total some 200,000 specimens, representing more than 3,225 species in 237 families.

An annual run of several thousand salmon has been developed and is maintained at the school by the release of thousands of fingerlings each spring. Returning adults utilize a fish ladder to enter the school's experimental fish hatchery. The run is the basis for both instruction and research on the life cycle of Pacific salmon. The school also maintains a saltwater aquarium.

Other laboratories provide for the study of the physiology, biochemistry, and behavior of fish and of the effects of pollutants on fish. Physiological facilities include equipment for surgical procedures and biochemical analysis of body fluids from both freshwater and marine fish.

The School of Fisheries and the Fisheries Research Institute maintain an extensive library of computer programs for processing biological data. The Fisheries Analysis Center of the school provides service in programming, data entry, and assistance with the use of the computer; the school maintains a CDC 200 user terminal to provide ready access to the larger computers in the University Computer Center.

A hundred-foot research trawler, the *Alaska*, is used for instruction and research in Lake Washington, Puget Sound, and the North Pacific Ocean. The school also uses smaller vessels for instructional and research work, including tow netting, purse seining, hydrowire, bottom grabs, and various sizes of otter trawls to depths of a hundred fathoms. These vessels are used in regular courses or training cruises to introduce students to shipboard operations.

Fisheries field stations at Big Beef Creek on Hood Canal provide additional opportunities for class field studies and research in stream and estuarine ecology. Other field activities are carried on at stations in both Washington and Alaska.

Food science facilities include separate well-equipped laboratories for food microbiology, food biochemistry, and food analysis. The food-processing and -engineering laboratory pilot plant complex comprises several separate facilities containing equipment for teaching and experimental work in applied areas of unit operations and processing.

Fisheries Club

The students of the College of Fisheries formed the Fisheries Club in 1922. Since its beginning, the club has been the center of extracurricular social and educational activities. Monthly meetings feature varied programs, which include speakers from the industry and motion pictures that deal with fisheries all over the world.

Food Science Club

Organized and run by food science majors in the school, this club promotes interest in food science and technology by organizing seminars, meetings, and other activities. Topics of current public interest in foods, including nutrition, toxicology, and technology, have been the subject of panel discussions and presentations by invited speakers. The club raises money to defray costs of attendance by students at professional food science meetings, and it works closely with the Puget Sound section of the Institute of Food Technologists.

Financial Aid

The school offers limited financial assistance to undergraduates and graduates through industrial and private scholarships. The *Handbook of Scholarships*, available from the Office of Financial Aid, 170 Schmitz, lists available scholarships.

Employment

The School of Fisheries maintains a file of permanent and summer job opportunities for its students. Both summer and part-time employment during the scholastic year are frequently available with the research organizations that are associated with the School of Fisheries on or near the campus and elsewhere in the Pacific Northwest. The Fisheries Research Institute normally hires students for summer work in the field and usually has several part-time positions available during the school year. Similar work is available in the Washington State Department of Game, Washington State Department of Fisheries, National Marine Fisheries Service, the International Pacific Halibut Commission, Laboratory of Radiation Ecology, Oregon Fish Commission, the International Pacific Salmon Fisheries Commission, and the Alaska Department of Fisheries. These jobs may be located within the state of Washington, but frequently they take students to Alaska or elsewhere in the United States. The school carries out a program for the federal government of selecting observers to be placed on foreign ships fishing in the U.S. fishery conservation zone. This program provides unique opportunities to obtain practical experience with large-scale fishing opportunities. Fisheries students are encouraged to seek such positions or other work in the field to gain valuable experience in both fishery biology and fisheries or food technology.

Undergraduate Program

The School of Fisheries offers three degree programs: Bachelor of Science in Fisheries, Bachelor of Science with a major in fisheries, and Bachelor of Science with a major in food science.

High School Preparation

Although the School of Fisheries does not have specific high school requirements, other than those of the University, students are urged to take intermediate algebra and trigonometry, because these are prerequisites for the first courses in mathematics included in all School of Fisheries curricula. Students who plan to enter this school should, if possible, complete these courses in addition to elementary algebra and plane geometry, which normally are the two units of college preparatory mathematics. Chemistry, physics, and biology are useful high school preparation.

Admission as a Premajor

A student entering the University directly from high school and indicating an intent to major in fisheries is automatically placed in premajor status. A student transferring from another college in the University or from another institution will, if he or she has not completed the equivalent of the courses in the premajor program listed below with a 2.30 grade-point average and at least 75 credits in total, also be accepted as a fisheries premajor. Currently, a fifth-year student must meet the requirements for major status to be admitted for a second baccalaureate degree. In general, a student on probationary status is not accepted as a transfer. A student indicating a desire to major in food science who is entering the University directly from high school or transferring from another college or institution will be placed in major status.

Premajor Program

Prior to becoming a fisheries major, a student must complete the quarter credits in these subjects: general biology, 15; general chemistry, 10; organic chemistry, 5; English (intermediate expository or technical writing), 5; mathematics (algebra, calculus), 13; statistical methods, 5; speech (public speaking), 5; general physics (strongly recommended)—total: 58.

FISH 101 and courses in humanities, social sciences, physics, or use of computers are recommended for additional credits while in premajor status. A total of 10 credits in foreign language must be earned, unless two high school units already have been taken. Students at the University of Washington may refer to subsequent pages in this bulletin for the number of specific courses required or recommended for the fishery science or food science curricula. Students at community colleges in Washington should consult the most recent University of Washington *Transfer Guide for Community Colleges in Washington*. Students at other institutions should take equivalent courses.

Students in the School of Fisheries must finish the premajor program or obtain permission from the instructor before entering a 400-level course in fisheries or food science other than FISH 401.

Admission as a Fisheries Major

After completing 75 quarter credits, including requirements of the premajor program, a student should apply for admission to the School of Fisheries with major status. Application forms may be obtained from the school office. When the number of applicants is greater than can be accommodated, satisfaction of minimum admissions standards will not ensure acceptance. Criteria of acceptance includes grade-point average, appropriateness of complete course work, academic objectives, motivation, references, or personal interviews with advisers. Applicants for major status must have earned a minimum overall grade-point average of 2.30 in the courses required for the premajor program. Minority and women students are urged to consider potential futures in this field. Literature on career opportunities is available in the school office. The school cooperates with the Educational Opportunity Program in giving special aid to students who have not received the usual educational advantages.

Cooperative Education Program

George W. Brown, Jr., Coordinator

The school cooperates with governmental agencies and private firms in an on-the-job cooperative education program.

Advising

After notification of admission and before registration, new students should visit or write to the School of Fisheries for help in planning their course programs. Academic and other counseling of fisheries students is given by faculty advisers in the School of Fisheries.

Graduation Requirements

Students who do not include two units of foreign language in their college preparatory programs are required to achieve equivalent competence in a foreign language as a graduation requirement. This requirement may be fulfilled by successful completion in the University of 10 credits of a foreign language or by passing an appropriate placement examination.

At least 36 of the 180 academic credits required for graduation must be taken in fisheries or food science. At least 60 of the 180 credits must be in upper-division courses (numbered 300 and above). Advanced ROTC courses do not count toward upper-division credit, and no more than 18 credits in advanced ROTC courses may be counted toward graduation. For graduation, students must have a cumulative average of 2.00 (*C*) in fisheries and food science courses and an overall average of 2.00 in all courses. Additional graduation requirements associated with specific degrees are given below.

A total of 25 credits may be taken S/NS, but only 5 of them may be for core curriculum courses. Any C/NC courses presented at the time of transfer into the School of Fisheries will reduce the number of S/NS credits that may be taken. A combined total of not more than 25 C/NC or S/NS credits will be accepted for a baccalaureate degree program.

Students who transfer from other institutions to the School of Fisheries are normally required to earn at least 10 credits in their major subjects in this school.

Fishery Science

Advisers

George W. Brown, Jr., Loveday L. Conquest, William K. Hershberger, John Liston, Theodore W. Pietsch

204 Fisheries Center

Core Curriculum

A baccalaureate degree requires completion of a common core curriculum and no fewer than 36 credits in fisheries. The normal program will include the subjects listed below or their equivalents.

Basic Science: (30 credits minimum) Biology, general—BIOL 210, 211, 212 (BIOL 101, 102, and BOT 113 or 320 may also be accepted, although some courses in fisheries require BIOL 210, 211, 212). Chemistry, general—CHEM 140, 150, 151. Chemistry, organic—CHEM 102, *or* 231, 232.

Mathematics and Statistics: (13 credits minimum beyond MATH 105) Mathematics—Q SCI 291, 292; *or* MATH 124, 125, Q SCI 381.

Environmental Sciences: (11 credits minimum for the *normal* program) BIOL 472 (Ecology) and 473 (Limnology); BIOL 474, 475 (Laboratories for Ecology, Limnology) *or* OCEAN 203. The Fish Industry curriculum requires only BIOL 472 and OCEAN 203, *or* OCEAN 101.

Fishery Science: (14 credits) FISH 101, 311, 401.

Social Sciences: (11 credits minimum) The following courses are recommended: ECON 211, 435; POL S 471 *or* A ORG 440. Also see distribution list for other recommended courses.

Functional Techniques: (20 credits minimum) ENGR 130 (3) and ENGR 331 (3) *or* STC 408 (3) and 409 (3) *or* ENGL 271 (5); FISH 314, 340, 395; SPCH 220.

Bachelor of Science in Fisheries Degree

In addition to the core curriculum, students select any two sets of prescribed courses from the following eight sets:

1. *Fish Culture:* FISH 352, 444, 450, 451, 452, 453, 454, 460, 462, 467, 499D (3, 3, 3, 3, 3, 4, 3, 4, 3, 5, 1); Q SCI 482, 483 (5, 5).

2. *Invertebrate Culture:* FISH 405, 406, 408, 454, 459 (5, 5, 3, 3, 5); Q SCI 482, 483 (5, 5); ZOOL 330 (5). Recommended: FISH 407 (3).

3. *Recreational Fisheries:* FISH 367, 467 (4, 5); ECON 435 (5); FOR M 452 (3); Q SCI 482, 483 (5, 5); SOC 110 (5), 330 (5). Choose at least 5 credits from: FISH 425, 460, 499 (5, 4, 1-5); ECON 312 (5); Q SCI 480 (3); URB P 412 (3).

4. *Aquatic Resource Management:* FISH 379 (3), 425 (5), 463 (5); FISH 450 (3) *or* 405 (5) *or* 406 (5); Q SCI 456 (4), 457 (4), 482 (5), 483 (5).

5. *Water Quality:* CHEM 321 (5); CEWA 456 (3), 457 (3); BIOC 405, 406 (3, 3); FISH 415 (3), 477 (3). Choose additional courses (9 credits) from among the following to total at least 31 credits in this option (exclusive of courses in other options). Additional courses from which selections may be made are: BOT 446 (5); CHEM 160 (4), 350 (3); CEWA 442 (3), 485 (3); FISH 430 (3), 431 (2), 456 (5), 459 (5), 460 (4), 472 (3), 473 (3), 434 (3 or 5), 435 (3); OCEAN 451 (3). (For this set, choose CHEM 231, 232 from the core curriculum.)

6. *Fish Industry:* FISH 379 (3), 467 (5); FISH 450 (3) and 451 (3) *or* 425 *or* 405 (5) *or* 406 (5); FD SC 378 (3), 380 (3), 385 (3), 481 (4), 491 (1); ACCT 210 (3), 220 (3), 230 (3); ECON 200 (5) and 201 (5); MKTG 300 (4), BG&S 200 (5). In addition, the following courses are recommended for graduate school consideration: CHEM 231 (3) and 232 (3) instead of CHEM 102. BIOL 210 and 211 instead of BIOL 101 and 102, with addition of BIOL 212 (5). Q SCI 482 (5) and 483 (5). PHYS 114 (4), 115 (4), 116 (4); BIOL 473 (3).

7. *Environmental Studies:* Two of FISH 430 (3), 434 (3 or 5), 435 (3); two of FISH 405 (5), 406 (5), 415 (3), 425 (5), 463 (5), 467 (5), Q SCI 482 (5), 483 (5). Choose additional courses from those listed above within this option or those below to total at least 31 credits exclusive of courses taken to satisfy other options. Additional courses from which selections may be made are: FISH 431, 456, 459, 472, 473, 475 (2, 5, 5, 3, 3, 3); FD SC 381 (3); FOR B 350 (3); ENV S 352 (5), 361 (5), 441 (3), 453 (3-5), 481 (5), 482 (3-5); CEWA 450 (5); GEOG 444 (3).

8. *Biometrics-Quantitative Fishery Biology:* Q SCI 391, 392, 393 (3, 3, 3) (MATH 238, 239 [3, 3] may be substituted for Q SCI 392, 393); Q SCI 482, 483 (5, 5), and 480 (3) *or* 486 (3), 456 (4); FISH 457 (4), 458 (4).

Bachelor of Science Degree With a Major in Fisheries

A student who wishes to enlarge the opportunity for choice of electives may pursue this option. In addition to the core curriculum, he or she will select any single set of prescribed courses from the above eight sets. Electives, sufficient to bring total credits to 180 and credits in fisheries to 36, are subject to approval by the school.

Food Science

Adviser

John Liston
213 Fisheries Center

Bachelor of Science Degree With a Major in Food Science

The Food Science program provides a curriculum leading to a Bachelor of Science degree with a major in food science. It is recommended that the entering student will have completed mathematics, including advanced algebra and trigonometry, and laboratory science, including chemistry and physics.

A student majoring in food science must complete the quarter credits in the basic subjects shown below:

General biology (zoology, botany, etc.) (10 credits); CHEM 140 (4), 150 (4), 151 (2), 160 (4), 231 (3), 232 (3), (*or* 235, 236), 241 (3), 242 (3), 321 (5); MATH 124 (5), 125 (5) (*or* Q SCI 291, 292); PHYS 114 (4), 115 (4), 116 (4); Q SCI 381 (5); ENGR 130 (3) and ENGR 331 (3) *or* STC 408 (3) or STC 409 (3) *or* ENGL 271 (5); FISH 395 (3); BIOC 405 (3), 406 (3), 426 (3); MICRO 301 (3), 302 (2); ENVH 440 (4) *or* 441 (3); FD SC 350 (3), 380 (3); 385 (3), 481 (4), 482 (3), 483 (3), 484 (4), 485 (3), 486 (3), 498 (2-5), 395 (1), 491 (1), 492 (2), 493 (2), 494 (3), 495 (2), 496 (2).

Students who intend to proceed to graduate study should consult with an adviser about the substitution of more advanced level courses in certain areas for those listed in the outline. All courses listed on an approved alternative or equivalent must be taken.

A suggested sequence of courses for the four-year curriculum in food science is as follows:

First year: First quarter: CHEM 140 (4); MATH 124 (Q SCI 291 and 292 may be substituted) (5); electives (6). Second quarter: CHEM 150, 151 (4, 2); MATH 125 (Q SCI 291 and 292 may be substituted) (5); electives (4). Third quarter: CHEM 160 (4); electives (11).

Second year: First quarter: CHEM 231, 241 (3, 3); PHYS 114 (4); electives (5). Second quarter: CHEM 232, 242 (3, 3); PHYS 115 (4); ENGR 130 and 331 (school requirement; strongly recommended; STC 408 and 409 or ENGL 271 may be substituted) (3 or 5); elective (1). Third quarter: CHEM 321 (5); Q SCI 381 (5); PHYS 116 (4); elective (1).

Third year: First quarter: MICRO 301, 302 (3, 2); ENVH 440 (ENVH 441 may be substituted) (4); FD SC 350 (3); electives (3). Second quarter: FD SC 380, 385, 395 (3, 3, 1); BIOC 405 (3), 426 (3); electives (2). Third quarter: BIOC 406 (3); FD SC 481, 491 (4, 1); electives (7).

Fourth year: First quarter: FD SC 482, 484, 492, 494, 498 (3, 4, 2, 3, 2); FISH 395 (school requirement) (3). Second quarter: FD SC 483, 493, 485, 495, 498 (3, 2, 3, 2, 2); electives (3). Third quarter: FD SC 486, 496, 498 (3, 2, 2); electives (3).

Electives should include 10 credits of biology. Students who intend to proceed to graduate study should consult with an adviser about the substitution of more advanced level courses in certain areas for those listed in the outline. All courses listed or an approved alternative or equivalent must be taken.

Graduate Program

The school offers programs leading to the Master of Science and Doctor of Philosophy degrees in fisheries and food science.

The time required is normally two years for an M.S. degree and two to three additional years for a Ph.D. degree. Completion of a master's degree is considered the first step in a doctoral degree program.

Areas of study within fishery science include fish physiology, fish taxonomy, population dynamics, management of freshwater and marine fisheries, ecology and life history of fishes, invertebrate fisheries, diseases of fish and shellfish, aquaculture, fish genetics, radiation ecology, marine acoustics, biological impact studies, and water-quality studies. In food science, students may specialize in the chemistry, microbiology, or biochemistry of foods and in advanced study of food processing methods.

An active research program within the school provides support for many graduate students and enhances the opportunities for accomplishing significant thesis and dissertation research. The school has four major divisions: Aquaculture and Invertebrate Fisheries, Quantitative Science in Fisheries, Food Science and Technology, and Fisheries Science and Aquatic Ecology, which are in addition to the Fisheries Research Institute. The Washington Cooperative Fishery Unit, supported by the U.S. Department of Interior, Washington State Department of Fisheries, and Washington State Department of Game, is a part of the Fisheries Science and Aquatic Ecology Division.

Admission Requirements

Basic requirements for admission to the graduate program are a baccalaureate degree from an institution of recognized standing, a grade-point average of 3.00 in the junior and senior years of college work, and approval of the School of Fisheries and of the Graduate School. Applicants must also take the Graduate Record Examination (general only) and submit the score with the application to the Graduate School. Preference will be given those with a strong background in the basic sciences. A student admitted with a baccalaureate degree is accepted initially for a Master of Science degree program.

Financial Aid

In addition to the *Handbook of Scholarships*, available from the Office of Financial Aid, 170 Schmitz, information concerning graduate student support is available in the office of the Director. Numerous scholarships, fellowships, and teaching and research assistantships are available for qualified graduate students. Students who require financial support should apply to the office of the Director.

Correspondence and Information

Graduate Program Coordinator
School of Fisheries, WH-10

Faculty

Director

Donald E. Bevan

Professors

Alverson, Dayton L.,* (Marine Studies),† Ph.D., 1967, Washington; fishery oceanography and stochastic models.

Bell, Milo C. (Emeritus), B.S.M.E., 1930, Washington; fisheries.

Bevan, Donald E.,* (Marine Studies), Ph.D., 1958, Washington; resource management, computer simulation.

Brown, George W., Jr.,* Ph.D., 1955, California (Berkeley); biochemical ecology, pollution.

Burgner, Robert L.,* Ph.D., 1958, Washington; ecology and population dynamics of salmonids, limnology.

Chapman, Douglas G. (Emeritus), Ph.D., 1949, California (Berkeley); biometrics, population dynamics.

Chew, Kenneth K.,* Ph.D., 1962, Washington; shellfish biology.

DeLacy, Allan C. (Emeritus), Ph.D., 1941, Washington; fisheries.

Donaldson, Lauren R. (Emeritus), Ph.D., 1939, Washington; fisheries.

Erickson, Albert W.* (Research), Ph.D., 1964, Michigan State; wildlife biology and marine mammals.

Fletcher, Richard I.,* Ph.D., 1973, Rhode Island; population dynamics.

Gallucci, Vincent F.,* (Forest Resources), Ph.D., 1971, North Carolina State; biomathematics and population dynamics.

Halver, John E.,* Ph.D., 1953, Washington; fish nutrition and comparative nutrition.

Liston, John,* Ph.D., 1955, Aberdeen (Scotland); food science, marine microbiology, fisheries technology.

Matches, Jack R.,* Ph.D., 1963, Iowa State; food science, food and environmental microbiology, fisheries technology.

Mathews, Stephen B.,* Ph.D., 1967, Washington; quantitative fishery management.

Mathisen, Ole A.,* Ph.D., 1955, Washington; dynamic management systems of salmon populations and their ecology, hydroacoustic stock estimation, krill in the southern seas.

Nakatani, Roy E.,* Ph.D., 1960, Washington; water pollution biology, radiation ecology, environmental impact of nuclear power plant.

Pigott, George M.,* Ph.D., 1963, Washington; food engineering.

Rogers, Donald E.* (Research), Ph.D., 1967, Washington; sockeye salmon research.

Royce, William F., Ph.D., 1943, Cornell; applications of fisheries science.

Salo, Ernest O.,* Ph.D., 1955, Washington; estuarine ecology and fish culture.

Seymour, Allyn H. (Emeritus), Ph.D., 1956, Washington; fisheries.

Smith, Lynwood S.,* Ph.D., 1962, Washington; fish physiology.

Stober, Quentin J.* (Research), Ph.D., 1968, Montana State; water pollution ecology, environmental assessment and fisheries management.

Taub, Frieda B.,* Ph.D., 1959, Rutgers; ecology.

Thorne, Richard E.* (Research), Ph.D., 1970, Washington; acoustic techniques of population estimation.

Van Cleve, Richard (Emeritus), Ph.D., 1936, Washington; fisheries.

Whitney, Richard R.,* Ph.D., 1955, Iowa State; recreational fisheries.

Wooster, Warren S.,* (Marine Studies),† Ph.D., 1953, California (Los Angeles); chemical, physical, and fisheries oceanography, international marine science affairs.

Associate Professors

Bledsoe, Lewis J.* (Research), Ph.D., 1976, Colorado; systems ecology.

Brannon, Ernest L.,* Ph.D., 1969, Washington; freshwater fish behavior.

Conquest, Loveday L.,* Ph.D., 1975, Washington; statistical analysis of water pollution and community ecology data, aquatic ecosystems, biostatistics.

Devol, Allan H.* (Research), Ph.D., 1975, Washington; statistical analysis of water pollution and community ecology data, aquatic ecosystems, biostatistics.

Eggers, Douglas M.* (Research), (Marine Studies), Ph.D., 1975, Washington; population biology and freshwater ecology.

Gunderson, Donald R.,* Ph.D., 1975, Washington; marine fisheries and stock assessment.

Hershberger, William K.,* Ph.D., 1968, Pennsylvania State; fish genetics aquaculture, fish breeding and protein polymorphisms.

Landolt, Marsha L.,* (Forest Resources, Pathology), Ph.D., 1975, George Washington; fish and shellfish diseases.

Miller, Bruce S.,* Ph.D., 1969, Washington; marine fish ecology and biology.

Navissi, Ahmad Ed,* (Research), Ph.D., 1973, Arkansas; radiochemistry.

Pauley, Gilbert B.,* Ph.D., 1971, California (Irvine); fish immunology, fish diseases, recreational fisheries.

Pietsch, Theodore W.,* Ph.D., 1973, Southern California; systematics, biogeography and functional anatomy of marine fishes.

Richey, Jeffrey E.* (Research), Ph.D., 1974, California (Davis); quantitative problems of aquatic ecosystems.

Swartzman, Gordon L.* (Research), Ph.D., 1969, Michigan; ecological modeling, quantitative natural resource management.

Wissmar, Robert C.* (Research), Ph.D., 1972, Idaho; ecology.

Assistant Professors

Anderson, James J.* (Research), Ph.D., 1977, Washington; fisheries oceanography.

Armstrong, David A.,* Ph.D., 1978, California (Davis); biology and management of shellfish.

Hardy, Ronald W.* (Research), Ph.D., 1978, Washington; fish nutrition.

Kocan, Richard M.* (Research), (Pathology), Ph.D., 1967, Michigan State; aquatic toxicology.

Sibley, Thomas H.* (Research), Ph.D., 1976, California (Davis); trace pollutants.

Thomas, Gary L.* (Research), Ph.D., 1978, Washington; marine acoustics.

Course Descriptions

Courses for Undergraduates

Fisheries

FISH 101 Introduction to Fisheries Science (5) A *Salo* Identification, distribution, and life histories of selected fish and shellfish; commercial and recreational fishing; utilization of fisheries products; problems faced in fisheries conservation and management.

FISH 311 Functional Anatomy of Fish and Shellfish (4) ASpS *Smith* Functional capabilities and limitations of fish and shellfish as reflected in their anatomy, biology, and ecology. The laboratory portion of the course includes dissection of representative species of economically and ecologically important fish and shellfish. Laboratory fee may be required. Prerequisite: 10 hours of biological science.

FISH 314 Methods and Instruments for Fishery Investigations (3) ASp Theory and practice of instrumentation and sampling in fisheries; shipboard experience with equipment, collecting and recording data from biological samples, and the physical environment. Laboratory fee may be required. Prerequisite: 5 credits in fisheries.

FISH 340 Applications of Digital Computers to Biological Problems (5) AW Methods and procedures for processing biological and natural resource data by means of digital computers; interactive computing, file manipulation, problem analysis, elementary FORTRAN programming, use of data base and statistical packages, interfacing of programs and software packages. Offered jointly with Q SCI 340. May not be taken for credit if Q SCI 340 has been taken. Laboratory fee may be required. Prerequisite: Q SCI 381 or equivalent.

FISH 352 Fundamentals in Fisheries Biochemistry (3) A *Brown* Occurrence and role of carbohydrates, lipids, proteins, amino acids, vitamins, nucleic acids, and other compounds in fishes and other aquatic organisms. Topics include respiration, digestion, absorption, growth, reproduction, excretion, body fluids, general metabolism, intermediate metabolism, energy metabolism, and detoxification. Emphasis on biochemistry as it relates to nutrition and fish. Credit not allowed if other biochemistry credits are used toward degree in fisheries. Prerequisites: organic chemistry and ten hours of biology.

FISH 367 Recreational Fisheries (4) Sp *Pauley* History of recreational fishing; present trends in sport fishing and prediction of future trends; types and characteristics of recreational fisheries; value of recreational fisheries; habitat requirements; ecology and behavior that are important considerations in management; management philosophy and techniques. Recommended for majors and nonmajors. Field trips. Laboratory fee may be required. Prerequisite: 10 credits in biological science.

FISH 379 Fisheries of the World (3) A *Gunderson* Review of aquatic living resources; other resources of the sea; present and future of world's fisheries; estimation of potential harvest and problems of development; law of the sea and international arrangements for fisheries; status of the United States fishing industry; prospects of aquaculture.

FISH 395 Literature Search in Fisheries and Food Science (3) AWSp Training in methods of searching fisheries and food science literature with emphasis on organizing and communicating the material. Prerequisites: public speaking and advanced expository writing.

FISH 401 Ichthyology (5) ASp *Pietsch* Concepts of systematics and organic evolution as applied to current problems in the phylogeny of fishes; classification of fishes of the world by habitat; geographic distribution and ichthyozoogeography. Prerequisites: 10 credits in biological science and junior standing or above.

FISH 405 Economically Important Mollusca (5) Sp *Chew* Classifications, life histories, distribution, methods of cultivation, and economic importance of oysters, clams, scallops, abalones, cephalopods, and other mollusca. Prerequisite: 10 credits in biological science.

FISH 406 Economically Important Crustacea (5) W *Armstrong* Classifications, life histories, distribution, methods of capture, and economic importance of crabs, shrimps, lobsters, crayfish, and the smaller crustacea. Mandatory laboratory fee. Prerequisite: 10 credits in biological science.

FISH 407 Shellfish Hatchery Management Techniques (3) W *Chew* Through laboratory experience with resident aquaculture biologist, techniques for spawning bivalves and rearing their larvae are taught. Experience in maintaining support facilities for algal culture and in knowledge of seawater treatment and filtration. Basic reproductive physiology, history of oyster hatcheries, and state-of-the-art techniques. Guest lecturers discuss other shellfish hatchery culture methods. Prerequisites: 405 and permission of instructor.

FISH 408 Physiological Ecology of Shellfish (3) A *Armstrong* Relationship between the principal physical-chemical factors of aquatic habitats and physiological adaptations of invertebrates, primarily mollusca and crustacea. Ability to tolerate extremes in unstable environments and the synergistic impact of adverse conditions at the molecular and trophic levels are examined as contributory causes to poor recruitment, reduced productivity, shifts in energy allocations, use of marginal habitats, etc. Prerequisites: 352 and CHEM 102 or equivalents, or permission of instructor.

FISH 415 Principles of Fish Physiology (3) W *Smith* Survey of the functions of the organ systems of teleost fishes, emphasizing salmonids. Prerequisite: 10 credits in biological science.

FISH 416 Fish Physiology Laboratory (2) W *Smith* Exercises and projects in fish physiology. To be taken concurrently with or following 415. Laboratory fee may be required.

FISH 425 Life History of Marine Fishes (5) W *Miller* Fecundity, spawning, incubation, and hatching of marine fishes; identification and survival of larvae and juveniles; aging; food and feeding of adults; migration; recognition of subpopulations. Prerequisites: 401 and major status or permission.

FISH 430 Biological Problems in Water Pollution (3) W *Taub* Ecological aspects of water pollution problems arising from processes such as electrical power production, oil utilization, pest control practices, and land management. Not available to undergraduates as a continuing education technical elective. Offered jointly with CEWA 430. Laboratory fee may be required.

FISH 431 Laboratory for Biological Problems in Water Pollution (2) *Taub* Laboratory experiments and field visits relating to biological problems in water pollution. Laboratory fee may be required. Offered jointly with CEWA 431.

FISH 434 Ecological Effects of Waste Water (3 or 5) ASp *Welch* Principles of aquatic ecology that relate to causes and effects of water quality problems in lakes and streams. Population growth kinetics, nutrient cycling, eutrophication; acidification, oxygen/temperature requirements, and effects of various wastes on aquatic animals. Offered jointly with CEWA 434. Prerequisite: senior or graduate standing in engineering or science.

FISH 435 Physiological Effects of Water Pollutants (3) Sp *Brown* Physiological effects of water pollutants on economically important or endangered fishes, especially with respect to wastewater. Types of industrial, urban, and agricultural entities that contribute wastes to natural waters. Monitoring procedures and assessment of changes in fisheries as a consequence of waste effluents. Offered jointly with CEWA 435. Prerequisites: upper-division or graduate standing, organic chemistry, and some background in any of the following: general physiology, cell biology, biochemistry, chemical biology, sanitary engineering.

FISH 444 Fisheries Genetics (3) A *Hershberger* Survey of principles and practices in the field of genetics that can be applied to fisheries biology, with emphasis placed on the qualitative and quantitative aspects of variability in aquatic species, natural and artificial selection, and genetic analysis of fish populations. Prerequisite: GENET 451 or equivalent.

FISH 450 Salmonid Behavior and Life History (3) A *Brannon* Marine distribution, homing migration, and spawning behavior of adult salmon; incubation, emergence, migration, and residence of fry; fingerling distribution and residence with reference to species interaction and population evolution. Prerequisites: 401 and 15 credits in biology.

FISH 451 Reproduction of Salmonid Fishes (3) A *Brannon* Artificial spawning and incubation of salmon; embryology and development rates of different species; practical exposure to artificial spawning techniques, egg handling and care, alevin hatching and treatment. Prerequisites: 401 and 15 credits in biology.

FISH 452 Fish Nutrition (3) W *Halver* Basic nutritional requirements of fish in nature and artificial environment; nutritional diseases; quality evaluation. Prerequisites: 352 and 10 credits in biology.

FISH 453 Salmonid Culture and Enhancement (4) Sp *Brannon* Design of fish production facilities; methods of incubation, rearing, and handling of fish; problems encountered in hatchery water supplies. Management goals and strategy; assessment of production; stocking; impact on natural populations. Laboratory fee may be required. Prerequisites: 451, 452, or permission of instructor.

FISH 454 Communicable Diseases of Fishes (3) A *Landolt* Organisms causing diseases in fishes; prevention and known treatments of fish diseases. Prerequisites: 10 credits each in biology and chemistry.

FISH 455 Communicable Diseases of Fishes Laboratory (2) A *Landolt* Laboratories to study bacteria, viruses, and parasites that cause diseases of fishes and to study diagnostic techniques. Laboratory fee may be required. Prerequisite: permission of instructor.

FISH 456 Aquatic Entomology (5) Sp Laboratory and field course dealing with the taxonomy, ecology, and life history of selected aquatic insects, with special reference to the impact of man on stream systems. Prerequisite: ZOOL 331 or permission of instructor. (Offered irregularly.)

FISH 457 Management of Exploited Animal Populations I (4) W *Mathews* Equilibrium yield model; spawner-recruit models, management methods; use of catch-effort statistics in estimation and management, computer simulation in management decisions. Offered jointly with Q SCI 457. Prerequisites: Q SCI 292, 381; BIOL 210 or FISH 425, or permission of instructor.

FISH 458 Management of Exploited Animal Populations II (4) Sp *Mathews* Extension of principles and practices of 457. Estimating catch and effort and analyzing catch-per-effort statistics. Standardizing effort, gear selectivity, recruitment, models of exploited fishery populations with management applications. Introduction to simulation of fish and wildlife populations, emphasis on applications using current data from fishery and game organizations. Offered jointly with Q SCI 458.

FISH 459 Aquatic Food Chains (5) W *Taub* Survey of the sources and nutritional values of foods for fisheries resources. Efficiencies, rates of transfer through the food chain, pollution effects, and the potential for using pollution are considered. Laboratory fee may be required. Prerequisite: major status or permission of instructor.

FISH 460 Water Management and Hydrology (4) A *Brannon, Kent* Nomenclature water cycles and soil retention, water-flow measurements in streams, flow in pipes and channels, determination of pressure in open and closed systems, screening of water diversions, upstream and downstream fish passage. Prerequisites: 401, MATH 105, and physics, or permission of instructor.

FISH 461 Culture and Reproduction of Temperate and Warm Water Fishes (3) Sp *Brannon, Pauley* History of pond fishes, reproduction, and culture of carp, catfish, bass, perch, and tilopia species; pond construction and pond management; polyculture. Prerequisite: 459 or permission of instructor.

FISH 462 Feeds and Diet Formulation (3) W *Halver, Hardy* Feed terminology and classification, nutritive characteristics; effect of processing on feed value, influence of storage on nutrient stability, nonnutritive feed additives; exposure to the fish feed industry. Laboratory fee may be required. Prerequisite: 452.

FISH 463 Principles of Resource Assessment (5) Sp *Gunderson* Theory and methods of conducting resource assessment surveys, including survey planning, survey execution and data acquisition; analysis, interpretation, and presentation. Emphasis on the use of survey techniques to understand the status of fishery resources. Prerequisites: 314, Q SCI 381, or permission of instructor.

FISH 465 Marine Fish Biology (9) S Taxonomy, ecology, and life history of the fishes of the San Juan Islands and northeast Pacific Ocean. Prerequisite: permission of instructor. (Offered at Friday Harbor Laboratories Summer Quarter only; offered alternate years.)

FISH 467 Fisheries Management (5) W *Whitney* Principles and practice of the management of commercial and recreational fisheries. Emphasis is on concepts. A field exercise provides practical experience. Guest lecturers from international, federal, and state agencies discuss the need to take into account factors other than biological in making management decisions. Students interested in a more quantitative emphasis should take Q SCI 456, 457. Prerequisite: Q SCI 381; recommended: 340.

FISH 472 Aquatic Radioecology I (3) A Nature, detection, and measurement of ionizing radiation. The use of radionuclides for aquatic ecological studies. Prerequisites: 10 credits each in chemistry and biological sciences. (Offered irregularly.)

FISH 473 Aquatic Radioecology II (3) W Natural and artificial radionuclides in the aquatic environment and their impact on man and other organisms. Prerequisites: 10 credits each in chemistry and biological sciences. (Offered irregularly.)

FISH 475 Marine Mammalogy (3) S Lecture in marine mammalogy: the evolution, taxonomy, physiology, life history, and behavior of marine mammals; the techniques of studying and the management and conservation of them. Prerequisite: upper-division standing.

FISH 476 Laboratory of Marine Mammalogy (2) S Laboratory in marine mammalogy; the evolution, taxonomy, physiology, life history, and behavior of marine mammals; the techniques of studying and the management and conservation of them. Laboratory fee may be required. Prerequisite: 15 credits in biology; recommended: vertebrate anatomy and physiology.

FISH 477 Applied Chemical Techniques in the Aquatic Environment (3) Sp Procedures for obtaining representative samples for chemical analysis of biological materials in the food chains; procedures for initial treatment and wet chemical or instrumental analysis in pollution-related problems; comparative methods for analysis of different sample types; sample collection in the field; analysis of biological material and water. Prerequisites: general inorganic (quantitative analysis), organic chemistry, CHEM 321 or 167, and CHEM 232 or 236 and permission of instructor.

FISH 478 Applied Chemical Techniques in the Aquatic Environment Laboratory (2) Sp Methods in practical field sampling and analysis for pollution-related contaminants. Shipboard procedures and new chemical methods are used on special problems selected by the students. Sediment, biota, and water samples collected are measured by instrumental analysis methods, including neutron activation, atomic absorption, and gas chromatography. 477 may be taken concurrently with 478. Laboratory fee may be required. Prerequisites: CHEM 321 or 167, and CHEM 232 or 236.

FISH 499 Undergraduate Research (1-5, max. 9) AWSpS Individual research within the School of Fisheries or on-the-job training in governmental or industrial fisheries organizations. A. Guest lecture series. B. Special problems. C. Special courses in fisheries. D. Special courses in fisheries. Prerequisite: permission of instructor.

Food Science

FD SC 300 Nutrition for Today (3) A Basic and applied nutrition and food science, including identification of nutrients, food properties related to good nutrition and safe food, significance of additives, preservatives, and food processing. Nutritional requirements, nutritional deficiencies, and food-related disease. Current issues of public significance. Offered jointly with NUTR 300.

FD SC 350 Food Components (3) A *Matches* Classification of foods and food ingredients. Chemical components of foods: lipids, proteins, carbohydrates, pigments, and small-molecule components. Major food classes, including their chemical structures and changes resulting from handling and processing.

FD SC 378 Principles of Fishing Gear and Vessel Development (3) A *Pigott* Principles of fishing techniques used in the major commercial fisheries related to vessel design, instrumentation and facilities required in the operation and handling of specialized fishing gear, and shipboard processing.

FD SC 380 Principles of Fisheries Technology (3) W *Liston* Composition of fish; biochemical and microbiological changes in fish postmortem; nature and effects of processing procedures, analytical control procedures; current technological developments. Prerequisite: CHEM 102 or 160.

FD SC 381 Environment, Food, and Technology (3) Sp *Pigott* Principles of seafood processing operations as related to control of pollution problems arising from food processing wastes through total utilization of raw materials.

FD SC 385 Food Engineering I (3) W *Pigott* Application of physical laws to the physical and chemical changes that occur in food during harvesting, transporting, processing, storage, packaging, and marketing. Given particular emphasis in the student assignments are problems in industrial stoichiometry as applied to material and energy relationships during these changes. Food science majors must take 385 concurrently with 395. Prerequisite: major status or permission of instructor.

FD SC 395 Food Engineering I Laboratory (1) W *Pigott* Laboratory demonstrations of basic food engineering principles that are studied in 385. Food science majors must take 395 concurrently with 385. Laboratory fee may be required.

FD SC 481 Introduction to Food Technology (4) Sp *Liston* Chemical and biological properties of foods; principles of processing, storage, distribution, and spoilage. Food science majors must take 491 concurrently with 481. Prerequisite: permission of instructor.

FD SC 482 Food Chemistry (3) A Chemical composition, structure, and properties of foods and some of the chemical changes they undergo. Components of formulated foods, including additives and naturally occurring toxins. Prerequisite: BIOC 406 or permission of instructor.

FD SC 483 Food Analysis (3) W Methods of proximate analysis. Principles of separation and identification of food components by physical, chemical, and spectrophotometric methods. Prerequisite: 482.

FD SC 484 Food Microbiology (4) A *Liston, Matches* Numbers, types, and significance of microorganisms in foods. Changes resulting from microorganisms' growth and activity. Fermentation and other microbiological processes in foods. Food science majors must take 494 concurrently with 484. Prerequisites: 481, MICRO 301, or permission of instructor.

FD SC 485 Food Engineering II (3) W *Pigott* Unit operations in food processing, emphasizing engineering and technological bases of commercial operations. Majors must take 495 concurrently. Prerequisites: 385 and 395, or permission of instructor.

FD SC 486 Deteriorative Processes in Foods (3) Sp *Matches* Biochemical, microbiological, physical, and chemical changes occurring in foods. Food science majors must take 496 concurrently with 486. Prerequisites: 483, 485 or permission of instructor.

FD SC 491 Introduction to Food Technology Laboratory (1) Sp *Liston* Laboratories and field trips to local food-processing plants to see and study important food-processing operations such as freezing, milling, canning, brewing, milk processing, and spice processing. Food science majors must take 491 concurrently with 481.

FD SC 492 Food Chemistry Laboratory (2) A Experiments in qualitative and quantitative analysis for components of foods, using physical and chemical techniques. Food science majors must take 492 concurrently with 482. Laboratory fee may be required.

FD SC 493 Food Analysis Laboratory (2) W Experiments in proximate analysis, chromatography, and other methods of separation and identification of food components. Food science majors must take 493 concurrently with 483. Laboratory fee may be required.

FD SC 494 Food Microbiology Laboratory (3) A *Liston, Matches* Selected experiments on the enumeration and identification of microorganisms in food, fermentation processes, and the changes in microbial populations as a result of handling, storing, and processing. Food science majors must take 494 concurrently with 484. Laboratory fee may be required.

FD SC 495 Food Engineering II Laboratory (2) W *Pigott* Laboratory investigations and demonstrations concerned with the application of modern engineering principles to efficient commercial processing of food with maximum retention of nutrient properties. Food science majors must take 495 concurrently with 485. Laboratory fee may be required.

FD SC 496 Deteriorative Processes in Foods Laboratory (2) Sp *Matches* Selected experimental problems in food deterioration. Food science majors must take 496 concurrently with 486. Laboratory fee may be required.

FD SC 498 Undergraduate Thesis (2-5, max. 5) AWSpS Prerequisite: permission of instructor.

Courses for Graduates Only

Fisheries

FISH 501 On-the-Job Training (1-5, max. 5 for M.S., 9 for Ph.D.) AWSpS Guided on-the-job training in governmental or industrial fisheries organizations. Prerequisite: permission of instructor.

FISH 503 Advanced Ichthyology (3) Sp *Pietsch* Biosystematic theory and practical application in ichthyology; analysis of recent advances and current problems in phylogeny and zoogeography. Prerequisite: 401 or equivalent.

FISH 504 Invertebrate Pathology (5) W *Landolt, Pauley* Pathological effects and communicable diseases in invertebrates. The discussion is phylogenetic and comparative. Juniors and seniors may take the course, but must have course prerequisites. Prerequisites: 454 and invertebrate zoology or equivalent, or permission. (Offered even-numbered years.)

FISH 505 Research Techniques in Shellfish Biology (5) Sp *Chew* Study of research methods in field surveys of invertebrates and of research techniques involved with the studies of reproduction, growth, and mortality of oysters and clams. Prerequisite: permission of instructor. (Offered irregularly.)

FISH 507 Special Problems in Fisheries (1-5, max. 15) AWSp Classroom, laboratory, or field studies on problems of current interest. A maximum of 6 credits of 507 is permitted to apply to a master's degree program. A. Guest lecture series. Offered on credit/no credit basis only. B. Special problems. C. Special course in fisheries. D. Special courses in fisheries. Prerequisite: permission of instructor.

FISH 515 Topics in Fish Physiology (3) Sp *Smith* Analysis of recent advances in salmonid physiology with detailed coverage of selected organ systems having greatest importance to class members. Prerequisite: 415 or permission of instructor.

FISH 516 Fish Physiology Laboratory (2) Sp *Smith* Selected experimental techniques in fish physiology. Prerequisite: 515 or concurrent registration.

FISH 520 Graduate Seminar (1) A Introduction to research in fisheries. Offered on credit/no credit basis only.

FISH 522 Graduate Seminar in Fisheries (1, max. 2) WSp Lectures and discussions of current problems and current research in fisheries. Offered on credit/no credit basis only.

FISH 525 Ecology of Marine Fishes (3) Sp *Miller* Spawning, growth, survival, and distribution of fish in relation to physical, chemical, and biological factors; diet and seasonal migration; emphasis is on fishes of the nearshore environment. Prerequisites: 401 or equivalent, and permission of instructor.

FISH 527 Experimental Aquatic Ecology (3) Sp *Taub* Microcosms, mesocosms, enclosures, experimental approaches to investigating ecosystem properties. Current research critically reviewed to contrast observational and experimental approaches. Responses of communities to chemical stresses, predation, and harvesting. May include closed ecological systems, gnotobiotic microcosms, or multispecies continuous-cultures. Recommended: ecology, and limnology or biological oceanography. (Offered odd-numbered years.)

FISH 535 Metabolic Effects of Chemical Pollutants (4) Sp *Brown* Physiological and biochemical effects of industrial, urban, and agricultural chemicals on aquatic biota; specific metabolic effects of various poisonous and inhibitory substances; models of inhibition of enzyme systems of aquatic organisms. Offered concurrently with 435. Prerequisites: upper-division or graduate standing, organic chemistry, general physiology, biochemistry, or cell physiology, or equivalent.

FISH 540 Application of Digital Computers to Biological Problems (5) ASp *Bevan, Geiszler* Methods and procedures for processing biological and natural resource data by means of digital computers; interactive computing, file manipulation, problem analysis, elementary FORTRAN programming, use of data-base and statistical packages, interfacing of programs and software packages. Not open for credit if 340 or Q SCI 340 has been taken. Prerequisite: Q SCI 381 or equivalent.

FISH 544 Genetics in Fish Management and Production (3) W *Harshbarger* Study of the possible changes in genetic characteristics and response of populations with the current types and levels of fisheries resource manipulation. Includes genetic considerations in population models, quantitative genetics and breeding, and use of genetic markers for population analysis. Prerequisites: 444, 451, Q SCI 482, 483, and upper-division or graduate standing.

FISH 545 Selection and Breeding in Aquaculture (3) Genetic bases, analytical techniques and experimental approaches for study and utilization of quantitative genetic variation in aquatic

species. Statistical determination of genetic and phenotypic parameters; design and assessment of selection and breeding programs; use of quantitative genetic data. Prerequisites: 444, GENET 451, Q SCI 486, or permission of instructor.

FISH 556 Introduction to Quantitative Population Dynamics (3) A *Fletcher* Simple analytic approaches to population management; applications of parent-progeny models and logistic models; biological and economic yields of natural populations; analysis of population data on high-speed digital computers. Prerequisites: Q SCI 291, 292, 483, 457, or permission of instructor.

FISH 557 Theoretical Models of Exploited Animal Populations (3) W *Fletcher* Mathematical representation of basic population processes such as growth, mortality, natality, and mobility; application of optimization technique to yield models. Laboratory work on digital computer. Prerequisite: 556 or permission of instructor.

FISH 559 Estimation of Population Parameters (3) Sp *Chapman* Statistical analysis of population data; design and analysis of mark-recapture experiments on natural populations; laboratory work on digital computer. Prerequisite: 557 or permission of instructor.

FISH 560 Methods of Acoustic Stock Assessment (3) Sp *Mathisen* Theory and implementation of processing of acoustic fish target signals. Application for estimation of fish stocks and the statistical properties of the estimation procedure. (Offered odd-numbered years.)

FISH 570 Management of Marine Fishes (3) W *Gunderson* Survey of biology, stock assessment, and management of major marine fisheries resources, including Atlantic cod, Pacific halibut, California sardine, northern anchovy, Atlantic menhaden, Peruvian anchoveta, and pandalid shrimp. Mixed species fisheries (i.e., groundfish resource in North Sea and California-Washington region). Prerequisites: 457, 458 (or 556, 557, 558), 463.

FISH 575 Principles of Ecology as Applied to Fishes (3) A *Zaret* Theoretical ecology as applied to fishes. Includes fish vision, color pattern determinants, adaptive radiation, competition and predation, fish behavior, reproductive patterns, community organization, and species diversity. Offered jointly with ZOOL 575. Prerequisite: graduate standing or permission of instructor.

FISH 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

FISH 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

FISH 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Food Science

FD SC 521 Graduate Seminar in Food Science (1, max. 3) AWSp Lectures and discussions of current problems and current research in food science. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

FD SC 522 Advanced Food Chemistry (3, max. 9) Sp *Iwaoka* Lecture and/or laboratory dealing with special or current topics in food chemistry and food analysis. Laboratory fee may be required. Prerequisite: graduate standing or permission of instructor. (Offered even-numbered years.)

FD SC 524 Microorganisms in Foods (3) W *Liston, Matches* Occurrence and activity of microorganisms important in foods as agents of spoilage, fermentation, and food-borne disease; relationship to food or food process; control and detection. Food science majors must take 534 concurrently with 524. Prerequisite: graduate standing in food science or permission of instructor.

FD SC 525 Advanced Unit Operations in Food Processing (3) Sp *Pigott* Application of modern engineering principles to operations such as evaporation, drying, distillation, pumping, and heat transfer in the handling, processing, and packaging of foods. To be taken concurrently with 526. Prerequisite: 485 or permission of instructor.

FD SC 526 Advanced Unit Operations in Food Processing Laboratory (3) Sp *Pigott* Laboratory investigations concerned with the engineering of food processes and processing facilities. To be taken concurrently with 525. Laboratory fee may be required.

FD SC 534 Microorganisms in Foods Laboratory (1) W Special projects or selected experiments designed to study microorganisms in foods. Food science majors must take 534 concurrently with 524. Laboratory fee may be required.

FD SC 600 Independent Study or Research (*) AWSpS

FD SC 700 Master's Thesis (*) AWSpS

Marine Studies

3707 Brooklyn Avenue Northeast

Graduate Program

The Institute for Marine Studies offers an interdisciplinary program of study leading to the Master of Marine Affairs degree. Marine affairs concerns management and policy questions on the uses of the coastal and offshore regions of the ocean and their resources. The core curriculum includes courses from the Institute for Marine Studies, business administration, economics, engineering, fisheries, law, oceanography, political science, and public affairs. The School of Law has a related Master of Law program with specialization in marine affairs.

A major program objective is to prepare students for professional careers in policy making, management, teaching, and research. Breadth of study is emphasized, and all students are expected to gain familiarity with relevant aspects of the social, technological, and environmental sciences. In addition, each student is expected to develop a professional and scholarly proficiency in a particular aspect of marine studies.

Completion of the M.M.A. program normally requires two academic years for students who have recently received a baccalaureate degree. During the first year, students develop a comprehensive understanding of the marine affairs field and develop analytic skills. During the second year, a special competence is developed in one of three areas of concentration (coastal zone management, marine policy, or marine resource management), and a research topic is prepared and presented in thesis format under the guidance of a faculty supervisory committee. Individual courses of study may be adjusted to accommodate prior experience and academic background, and especially qualified students, such as those in midcareer, may be able to meet the degree requirements in twelve months of study.

Admission Requirements

Admission to the Institute for Marine Studies is based on evaluation of required application materials in competition with other applicants. Required materials include Graduate Record Examination general test scores, subject tests, completed departmental supplementary information form, three letters of recommendation, official academic transcripts, and a statement of career objectives. In addition, applicants must make separate application to, and be accepted by, the Graduate School of this university.

Course sequences begin each Autumn Quarter, and new students are normally admitted at that time. However, in rare instances, exceptionally qualified students with prior academic and practical or professional experience in the field may be considered for admission Winter Quarter or Spring Quarter.

Financial Aid

The Institute for Marine Studies has a limited number of positions for graduate student appointments as research and teaching assistants. Applicants in need of support are urged to investigate outside sources of funding.

Correspondence and Information

Graduate Program Coordinator
Institute for Marine Studies, HF-05

Faculty

Director

Edward L. Miles

Professors

Alverson, Dayton L.,* (Fisheries),† Ph.D., 1967, Washington; techniques for assessing fisheries resources, ecology and growth of marine fishes and shellfishes.

Bevan, Donald E.,*‡ (Fisheries), Ph.D., 1959, Washington; salmonoid culture, international and world fisheries management, quantitative biology.

Burke, William T.,* (Law),† J.S.D., 1959, Yale; international law of the sea.

Crutchfield, James A. (Emeritus), (Economics),† Ph.D., 1954, California (Berkeley); natural resources economics, policy and management, especially marine and environmental resources.

Fleagle, Robert G.,*‡ (Atmospheric Sciences), Ph.D., 1949, New York; theoretical and dynamic meteorology, weather modification and public policy, air-sea interaction processes.

Fleming, Richard H. (Emeritus), Ph.D., 1935, California (La Jolla); regional oceanography, man's interactions with the ocean.

Harshman, Marc J.,* (Law),† J.D., 1967, Temple; law of the coastal socioeconomic aspects of the uses of the coastal zone, port development.

Johnson, Ralph W.,*‡ (Law), J.D., 1949, Oregon; coastal zone law and management, American Indian legal problems.

McManus, Dean A.,*‡ (Oceanography), Ph.D., 1959, Kansas; geological oceanography, exploration.

Miles, Edward L.,* (Public Affairs),† Ph.D., 1965, Denver; international law and organization, science and international relations, marine policy and ocean management.

Murphy, Stanley R.,*‡ (Oceanography, Mechanical Engineering), Ph.D., 1958, Washington; ocean engineering, marine acoustics, coastal zone management, research administration.

Vesper, Karl H.,* (Management and Organization, Mechanical Engineering),† Ph.D., 1969, Stanford; entrepreneurship, technological innovation, interdisciplinary management, marine systems design.

Wooster, Warren S.,* (Fisheries),† Ph.D., 1953, California (Los Angeles); circulation and distribution of physical and chemical properties of the world ocean, application of such information to fishery problems, ocean affairs.

Associate Professors

Adee, Bruce H.,*‡ (Mechanical Engineering), Ph.D., 1972, California (Berkeley); ocean, naval, aeronautical engineering, marine technology.

Delaney, John R.,‡ (Oceanography), Ph.D., 1977, Arizona; geochemistry and tectonics with special interests in the role of volatiles in submarine basalts.

Duxbury, Alyn C. (Research), (Oceanography),† Ph.D., 1963, Texas A&M; descriptive physical oceanography with emphasis on coastal and estuarine processes and education.

Gunderson, Donald R.,*‡ (Fisheries), Ph.D., 1975, Washington; trawl and hydroacoustic assessment of fisheries resources, population dynamics and management of marine fisheries resources.

Kaczynski, Wlodzimierz M.* (Research), Ph.D., 1973, Gdansk (Poland); fishery economics, international joint ventures in marine fisheries, international fisheries policy and management.

Lee, Kai N.,*‡ (Environmental Studies, Political Science), Ph.D., 1971, Princeton; technology and public policy, nuclear energy, regional electric power development.

Leschine, Thomas M. (Research), Ph.D., 1975, Pittsburgh; quantitative methods in resource management and environmental assessment, marine pollution management.

Stokes, Robert L.,* (Economics), Ph.D., 1975, Washington; natural resource economics, marine policy economics.

Assistant Professors

Miller, Marc L.,* (Anthropology), Ph.D., 1974, California (Irvine); maritime anthropology, cognitive anthropology and social/cultural change.

Stein, Ted L.,‡ (Law), J.D., 1977, Harvard; international law and legal process, maritime boundary delimitation, U.S. law governing activities in the marine environment.

Course Descriptions

IMS 455 Marine Resource Policy of the Soviet Bloc (3) A *Kaczynski* Criteria applied by communist states in developing ocean resource use and management strategy. Problems and choices influencing ocean policy; areas of conflicting ocean interests, including those of the West and developing countries. Offered jointly with SISRE 455. Prerequisite: understanding of communist block economic and political systems or permission of instructor.

IMS 499 Undergraduate Research (1-3, max. 6) AWSpS Research on assigned topics under the supervision of faculty members. Prerequisite: permission of instructor.

IMS 500 Marine Affairs (5) A *Miller* Surveys a wide range of academic disciplines and substantive problems pertinent to interaction of human beings and the world's oceans and coasts. Management of living/nonliving resources, shipping, scientific research, pollution, recreation, and others. Lecture and discussion by invited specialists.

IMS 505 Marine Uses and Resources: Living Resources (3) Sp *Alverson* Survey of living marine resources; factors affecting distributions and abundance; direct and indirect impact of human activities; bases for management; the origin and character of conflict in fisheries management. Prerequisite: 500 or permission of instructor.

IMS 508 International Law of the Sea (4) W *Burke* Ways nations claim authority to regulate activities at sea. Fundamental policies and decisions regarding navigation for commercial and military purposes, fisheries, exploitation and conservation, continental shelf resources, scientific research, protection of environment, deep-sea mining, and other uses of the ocean. Offered jointly with LAW B 561.

IMS 507 International Organizations and Ocean Management (3) W *Miles* Survey of the manner in which international organizations attempt to manage and regulate the uses of the ocean. Primary emphasis is on the analysis of processes that support or constrain these organizations and on the search for alternative policies and organizations. Offered jointly with PB AF 507. Prerequisite: 500 or permission of instructor.

IMS 508 Economic Aspects of Marine Policy (3) W *Stokes* Development of pertinent economic concepts and their application to selected topics in marine policy decision making. Offered jointly with ECON 537. Prerequisite: 500 or permission of instructor.

IMS 509 Principles of Coastal Zone Management (3) W *Hershman* Multiple uses of coastal waters and the adjacent land; conflicts arising from competition for space and resources; organizational problems associated with overlapping jurisdiction and spheres of interest; the development of alternatives for the resolution of conflicts. Prerequisite: 500 or permission of instructor.

IMS 510 Coastal Zone: Legal Regulation of Onshore Activities (2) Federal and state law related to ownership and land use in the coastal zone. Role of federal and state common law in property relations in the coastal zone, public trust doctrine, beach access, takings, federal Coastal Zone Management Act, and state coastal zone management programs. Offered jointly with LAW B 560.

IMS 511 Coastal Environment Management (3) Sp *Duxbury, Ruotsala* Coastal zone planners and managers evaluate proposed and ongoing use activities that affect wetland, estuarine, and nearshore environments. Concepts and techniques for retrieving, analyzing, and using technical environmental information in planning and decision making. Washington State case examples and practical exercises. Prerequisite: OCEAN 580 or permission of instructor.

IMS 512 Ocean Environment and Living Resources (3) W *Wooster* Analysis of characteristics and processes in the ocean environment affecting abundance of marine organisms; implications for management of oceanic fisheries. Prerequisite: permission of instructor.

IMS 515 United States Law and the Marine Environment (3) United States law relating to activities in the marine environment. Federal/state boundary problems, living resources management, offshore oil and gas production, vessel and tanker safety. Offered jointly with LAW B 565.

IMS 517 Marine Uses: Transportation and Commerce (3) W *D. K. Fleming* Role of the oceans in the transportation of men and materials; character and trends in vessel design and terminal facilities; pattern and nature of industry organization; regulations; economics of the shipping industry; management of fleets and vessels; manpower at sea and ashore; national policies affecting the merchant marine and port facilities. Prerequisite: 500 or permission of instructor.

IMS 530 The Regional Implementation of an Extended Economic Zone (3) Sp *Miles* Team-research seminar to evaluate the implications of two-hundred-mile economic zones in the Central and North Pacific and Atlantic oceans, the Arctic and Indian oceans, and the Mediterranean Sea. Focus is on one region at a time. Prerequisite: 507 or permission of instructor.

IMS 538 Economic Aspects of Marine Policy II (3) Sp *Stokes* Development of pertinent economic concepts and their application to selected topics in marine policy. Offered jointly with ECON 538. Prerequisite: 508 or permission of instructor.

IMS 540, 541 Economics of World Fisheries I, II (3,3) A,W *Kaczynski* World view of the contemporary problems in use and management of the marine living resources. How to approach and analyze international fisheries issues in students' own research. 540: analysis of basic economic tools and concepts. 541: application of basic tools and concepts to problems of particular importance in regional or global perspectives. Prerequisite: 500 or permission of instructor.

IMS 550 Special Topics in Marine Studies (1-3, max. 18) AWSpS Examination of various aspects of marine studies. Content varies, depending upon the interests of the faculty and students. Intended for the joint participation by the faculty and advanced students in the investigation of selected topics. One or more groups are organized each quarter.

IMS 555 Soviet Ocean Policy (3) W *Kaczynski* Problems of Soviet ocean policy and challenge of Soviet ocean expansion. How Soviet navy, fishing fleet, merchant marine, ocean research capability, and network of overseas land support bases have put USSR in the front rank of military powers. Offered jointly with SISRE 555. Prerequisite: permission of instructor.

IMS 562-563 Ocean Policy and Resources Seminar (3-3) W,Sp *Burke, Miles* Study and research into selected problems relating law, international organizations, and marine affairs. Special attention devoted to global and regional problems involving decision processes and structures that are under particular stress due to social, including technological, change. Problems examined change from year to year. Offered jointly with LAW B 563-B 564. Prerequisites: 506, 507, or permission.

IMS 565 Seminar in Atmospheric and Marine Science Policy (1-3) Sp *Fleagle, Wooster* Decision making and policy determination in major atmospheric and marine programs. Case studies of policy development relating to global observations, acid precipitation, air and water quality, climate change. Individual study of selected topics, with emphasis on developing and evaluating alternate policies. Offered jointly with ATM S 565 and SMT 565. Prerequisite: permission of instructor.

IMS 571-572-573 Advanced Seminar in Coastal Zone Management ((1-3)-(1-3)-(1-3), max. 6) A,W,Sp *Hershman* Students develop analytical and conceptual papers addressing an important theme in coastal zone management. Readings and discussions in selected topical subjects. Papers can complement theses or other degree requirements. Designed for students with career orientation related to coastal zone management. Prerequisite: 509 or permission of instructor.

IMS 587-588 Research Seminar in Marine Resource Management (3-3) A,W *Crutchfield, Stokes, Wooster* For students who select marine resource management as an area of concentration within the marine affairs program. Integration of multidisciplinary analysis and supervised student research, leading to completion of the thesis, are primary objectives.

IMS 600 Independent Study or Research (*) AWSpS

IMS 700 Master's Thesis (*) AWSpS

Oceanography

108 Oceanography Teaching

The School of Oceanography, which had its beginnings in 1930, offers courses and conducts basic research in oceanography, the science that examines physical, geological, chemical, and biological processes in the ocean and interactions of the ocean with the earth, the biosphere, and the atmosphere. Education and research in the school include studies of seawater in motion; life in the sea; chemical composition and properties of seawater; interactions between the sea and the atmosphere, the sea and the land, sediments and rocks beneath the sea; and the geophysics of the ocean floor. Because the science of oceanography is interdisciplinary in nature, joint programs are maintained in the areas of geochemistry and biochemistry, geophysics, atmospheric sciences; marine biology and botany, and geophysical fluid dynamics, with the departments of Botany, Zoology, Atmospheric Sciences, Applied Mathematics, Geophysics, and Geology, and with the other units in the College of Ocean and Fishery Sciences. The program presently is under revision, and current information is available by contacting the school.

Courses

A full spectrum of basic and advanced courses is offered in each of the areas of specialization in oceanography: biological oceanography, chemical oceanography, marine geology and geophysics, and physical oceanography. Among the wide variety of courses open to students are the following: zooplankton ecology, marine microbiology, advanced problems in chemical oceanography, ocean and climate variation, applications of underwater acoustics, sedimentary history of the ocean, marine science of coastal zone management, and man and the ocean.

Summer Quarter instruction is offered both on the main campus and at the Friday Harbor Laboratories on San Juan Island.

Advising

The advising office is staffed with an academic counselor and a program assistant, who assists students with curriculum, scheduling, and career counseling. Students also are assigned faculty advisers.

Research

Each year the school participates in a broad range of oceanographic investigations, ranging from individual research projects to multidisciplinary and/or multiuniversity projects. Major biological programs are carried out in Puget Sound, in the waters of the continental shelf off Washington and Oregon, and in the North Pacific Ocean. These projects include investigations of the processes governing the communities or organisms in the water column, on the seabed, and in the surf zone. Chemical oceanography includes work on the distribution of organic material and trace metals in Puget Sound and the open sea, the geochemistry of the sediment-water interface, and study of chemical processes in waters trapped in the sediments. Geological investigations include theoretical studies and field experiments on sediment motion and sedimentary processes. This work has ranged from the Columbia River to Prudhoe Bay to the East China Sea, where a cooperative program with Chinese scientists is under way.

The effect of organisms on sediment transport is a major new interdisciplinary program among geology, biology, and physical oceanography. Geophysical research is concerned with the oceanic crust and upper mantle. Topics include seismic experiments on plate boundaries; crustal formation processes in the Juan de Fuca-Gorda Ridge System; and studies of the earth's magnetic field. Physical oceanographic programs range from large-scale circulation studies of the North Pacific, the North Atlantic, the tropical oceans, and the antarctic circumpolar current to coastal circulation studies and small-scale mixing programs. The theoretical and experimental programs include studies of air-sea interaction, surface and internal waves, oceanic fronts, and sea ice.

The school is particularly strong in arctic research, which includes both physical oceanographic studies and multidisciplinary ecosystem studies of the processes and resources in the Bering Sea. Studies in local waters include sediment transport and mixing processes in fjords and inlets and the chemistry of Lake Washington.

Facilities and Vessels

Housed in three large and several smaller buildings on Portage Bay, the school is equipped with modern laboratories and teaching facilities, including controlled-environment rooms, a paleomagnetics laboratory, and a sea-ice laboratory. It also has offices and staging areas on a barge anchored permanently near these buildings. Large and small docks moor research vessels, which include the 209-foot, deep-sea research vessel *Thomas G. Thompson*, the 65-foot *Onar*, and the 65-foot *Barnes*. The latter two are used for research in protected waters of the northwest coastal zone. The school also has an operating tide model of Puget Sound—prototype of the one now on display at the Pacific Science Center. Also available are the Fisheries-Oceanography Library, Academic Computer Center, and the Friday Harbor Laboratories.

Funding

The school is supported primarily by funds from the state of Washington and federal agencies. Major sources of federal funding include the National Science Foundation, National Oceanic and Atmospheric Administration, Office of Naval Research, and Department of Energy. Funds are also provided by the Army Corps of Engineers, Air Force, various state and local government agencies, and private organizations.

Undergraduate Program

Degrees

Students may earn a Bachelor of Science degree or a Bachelor of Arts degree, with specialization in biological, chemical, or physical oceanography, marine geology, or marine geophysics.

Vocational Opportunities

Professional work in oceanography is open to both men and women. Many opportunities exist for oceanographers with general training, as well as for those who have specialized in some particular phase of the marine sciences.

Upon completing his or her studies, a student may find positions in government agencies such as the Naval Oceanographic Office, Office of Naval Research, Coast Guard, Army Corps of Engineers, Department of Ecology, National Marine Fisheries Service, and National Ocean Survey under the auspices of the National Oceanic and Atmospheric Administration. These agencies use oceanographic data for charts and atlases, survey ice conditions and movements of icebergs, and conduct research on the food resources of the seas. Planning agencies of coastal states and countries, universities, and marine laboratories also offer opportunities for research. Teaching opportunities for persons with either a baccalaureate or advanced degree in oceanography are expanding.

Public health agencies, municipal and state governments, pulp mills, and manufacturing plants need oceanographic studies to help solve problems relating to the disposal of sewage and industrial wastes. Increased contamination and pollution of inshore waters provide major areas for research. Exploitation of oil and mineral deposits beneath the sea is opening up new opportunities; research on plankton, the food source for marketable fish, is also a growing field.

High School Preparation

A high school student considering oceanography as a career should be guided by an interest in natural sciences and his or her record in high school science courses, particularly mathematics. To be well prepared the student should plan to meet the general University entrance requirements: four years of English, or other language arts; three years of college preparatory mathematics; and courses through the third-year level of a foreign language. Recommended for the major are four years of high school mathematics, including trigonometry, and one year each of biology, chemistry, and physics.

Admission Requirements

The School of Oceanography has no formal admission requirement. A student who indicates oceanography as his or her choice of major on the undergraduate application form obtained from the admissions office will be admitted into the program upon acceptance for admission to the University.

Bachelor of Arts Degree

The Bachelor of Arts degree program has sufficient flexibility to serve both those students entering the profession directly and those planning graduate study. The student must meet the distribution requirement of 20 credits of social sciences and 20 credits of humanities; MATH 124, 125, 126; CHEM 140, 150, 151; PHYS 121, 122, 123. Courses can be substituted by permission from an adviser. Recommended foreign languages are German, French, Japanese, and Russian. The program presently is under revision, and current information may be obtained by contacting the school.

Bachelor of Science Degree

The Bachelor of Science curriculum is recommended for students who desire to complete a program more intensive than that required for the Bachelor of Arts degree. The student must meet the distribution requirement of 20 credits of social sciences and 20 credits of humanities; 5-10 credits in upper-division science or mathematics; MATH 124, 125, 126; CHEM 140, 150, 151; PHYS 121, 122, 123. Courses can be substituted by permission from an adviser. Recommended foreign languages are German, French, Japanese, and Russian. The program is presently under revision, and current information may be obtained by contacting the school.

Requirements should be checked with school adviser.

The honors adviser may be consulted about requirements for the honors program.

Student Oceanographic Society

The Student Oceanographic Society (SOS) is an undergraduate organization comprising students majoring in oceanography. SOS coordinates tours of the facilities and elects the undergraduate representatives to the school's student council. The club also provides the students with an informal environment for meeting with the faculty and other students who share an interest in the marine sciences.

Graduate Program

Roy Carpenter, Graduate Program Coordinator

Basic and advanced courses are offered in each area of specialization. Courses offered include: zooplankton ecology, marine microbiology, advanced problems in chemical oceanography, ocean and climate variation, applications of underwater acoustics, sedimentary history of the ocean, marine science of coastal zone management, and man and the ocean.

Master of Science Degree

Admission Requirements: Grade records, three letters of recommendation, and the Graduate Record Examination. A broad background in science and mathematics and knowledge of a foreign language are encouraged.

Graduation Requirements: Program of study approved by the supervisory committee in chosen option, three quarters of OCEAN 520, minimum of 5 credits in each option completed within the first two years of study, and qualifying examination. The supervisory committee must be consulted about language requirements. With thesis: approved thesis presented at seminar. Without thesis: a research activity; written or oral reports (requirement decided by supervisory committee).

Doctor of Philosophy Degree

Admission Requirements: Same as for Master of Science degree.

Graduation Requirements: Program of study approved by the Supervisory Committee in chosen option, three quarters of OCEAN 520, minimum of 5 credits in each option completed within the first two years of study, qualifying examination, General Examination, dissertation, Final Examination.

Financial Aid

Half-time teaching and research appointments for nine months are available. Scholarships, fellowships, and traineeships are offered. Foreign students are usually not given financial aid during the first year of study.

Research

A broad range of oceanographic investigations, from individual research projects to multidisciplinary and multiuniversity projects, is available. Major biological programs include investigations of processes governing communities of organisms in the water column, on the seabed, and in the surf zone. Chemical oceanography includes work on distribution of organic material and trace metals in Puget Sound and the open sea, geochemistry of the sediment-water interface, and study of chemical processes in waters trapped in the sediments. Geological investigations include theoretical studies and field experiments on sediment motion and sedimentary processes. The effect of organisms on sediment transport is a major new interdisciplinary program among geology, biology, and physical oceanography. Geophysical research is concerned with the oceanic crust and upper mantle. Physical oceanographic programs range from large-scale circulation studies to coastal circulation studies and small-scale mixing programs.

The school is strong in arctic research, including both physical oceanographic studies and multidisciplinary ecosystem studies of processes and resources in the Bering Sea.

Facilities and Vessels

The school is equipped with modern laboratories and teaching facilities, including controlled-environment rooms, a paleomagnetics laboratory, and a sea-ice laboratory. Research vessels include: the 209-foot deep-sea research vessel *Thomas G. Thompson* and the 65-foot *Barnes*.

Faculty

Director

Brian T. R. Lewis

Professors

Aagaard, Knut N.* (Research), Ph.D., 1966, Washington; physical oceanography, ocean circulation, arctic oceanography.

Anderson, George C. (Emeritus), Ph.D., 1954, Washington; plankton ecology, biological oceanography.

Baker, D. James,* (Atmospheric Sciences), Ph.D., 1962, Cornell; physical oceanography, physics of large-scale ocean circulation, instrumentation.

Banse, Karl,* Ph.D., 1955, Kiel (Germany); biological oceanography, plankton production and methodology, polychaete systematics.

Barnes, Clifford A. (Emeritus), Ph.D., 1936, Washington; physical oceanography, water properties, circulation.

Carpenter, Roy,* Ph.D., 1968, California (Los Angeles); marine geochemistry of metals and hydrocarbons in coastal zones.

Coachman, Lawrence K.,* Ph.D., 1962, Washington; physical oceanography, water properties circulation, arctic oceanography.

Creager, Joe S.,* (Geological Sciences),† Ph.D., 1958, Texas A&M; geological oceanography, sea-level changes, recent marine sediments, shallow-water sediment transportation.

Criminale, William O., Jr.,* (Applied Mathematics, Geophysics),† Ph.D., 1960, Johns Hopkins; applied mathematics, geophysical fluid mechanics, air-sea interactions.

English, T. Saunders,* Ph.D., 1961, Washington; biological oceanography, nekton, sampling, arctic plankton ecology, bioacoustics.

Ewart, Terry E.* (Research), Ph.D., 1965, Washington; physics, ocean microstructure, diffusion, acoustic transmission.

Fleming, Richard H. (Emeritus), Ph.D., 1935, California (Berkeley); physical and general oceanography.

Frost, Bruce W.,* Ph.D., 1969, California (San Diego); biological oceanography, marine zoogeography, plankton ecology and systematics.

Gregg, Michael C.* (Research), Ph.D., 1971, California (San Diego); physical oceanography, ocean microstructure.

Henry, Dora P. (Research), Ph.D., 1931, California (Berkeley); systematics and ecology of barnacles.

Johnson, H. Paul* (Research), Ph.D., 1972, Washington; paleomagnetism and marine geophysics.

Jumars, Peter A.,* Ph.D., 1974, California (San Diego); biological oceanography, benthos, biological sedimentary dynamics and spatial statistics.

Lewis, Brian T. R.,* (Geophysics),† Ph.D., 1970, Wisconsin; marine geophysics, marine seismology, gravity, magnetics, and computer modeling of those processes.

Lister, Clive R. B.,* (Geophysics),† Ph.D., 1962, Cambridge; marine geophysics, cooling processes in the outer layers of the earth, geodynamics.

Lorenzen, Carl J.* (Research), Ph.D., 1964, Cornell; biological oceanography, marine food chain dynamics, carbon cycling in the ocean.

Martin, Seelye* (Research), Ph.D., 1967, Johns Hopkins; geophysical fluid dynamics, properties of sea ice.

McManus, Dean A.,* (Marine Studies), Ph.D., 1959, Kansas; geological oceanography, continental shelf sediments.

Merrill, Ronald T.,* (Geophysics, Geological Sciences),† Ph.D., 1967, California (Berkeley); geomagnetism and paleomagnetism.

Murphy, Stanley R.,* (Mechanical Engineering),† Ph.D., 1959, Washington; physical oceanography, underwater acoustics.

Rattray, Maurice, Jr.,* Ph.D., 1951, California Institute of Technology; physical oceanography, hydrodynamics, estuarine circulation, internal waves, ocean circulation modeling.

Richards, Francis A.,* Ph.D., 1950, Washington; chemical oceanography, nutrient and gas cycles, oxygen-deficient environments.

Sanford, Thomas B.* (Research), Ph.D., 1967, Massachusetts Institute of Technology; physical oceanography, dynamics of ocean currents, motional induction, instrumentation.

Smith, J. Dungan,* (Geophysics, Geological Sciences),† Ph.D., 1968, Chicago; coastal and estuarine physical oceanography, turbulent boundary layers, sediment transport.

Stemberg, Richard W.,* Ph.D., 1965, Washington; geological oceanography, marine sedimentation processes.

Stuiver, Minze,*‡ (Geological Sciences), Ph.D., 1958, Groningen (Netherlands); chemical oceanography, limnology, isotope geology, geochronometry.

Welander, Pierre L. R.,* Ph.D., 1954, Stockholm; theory of general ocean circulation, large-scale atmosphere-ocean interaction.

Winter, Donald F.,* (Applied Mathematics),† Ph.D., 1962, Harvard; applied mathematics, hydrodynamics, biological oceanography.

Wooster, Warren S.,*‡ (Fisheries, Marine Studies), Ph.D., 1953, California (Los Angeles); physical oceanography, ocean circulation, fishery oceanography and ocean affairs.

Associate Professors

Ahmed, Saiyed I.* (Research), Ph.D., 1963, J.W. Goethe (Frankfurt); marine phytoplankton, ecology and nitrogen assimilation, biofouling, anoxic marine environments.

Delaney, John R.* (Marine Studies), Ph.D., 1977, Arizona; geological oceanography, igneous petrology, properties and origin of the oceanic crust and upper mantle.

Duxbury, Alyn C. (Research), Ph.D., 1963, Texas A&M; descriptive physical oceanography, mechanics of estuarine and coastal circulation.

Emerson, Steven R.,* Ph.D., 1974, Columbia; marine geochemistry/chemical oceanography, sediment diagenesis.

Hedges, John I.,* Ph.D., 1975, Texas (Austin); organic geochemistry, sources, transport, fate of organic material in coastal zones.

Hickey, Barbara M.* (Research), Ph.D., 1975, California (San Diego); physical oceanography, dynamics of equatorial and shelf circulation.

Holloway, Gregory* (Research), Ph.D., 1976, California (San Diego); physical oceanography, turbulence theory, geophysical fluid dynamics.

Landry, Michael R.* (Research), Ph.D., 1976, Washington; biological oceanography, zooplankton-phytoplankton interactions, grazing, predation.

Larsen, Lawrence H.* (Research), Ph.D., 1965, Johns Hopkins; physical oceanography, hydrodynamics, waves, sediment transport.

Murray, James W.,* Ph.D., 1973, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution; marine geochemistry, aquatic chemistry.

Nowell, Arthur R. M.,* Ph.D., 1975, British Columbia; physical oceanography, turbulent boundary layer dynamics, sediment transport.

Perry, Mary Jane* (Research), Ph.D., 1974, California (San Diego); biological oceanography, phytoplankton physiology, nutrient cycling.

Stewart, Richard J.,*‡ (Geological Sciences), Ph.D., 1970, Stanford; geological oceanography, sedimentary petrology, sediment diagenesis.

Assistant Professors

D'Asaro, Eric (Research), Ph.D., 1980, Massachusetts Institute of Technology; upper ocean dynamics, oceanic internal waves, bottom boundary-layer processes, oceanic turbulence and mixing processes.

Lidstrom, Mary E.,‡ (Microbiology and Immunology), Ph.D., 1977, Wisconsin (Madison); marine microbiology, marine methane oxidation.

McDuff, Russel E.* (Research), Ph.D., 1978, California (San Diego); marine geochemistry.

McPhaden, Michael J. (Research), Ph.D., 1980, California (San Diego); tropical physical oceanography, equatorial dynamics, air-sea interaction, and ocean climate studies.

Riser, Stephen C.* (Research), Ph.D., 1981, Rhode Island; physical oceanography, large- and mesoscale mixing in the ocean, water masses and tracer fields in the ocean, physics of mesoscale eddies, numerical models of ocean circulation.

Course Descriptions

Courses for Undergraduates

OCEAN 101 Survey of Oceanography (5) AWSpS Origin and extent of the oceans; nature of the sea bottom; causes and effects of currents and tides; animal and plant life in the sea. Intended for nonmajors.

OCEAN 102 Man and the Ocean (3) W Designed to study in detail the benefits and the scientific problems created by man's activities impinging on the oceanic environment. Prerequisite: 101 or permission of instructor.

OCEAN 109 Survey of Oceanography—Honors (5) Origin and extent of the oceans; nature of the sea bottom; causes and effects of currents, waves, and tides; animal and plant life in the sea. Not intended for oceanography majors. Prerequisites: College of Ocean and Fishery Sciences honors program and permission of instructor.

OCEAN 110, 111, 112 Lectures in Oceanography (1,1,1) A,W,Sp Selected aspects of oceanography ranging from deep-sea drilling and hydrothermal springs to the ocean's role in climate. Students interested in oceanography can learn more about the field. May be entered any quarter.

OCEAN 180 Lower-Division Tutorial—Honors (6) Research with a departmental program. Prerequisites: College of Ocean and Fishery Sciences honors program and permission of instructor.

OCEAN 201 Introduction to Field Oceanography (6) Introduction to methods of oceanographic field study. Students work in the laboratory and at sea; must be prepared to go on overnight field trips scheduled on weekends. Prerequisites: sophomore standing in oceanography or a related science, or permission of instructor.

OCEAN 203 Introduction to Oceanography (5) Sp Description of the oceans; physical, chemical, biological, and geological aspects of the sea; areal distribution and seasonal cycles of properties; currents; factors affecting populations. Intended for science majors. Prerequisite: sophomore standing in a science curriculum or permission of instructor.

OCEAN 230 Biological Oceanography of Washington Waters (2) Sp Principles of biological oceanography. Temporal and spatial distributions of organism and the production and fate of organic matter in Puget Sound and offshore waters of Washington. Offered on credit/no credit basis only. Prerequisite: MATH 124 or permission of instructor.

OCEAN 280 Introduction to Oceanography—Honors (5) Descriptive and regional oceanography covering physical, chemical, biological, and geological aspects of the sea. Intended for science majors. Prerequisites: sophomore standing in College of Ocean and Fishery Sciences honors program and permission of instructor.

OCEAN 351, 352 Quantitative Methods I, II (3,3) A,W Applications of mathematical techniques and basic principles of the natural sciences to major problems in engineering and oceanography. 351: ordinary differential equations. 352: approximate methods; curve fitting, Fourier series; introduction to partial differential equations; boundary value problems. Offered jointly with AMATH 351, 352. Prerequisites: one year of physics and MATH 126 for 351; 351 or MATH 238 for 352.

OCEAN 380 Upper-Division Tutorial—Honors (6) Research under faculty supervision. Prerequisites: junior standing in College of Ocean and Fishery Sciences honors program and permission of instructor.

OCEAN 401, 402 General Physical Oceanography I, II (5,5) A,W Physical properties and processes; theories and methods involved in ocean currents, waves, and tides. Not open to physical oceanography majors. Prerequisites: one year each of chemistry and physics, MATH 126 for 401; 401 for 402.

OCEAN 408 Geological Oceanography Laboratory (2) Sp Field methods in geological oceanography. Collect samples of data using such instruments as echo sounder, seismic reflection profilers, side-scan sonar, grab samplers, corers, sextants, and electronic navigation aids. Produce an integrated report on the sedimentology and stratigraphy of a small area of Puget Sound. Prerequisite: senior or graduate standing in geological or geophysical oceanography or geological sciences.

OCEAN 417, 418 Physical Oceanography I, II (5,5) A,W Topics: physical properties of seawater; observed distributions of properties and currents, budgets, kinematics, hydrostatics, dynamics of ocean circulation, vorticity dynamics, viscosity, eddy fluxes, estuaries. Prerequisites: MATH 427, which may be taken concurrently, PHYS 226, CHEM 160, or permission, for 417; 417 and MATH 428, which may be taken concurrently, for 418.

OCEAN 419 Ocean Tides and Waves (5) Sp Theory of surface waves; wave forecasting; transformation of waves in shallow water, wave forces. Tide theory: analysis and prediction of tides and tidal currents. The course includes laboratory and computer simulation. Prerequisite: 418 or permission of instructor.

OCEAN 421 Chemical Oceanography (3) A Physical and chemical properties of seawater and marine products; processes determining the chemical makeup of the oceans. Prerequisite: 401 or 417, or concurrent registration in one.

OCEAN 422 Aquatic Chemistry (3) Sp Application of elementary principles of physical chemistry to understand the chemical composition of natural water systems. Acids and bases, solubility, metal ions in solution, oxidation-reduction, and silicate mineral actions. Prerequisites: 421 and CHEM 350, CHEM 351, or permission of instructor.

OCEAN 423 Chemical Oceanography Laboratory (3) W Laboratory problems in the analytical and physical chemistry of seawater and marine materials. Prerequisites: 421, which may be taken concurrently; and CHEM 321.

OCEAN 433 General Biological Oceanography (5) W Marine organisms, their quantitative distribution in time and space and their effect on the sea. Recommended for nonbiologists. Prerequisites: 203 or 401 or 417 and BIOL 101-102, or permission of instructor.

OCEAN 434 Biological Oceanography: Phytoplankton (4) W Ecological physiology of phytoplankton. Quantitative distribution in time and space of primary producers including benthic plants. Rates of processes. Methods of measurement. Prerequisites: 203, 401, or 417, and 20 credits in biological sciences, or permission of instructor.

OCEAN 435 Biological Oceanography: Zooplankton and Nekton (3) Sp Ecology of pelagic animals. Distribution in time and space of secondary production in the pelagic realm. Methods of measurement. Zoogeography in the pelagic realm. Prerequisite: 434 or permission of instructor.

OCEAN 436 Biological Oceanography: Benthic Communities (4) A Inspection of the marine benthic domain, emphasizing subtidal, soft-bottom communities. Interrelationships between the water column and the seafloor. Adaptations of organisms, trophic relationships, and community structure. Prerequisite: 15 credits in biological sciences or permission of instructor.

OCEAN 438 Marine Microbiology (3) Taxonomy and symbiotic relationships of marine and estuarine microorganisms; metabolic activities, including nutrient cycles and geobiological activities; effects of environmental parameters and land-based intrusions; considerations of marine microbial activity. Prerequisites: BIOL 210, 211, 212, or equivalents and CHEM 231, 232, or equivalents.

OCEAN 439 Marine Microbiology Laboratory (2) Techniques for enumeration and isolation of marine microorganisms, heterotrophic activity measurements, anaerobic methods, and measuring dissolved oxygen; biochemical oxygen demand; effect of media and temperature on growth; marine metabolic activity measurement. Prerequisites: BIOL 210, 211, 212, or equivalents and CHEM 231, 232, or equivalents.

OCEAN 440 Instrumentation in Oceanography (3-6) Sp Introduction to the general principles of instrument design, including discussions of sensors, signal processing, telemetry, and recording from the point of view of the experimental scientist. Laboratory work, for variable credit, is offered in the form of projects, preferably practical ones resulting in the completion of a small hardware device.

OCEAN 443 Regional Oceanography (3) Sp Applications of modern methods to the comprehensive description of selected areas of the oceans.

OCEAN 450 Geophysical Oceanography (4) A Fundamentals of the seismic reflection and refraction, magnetic, gravity and heat-flow methods are discussed together with marine applications. Data from geophysical methods used in conjunction with petrological and other geological data to investigate (1) the composition, structure, and origin of the oceanic crust and upper mantle, and (2) tectonic processes acting in the earth. Prerequisites: major in geological oceanography or geology, MATH 126, or permission of instructor.

OCEAN 451 Marine Geochemistry (3) W Study of chemical aspects of more abundant minerals in marine sediments; origin or mode of formation; isotopic and chemical composition; rate of deposition; distribution and relative importance in major sedimentary cycle; influence on chemical composition of seawater. Prerequisite: one year of general chemistry.

OCEAN 452 Principles of Sediment Transport by Turbulent Flow (3) Introduction to theoretical and experimental techniques used in studying erosion, transportation, and deposition of sediment. Analysis of sediment samples, initial motion of sediments, bed-load motion, suspension of sediment by turbulent flows, erosion and deposition of sediment by turbulent flows, mass movement of sediments, and applications of sediment transport theory to problems of geological interest. Offered jointly with GEOL 452 and GPHYS 452. Prerequisite: GEOL 410.

OCEAN 453 Sedimentary History of the Ocean Basin: Data and Interpretation (3) Sp Criteria for selecting and evaluating data from a large data bank, the Deep Sea Drilling Project. Contrast with individual data; synthesis; student development of deep-sea sedimentologic interpretations, using geological literature, and presented as a series of written reports in journal style. Prerequisite: 450 or permission of instructor.

OCEAN 454 Biogenic Sediments I (3) W Survey of pelagic organisms found as deep-sea microfossils with regard to their use as paleoecological indicators and their application to correlating radiometrically and paleomagnetically dated sediments. Prerequisite: either 101 or GEOL 205, or permission of instructor.

OCEAN 457 Marine Sedimentation (3) Sp Origin, transportation, and deposition of marine sediments; marine sedimentary environments; physical aspects of marine sedimentary processes. Prerequisite: 402 or permission.

OCEAN 458 Chemical Aspects of Marine Sediments (3) W Laboratory exercises and lectures illustrating techniques and problems in marine geochemistry, especially the origin or mode of formation, the chemical composition, and the alteration after deposition of minerals in marine sediments. Prerequisites: one year of general chemistry and CHEM 321.

OCEAN 460 Field Experience in Oceanography (2 or 5, max. 7) WSp Offered in two parts. In Winter quarter students discuss field projects, then design fieldwork and plan cruises for 2 credits. In Spring or Summer quarter, students participate in cruises collecting the appropriate chemical, biological, geological, or physical data, followed by an analysis of the data, a report that includes the data and an interpretation of the results for 5 credits. One or more cruises may be required. Prerequisite: permission of instructor.

OCEAN 475 Biogeography (3) W Survey of modern and classical approaches to the problems of species geographic distributions. Prerequisite: BIOL 210; recommended: BIOL 472.

OCEAN 480 Undergraduate Research—Honors (6) Independent research. Prerequisites: 180 or 380, and permission of instructor.

OCEAN 485 Topics in Oceanography (1-4, max. 6) Series of weekly lectures. Physical and chemical properties of water, motions, life in the sea, geological features, data collection and analysis, etc. For nonmajors. Prerequisite: upper-division standing in science.

OCEAN 488 Field Experience—Honors (2-6, max. 6) Participation in extended oceanographic field operations on a research vessel, data analysis and reduction, report preparation. Prerequisites: 380 or 480, and permission of instructor.

OCEAN 489 Undergraduate Thesis—Honors (1-6, max. 6) Theoretical or experimental contribution to oceanography. Prerequisites: 480 and permission of instructor.

OCEAN 499 Undergraduate Research (1-12, max. 24) AWSpS Research on assigned topics that may involve laboratory work, fieldwork, or literature surveys. Prerequisite: permission of instructor.

Courses for Graduates Only

OCEAN 500 Current Problems in Oceanography (1) Discussion of research topics that are currently being investigated within the department. Prerequisite: permission of instructor.

OCEAN 501 Marine Geological Processes (5) A Overview of petrologic and sedimentologic processes that generate, modify, consume oceanic geologic record; plate-margin, midplate basalt genesis; hydrothermal metamorphism of oceanic crust; sediment sources, accumulation, postdepositional modification; passive margin sediment accumulation; trench subduction zones, basalts and andesites of oceanic island arcs; continental accretion. For first-year oceanography students. Prerequisite: permission of instructor.

OCEAN 506 Physics of Marine Geologic Processes (5) W Thermomechanics of hot material upwelling at spreading centers and formation of characteristic physical structures; lithosphere thickening with age and related geophysical observables; mechanics of subduction zones; fate of sinking slabs and deep-mantle recycling; geometry of plate tectonics on a sphere; causes of vertical motions at the earth's surface. Offered jointly with GPHYS 506. Prerequisite: permission of instructor.

OCEAN 511, 512, 513 Marine Hydrodynamics I, II, III (4,4,4) A,W,Sp Methods for solving problems in physical oceanography. Prerequisite: major standing in a physical science.

OCEAN 514 Seminar in Physical Oceanography (1, max. 9) AWSp Discussion of selected problems of current interest in physical oceanography. Prerequisites: 402 or 419, and permission of instructor.

OCEAN 515 Waves (4) A Application of marine hydrodynamics principles to wave motion in oceans. Prerequisite: 513. (Offered even-numbered years.)

OCEAN 516 Ocean Circulation (4) W Hydrodynamic theories concerning origin and characteristics of major ocean currents. Prerequisite: 513. (Offered even-numbered years.)

OCEAN 517 Oceanography of Inshore Waters (5) Sp Theories and techniques of investigation and interpretation of conditions existing in inshore waters with particular reference to mixing and flushing and to areas adjacent to the state of Washington; use of dynamic models. Prerequisite: 512. (Offered odd-numbered years.)

OCEAN 518 Seminar on Dynamical Oceanography (1, max. 9) AWSp Selected problems of current importance concerning the dynamics of the ocean. Concentrates on those topics that are considered fundamental and central of importance to most of the areas of applications.

OCEAN 519 Oceans and Climate Variation (3) Sp Interchange of heat, water, and energy; study of budgets and of mechanisms of exchange. Prerequisites: 418, ATM S 462. (Offered even-numbered years.)

OCEAN 520 Seminar (1) AWSp Introduction to current research topics for beginning graduate students.

OCEAN 521 Seminar on Chemical Oceanography (*, max. 9) AWSp Lectures, discussions, and readings on selected problems of current interest. Prerequisite: permission of instructor.

OCEAN 522 Radiochemical Tracers and Ocean Mixing (3) Distribution of natural and bomb-produced radioactive tracers in the ocean. Application of models used to derive information concerning time scales of (1) gas transfer at the water atmosphere interface; (2) whole ocean, thermocline, and deep-ocean water circulation; and (3) particulate settling in the marine environment. Knowledge of elementary differential equations suggested. Prerequisites: 401, 402, 421.

OCEAN 523 Advanced Problems in Chemical Oceanography (1-4, max. 18) AWSp Field and laboratory work on selected problems of current interest. Prerequisites: 424 and permission of instructor.

OCEAN 524 Marine Chemical Thermodynamics (3) W Application of chemical thermodynamic principles to the study of chemical processes and chemical reactions in the oceans. Thermodynamics of seawater (pressure, temperature, and volume changes), thermodynamics of multicomponent systems, general equilibrium theory, pressure and temperature effects on chemical equilibria, equilibrium models and calculation of complex equilibria. Prerequisites: CHEM 455, 456, 457, 460, or permission of instructor.

OCEAN 525 Marine Chemical Dynamics (3) Sp Application of reaction rate theory to the study of chemical processes not at equilibrium in the oceans. Nonequilibrium conditions in natural waters, transient states, basic kinetic theory, reaction rates at the air-sea and sediment-water interfaces, uptake and cycling rates of chemical species by biological systems. Prerequisites: 421, 422, CHEM 455, 456, 457, 460, or similar background.

OCEAN 526 Marine Organic Geochemistry (3) W Sources, reactions, and fates of organic molecules in the marine environment along with the stable isotope geochemistry of marine organic substances. Prerequisites: 421, CHEM 231, 232, or permission of instructor.

OCEAN 527 Marine Chemistry (3) Processes controlling the chemical composition of seawater. Physical chemistry and equilibrium concepts, biologically controlled cycles and kinetic concepts, and radioactive elements and rates of oceanic processes.

OCEAN 530 Marine Primary Productivity (3) Sp General concepts of marine phytoplankton production, laboratory and field studies, critical examination of special problems. Not open to students who have taken 534. Prerequisites: 433 or 434, and 435, and permission of instructor.

OCEAN 531 Seminar in Biological Oceanography (*, max. 9) AWSp Lectures, discussions, and work on selected problems of current interest. Prerequisite: permission of instructor.

OCEAN 533 Zooplankton Ecology (3 or 6, max. 9) S Sampling methods, population dynamics and energetics, community structure, and other current topics. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

OCEAN 534 Experimental Plankton Ecology (18) S Physiology, productivity, and ecology of bacteria, phytoplankton, and zooplankton, and their interactions with each other and the ocean. Laboratories, field trips, and independent projects focus on different themes each year. Enrollment limited to twelve students (offered at Friday Harbor Laboratories). Offered on credit/no credit basis only. Prerequisite: background in oceanography, aquatic sciences, or biology.

OCEAN 535 Advanced Plankton Ecology (2-4) A Methods of sampling and analysis of standing stock as affected by the ecology of plankton.

OCEAN 536 Benthos Ecology (3) Sp Distributions, abundances, and interrelationships of the organisms of the ocean floor; methods of sampling and analysis. Prerequisite: permission of instructor.

OCEAN 537 Environmental Physiology of Marine Microalgae (2-4) W Physiology and biochemistry of microalgae, with emphasis on marine systems; physiological approach in understanding phytoplankton processes in the ocean. Laboratory includes culturing methodology and techniques for the study of physiological processes relevant to phytoplankton ecology. Prerequisite: permission of instructor.

OCEAN 538 Identification and Structure of Marine Benthic Communities (2) Sp Sampling gear and sampling techniques; qualitative and quantitative methods for identification and ordination of communities; structure of benthic communities; biomass, productivity and benthos/fish relationships; historic review of benthos research. Prerequisite: permission of instructor.

OCEAN 540 Seminar in Geostatistics (1-3) AWSp Lectures and discussions on selected problems in the applications of statistics in earth science. Prerequisite: Q SCI 483.

OCEAN 541 Marine Reflection Seismology (3) Sp Principles of ocean reflection acoustics; effect of frequency on reflection coefficient and attenuation; bandwidth and resolution; sound sources; hydrophones, acoustic noise, tow noise; multichannel techniques; migration of reflectors; normal move out and wave-equation; physical basis and numerical methods. Offered jointly with GPHYS 541. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

OCEAN 542 Sediment Diagenesis and Maturation (3) W Changes in cold sediment undergoing deep burial and heating examined in terms of processes influencing porosity and permeability reduction, dewatering, chemical and mineralogical rearrangements. Near-surface diffusion processes, transformations of clay minerals, organic reactions and maturation phenomena stressed in tracing history of sedimentary strata undergoing temperature changes and time in sinking, filling sedimentary basins.

OCEAN 543 Petrogenesis and Geochemical Evolution of Marine Igneous Rocks (3) Sp Petrologic processes involved in generation and metamorphism of igneous rocks in oceanic basins. Emphasizing genesis of special petrotectonic assemblages, including ridge and "hot spot" basalts, oceanic islands, midplate volcanics, igneous sequences associated with oceanic island arcs. Includes geochemical characterization of important rock types. Prerequisites: 501, 506, GEOL 424 and 425 or equivalent, and permission of instructor.

OCEAN 544 Statistical Models in Oceanography (3) W Multivariate analysis: regression, trend surface analysis, factor analysis, discriminant functions, and stochastic process models in oceanography. Prerequisite: Q SCI 483 or permission of instructor.

OCEAN 545 Thermomechanics and Mechanisms in Hydrothermal Systems (3) W Thermal balance of hot material injected at a plate divergence; heat transport capability of fluid convection through cracks compared to thermal conduction; theory of hydrothermal penetration into hot rock by thermal contraction cracking; development history of a hydrothermal system; effects of rock/water chemical interaction and mineral deposition; mineral stills. Offered jointly with GPHYS 545. Prerequisite: permission of instructor.

OCEAN 548 Topics in Physical Oceanography (1-4, max. 9) AWSp Lecture series on topics of major importance in physical oceanography.

OCEAN 550 Seminar on Geological Oceanography (*, max. 9) AWSp Lectures, discussions, and field and laboratory work on selected problems of current interest. Prerequisite: permission of instructor.

OCEAN 551 Marine Sediments (2) Sp Topics in interpreting environmental significance of marine sediments. Prerequisite: permission of instructor.

OCEAN 554 Techniques for Ocean Floor Research (3) A Planning field programs; selection of equipment and survey procedures; collection, analysis, compilation, and presentation of bathymetric and sediment data; evaluation of techniques and results. Prerequisites: 450, 453 or 551, which may be taken concurrently.

OCEAN 556 Advanced Marine Geology and Geophysics (*, max. 9) AWSp Contemporary problems in marine geology; concepts supporting or at variance with accepted hypotheses; discussion of recent advances. Prerequisite: permission of instructor.

OCEAN 560 Mechanics of Erosion and Sediment Transport (3) A *Smith* Physics of erosion, deposition, and transportation of sediments by turbulent flows. use of theoretical fluid mechanics to formulate and solve problems of bed load and suspended load transport. Offered jointly with GEOL 560 and GPHYS 560. Prerequisites: 452 and MATH 329. (Offered odd-numbered years.)

OCEAN 561 Seminar in Geological Fluid Mechanics (3) W Reading and discussion of topics of current interest in geological fluid mechanics. Course work includes a report on a specialized topic. Offered jointly with GEOL 561 and GPHYS 561. Prerequisite: permission of instructor.

OCEAN 562 Mechanics of Sediment Transporting Flows (3) A *Smith* Comprehensive investigation of mechanics of turbulent, near-bottom flows responsible for erosion and transportation of sediment. How bed load and suspended load transport modify characteristics of these flows. Marine, estuarine, and fluvial systems. Offered jointly with GEOL 562 and GPHYS 562. Prerequisites: GEOL 452, 455. (Offered even-numbered years.)

OCEAN 570 Simulation Analysis of Marine Systems (3) Sp Introduction to the analytical methods of systems ecology. Simulation models are used in comparative analyses of the structure, nutrient and energy flow, and sensitivity of response in representative aquatic ecosystems. Prerequisites: BIOL 472, FORTRAN, MATH 126, Q SCI 482, or permission of instructor.

OCEAN 571 Gravity and Geomagnetic Interpretation (3) A Power of the numerical Fourier transform to compute potential fields; gravity and magnetic fields of source bodies of arbitrary shape; inversion of observational data to plausible source models; application of the techniques to a real problem on the computer. Offered jointly with GPHYS 571. Prerequisites: MATH 328, PHYS 323 or equivalents or permission of instructor.

OCEAN 572 Geodynamics (3) *Lister* Driving forces of plate tectonics and other large-scale motions. Critical review of measured data, energy balances, basic properties of low Reynolds number flow. Qualitative physics of processes and order-of-magnitude calculations, rather than complex mathematic theory. Critiques of some hypotheses. Offered jointly with GPHYS 572. (Offered odd-numbered years.)

OCEAN 573 Terrestrial Magnetism (3) Sp. Advanced aspects of earth magnetism intended for specialists in this field. Extensive discussion of origin theories and their implications; physical basis and theories of magnetism in rocks; paleomagnetic techniques and results. Offered jointly with GPHYS 573. Prerequisite: permission of instructor. (Offered alternate years.)

OCEAN 580 Marine Science in the Coastal Zone (4) Major oceanic and nearshore processes, conditions, and their influence on man's activities in coastal zone. Methods of understanding and accessing the accumulated knowledge on marine processes and its application to decision-making process. Lectures and discussions of biological, chemical, geological, and physical oceanography. Generation and use of data bases as interpretative tools.

OCEAN 600 Independent Study or Research (*) AWSpS

OCEAN 700 Master's Thesis (*) AWSpS

OCEAN 800 Doctoral Dissertation (*) AWSpS

School of Pharmacy

Dean

Milo Gibaldi
D341 Health Sciences

The School of Pharmacy prepares students to deliver distributive and consultative pharmaceutical services in a variety of settings, including community pharmacies, hospitals and other health-care institutions, the pharmaceutical industry, and governmental agencies. Students are trained in the biological, chemical, physical, and social sciences and in clinical and professional practice. Training programs lead to the Bachelor of Science in Pharmacy degree or to the Doctor of Pharmacy degree. Graduates meet the educational requirement for licensure in all fifty states, because the School of Pharmacy is fully accredited by the American Council on Pharmaceutical Education. The Washington State Board of Pharmacy awards a maximum of seven hundred hours of internship experience for designated academic practicum courses.

The School of Pharmacy is organized into departments of Medicinal Chemistry, Pharmaceutics, and Pharmacy Practice. Information about undergraduate programs and advising may be obtained from the Office of Academic and Student Programs, T329 Health Sciences. Clinical clerkship and institutional externship training sites are provided by Children's Orthopedic Hospital and Medical Center, Group Health Cooperative Hospital, Harborview Medical Center, Providence Medical Center, Swedish Medical Center, University Hospital, Veterans Administration Hospital, Virginia Mason Hospital, and other Seattle area hospitals. Students also are assigned to a variety of community practice pharmacy sites for externships.

Bachelor of Science in Pharmacy Degree

This program provides educational requirements for licensure to practice pharmacy. Admission to the three-year professional program requires a minimum of 90 credits of prepharmacy training, including a year's sequences in biology, general chemistry, and organic chemistry, as well as courses in calculus, English composition, and microbiology. Admission is competitive, based on academic achievement, communicative skills, and identifiable aptitude for pharmacy. An applicant who is admissible to the University is not necessarily assured of admission to the School of Pharmacy. Students are ordinarily admitted to the baccalaureate degree program only at the beginning of Autumn Quarter; the deadline for submission of applications is April 1. Details on admission requirements, application procedures, and program content can be obtained from the Office of Academic and Student Programs.

The baccalaureate degree program provides basic training on biological, chemical, and physical properties of drugs and on the clinical and practical aspects of drug utilization. Core courses are required in biochemistry, biopharmaceutics and pharmacokinetics, clinical pharmacy, drug dispensing, human physiology, immunizing and antibiotic agents, medicinal chemistry, pathology, pharmacology, pharmacy law, physical principles of drug formulation, and social aspects of pharmacy and drug use. In the third year of the professional program, students must complete a clinical clerkship and externships in community and institutional pharmacies. The 238 credits required for graduation include an opportunity for developing areas of individual expertise; at least half of the 55 elective credits must be professional in nature.

Pharmacy Practice

Chairperson

William H. Campbell

Doctor of Pharmacy Degree

The Department of Pharmacy Practice, in cooperation with the Department of Pharmacy Services of University Hospitals, directs a joint Doctor of Pharmacy and American Society of Hospital Pharmacists (ASHP) accredited residency program. This two-year postbaccalaureate program provides academic and clinical training in advanced pharmacy practice. Enrollment is limited to six students per year. Applicants must be graduates of an accredited school or college of pharmacy and must be eligible for licensure to practice pharmacy in the state of Washington. Admission is competitive, based on academic achievement, letters of recommendation, and a personal interview. Students are only admitted to the program starting on July 1 of each year. Applicants must register for the ASHP residency matching program by mid-December, and the Department of Pharmacy Practice must have received all application materials by January 15. Details on application procedures and program content can be obtained from Dr. Jeffrey R. Koup, the director of the Doctor of Pharmacy degree program, or by reading the brochure describing the Doctor of Pharmacy/Residency Program.

Students complete 50 credits in didactic courses including: advanced therapeutics, biostatistics, clinical pharmacokinetics, research methods, case conferences, and departmental seminars. Sufficient elective course opportunities exist to allow the student to develop specialized expertise. In addition, 2,080 hours (40 credits) are spent in clinical clerkships and residency rotations that are individually precepted by faculty members of the Department of Pharmacy Practice.

The residency component is completed at the University Hospital and at Harborview Medical Center under the guidance of the Director of Pharmacy Services, V. de Paul Burkhart. The residency consists of experience in clinical practice, drug distribution, and hospital pharmacy administration. An annual stipend is associated with the joint Pharm.D./Residency program.

Postgraduate Professional Pharmacy Program

Master of Public Health Degree

Students in the Department of Pharmacy Practice can earn the Master of Public Health degree through the School of Public Health and Community Medicine. Students complete an American Society of Hospital Pharmacy-accredited general residency concurrent with a two-year program of academic study. The academic portion is broad based, with a central theme of administration. Areas of training include health services, biostatistics, epidemiology, institutional administration, pharmacy administration, and advanced clinical pharmacy and therapeutics. This combination provides the student with a solid foundation for a career in institutional pharmacy administration and offers the opportunity for further career advancement in health services administration.

Enrollment is competitive and limited to a small number of students. Applicants must be graduates of an accredited school or college of pharmacy and be eligible for licensure as a pharmacist. Students are admitted to the program starting on July 1 of each year. Applicants should register for the American Society of Hospital Pharmacists residency matching program by mid-December and complete all application materials by January 31. Additional information is available from Dr. Dale Christensen, Department of Pharmacy Practice.

Medicinal Chemistry

Chairperson

Wendel L. Nelson

Graduate Program

Wendel L. Nelson, Graduate Program Coordinator

The Department of Medicinal Chemistry offers programs of graduate study leading to the degrees of Master of Science and Doctor of Philosophy. The primary area of research training of the Department of Medicinal Chemistry is in chemical and molecular aspects of drug action and of drug metabolism. Studies in the field include, for example, the relationship between chemical structure and biologic effect, function, and toxicity; delineation of the metabolic spectrum of drugs or foreign substances in man and animals; and the factors (environmental, disease, etc.) that affect this spectrum of metabolites, the study of the nature and catalytic properties of the enzymes responsible for metabolic reactions, and the molecular mechanisms by which such reactions occur.

Graduates from the program must possess the necessary skills to develop quantitative and qualitative methodologies to pursue studies at the whole animal, organ, microsomal, or purified enzyme level; to elucidate and evaluate the chemical transformations that occur in metabolic processes by isolation, purification, spectroscopic investigation, structural determination, and chemical synthesis; and ultimately to provide an understanding and rationale at the molecular level for events that occur at the biological level.

When substantive information is available, permission may be granted for the student to bypass the master's degree and proceed directly to the doctoral program. Evidence of reading competence in one foreign language (French, German, Japanese, or Russian) is required of all graduate students, and a student who has not satisfied this requirement prior to admission is expected to do so at the earliest opportunity. Participation in a cumulative examination process and at least two quarters of teaching experience are additional requirements for the Ph.D. program.

Admission Requirements

Students who intend to work toward a Master of Science or Doctor of Philosophy degree must apply for admission to the Graduate School and meet the requirements outlined in the graduate study section of this catalog. Graduate students must satisfy the requirements for an advanced degree in force at the time the degree is to be awarded. Graduate study requires approval of the Graduate School and the Department of Medicinal Chemistry.

Special Requirements

Students with undergraduate degrees in pharmacy or in the biological or physical sciences are accepted for graduate study in medicinal chemistry. Undergraduates who plan to pursue graduate study may expedite their programs by selection of pertinent electives. Although the choice of electives varies with the student's ultimate goals, graduate study in medicinal chemistry requires adequate preparation in mathematics and in the biological and physical sciences.

Master of Science Degree

A student in the M.S. degree program must present at least 27 credits of course work, exclusive of thesis and nonthesis research. The student also must complete a research project, prepare an acceptable thesis, and pass a final examination.

Doctor of Philosophy Degree

A student in the Ph.D. program must present a minimum of 45 credits of course work, exclusive of dissertation and nonthesis research. Credits earned for the master's degree may be applied toward the doctoral degree. The student must pass a General Examination for admission to candidacy for the doctoral degree, complete a research project, prepare an acceptable dissertation, and pass a Final Examination. Research for the doctoral degree must be done at this university.

Financial Aid

Financial support in the form of research assistantships and fellowships may be available to students in good standing throughout their graduate careers. Availability of financial support varies from year to year, and prospective applicants should contact the graduate program coordinator for additional information.

Correspondence and Information

Graduate Program Coordinator
305A Bagley, BG-20

Pharmaceutics

Chairperson

René H. Levy

Graduate Program

René H. Levy, Graduate Program Coordinator

The Department of Pharmaceutics offers programs of graduate study leading to the degrees of Master of Science and Doctor of Philosophy.

Program Description

These programs train research scholars in the fundamental aspects of drug disposition and action in animals and man. Graduates possess expertise in quantitative analytical techniques and in the elaboration of mathematical models to describe the various processes of pharmacokinetics (drug absorption, distribution, and elimination). Scientists graduating from this program assume positions in academia, pharmaceutical industry, or various government research institutions. Didactic training for the doctoral program includes courses in advanced pharmaceutics, mathematics, biostatistics, computer science, drug analysis, and metabolism. After the first year, permission may be granted for students to bypass the master's degree and proceed directly to the doctoral program.

Admission Qualifications

Students with undergraduate degrees in pharmacy or in the biological or physical sciences are accepted for graduate study in pharmaceutics. Undergraduates who plan to pursue graduate study may expedite their programs by selection of pertinent electives.

Financial Aid

Financial support in the form of teaching or research assistantships and fellowships may be available to students in good standing throughout their graduate careers. Prospective applicants should contact the graduate program coordinator for additional information.

Correspondence and Information

Graduate Program Coordinator
303 Bagley, BG-20

Faculty

Professors

Brady, Lynn R.,* (Medicinal Chemistry), Ph.D., 1959, Washington; pharmacognosy.

Campbell, William H.,* (Pharmacy Practice), Ph.D., 1971, Purdue; pharmacy administration.

Fischer, Louis (Emeritus), (Medicinal Chemistry), Ph.D., 1933, Washington; medicinal chemistry.

Gibaldi, Milo,* (Pharmaceutics), Ph.D., 1963, Columbia; pharmacokinetics.

Hall, Nathan A. (Emeritus), (Pharmacy Practice), Ph.D., 1948, Washington; pharmacy practice.

Hammarlund, E. Roy (Emeritus), (Pharmaceutics), Ph.D., 1951, Washington; pharmaceutics.

Huitric, Alain C. (Emeritus), (Medicinal Chemistry), Ph.D., 1954, California; medicinal chemistry.

Krupski, Edward (Emeritus), (Medicinal Chemistry), Ph.D., 1949, Washington; pharmaceutical sciences.

Levy, René H.,* (Pharmaceutics), Ph.D., 1970, California (San Francisco); pharmacokinetics.

McCarthy, Walter C. (Emeritus), (Medicinal Chemistry), Ph.D., 1949, Indiana; medicinal chemistry.

Nelson, Sidney D., Jr.,* (Medicinal Chemistry), Ph.D., 1974, California (San Francisco); medicinal chemistry.

Nelson, Wendel L.,* (Medicinal Chemistry), Ph.D., 1965, Kansas; medicinal chemistry.

Orr, Jack E. (Emeritus), (Pharmacy Practice), Ph.D., 1943, Wisconsin; pharmacy practice.

Plein, Elmer M. (Emeritus), (Pharmacy Practice), Ph.D., 1936, Colorado; pharmacy practice.

Plein, Joy B.,* (Pharmacy Practice), Ph.D., 1956, Washington; geriatrics, interdisciplinary programs.

Trager, William F.,* (Medicinal Chemistry), Ph.D., 1965, Washington; medicinal chemistry.

Associate Professors

Baillie, Thomas A.,* (Medicinal Chemistry), Ph.D., 1973, Glasgow (Scotland); medicinal chemistry.

Burkhart, V. de Paul, (Pharmacy Practice), M.S., 1972, Maryland; hospital pharmacy.

Christensen, Dale B.,* (Pharmacy Practice), Ph.D., 1977, Minnesota; pharmacy administration.

Elmer, Gary W.,* (Medicinal Chemistry), Ph.D., 1970, Rutgers; pharmacognosy.

Ivey, Marianne, (Pharmacy Practice), B.S.Pharm., 1967, Wisconsin; hospital pharmacy.

Koup, Jeffrey, (Pharmacy Practice), Pharm.D., 1974, State University of New York (Buffalo); clinical pharmacokinetics.

Kradjan, Wayne A.,* (Pharmacy Practice), Pharm.D., 1970, California (San Francisco); clinical pharmacy.

Shen, Danny D.,* (Pharmaceutics), Ph.D., 1975, State University of New York (Buffalo); pharmaceutics.

Assistant Professors

Bauer, Larry A.,* (Pharmacy Practice), Pharm.D., 1980, Kentucky; clinical pharmacy.

Edwards, W. Drew, (Pharmacy Practice), M.S., 1971, Wisconsin; gastroenterology, management.

Ellsworth, Allan J., (Pharmacy Practice), Pharm.D., 1977, Philadelphia College of Pharmacy and Science; clinical pharmacy.

Horn, John M., (Pharmacy Practice), Pharm.D., 1977, Cincinnati; clinical pharmacy.

Malone, Patrick M., (Pharmacy Practice), Pharm.D., 1979, Michigan; clinical pharmacy.

Meier, G. Patrick, (Medicinal Chemistry), Ph.D., 1981, Wisconsin; organic chemistry.

Slattery, John T.,* (Pharmaceutics), Ph.D., 1978, State University of New York (Buffalo); pharmacokinetics.

Teng, Lin-nar (Research), (Medicinal Chemistry), Ph.D., 1970, Washington; medicinal chemistry.

Toothaker, Roger,* (Pharmaceutics), Ph.D., 1981, Wisconsin; pharmacokinetics.

Instructors

Black, Douglas J., (Pharmacy Practice), Pharm.D., 1983, Washington; pharmacy practice.

Brennan, Cynthia F., (Pharmacy Practice), Pharm.D., 1980, Southern California; pharmacy practice.

Miller, Sheree A., (Pharmacy Practice), Pharm.D., 1983, Washington; pharmacy practice.

Lecturers

Davis, Paul W., (Pharmacy Practice), Ph.D., 1966, Michigan; pharmacology.

Dawson, Karan N., (Pharmacy Practice), M.S., 1978, Washington; continuing education.

Fassett, William E., (Pharmacy Practice), M.B.A., 1983, Puget Sound; practice management/marketing.

Howald, William N., (Medicinal Chemistry), B.S., 1967, Washington; chemistry.

Jones, Lillie L., (Pharmacy Practice), B.S.Pharm., 1960, Washington; pharmacy practice.

Taniguchi, Theodore, (Pharmacy Practice), M.S., 1951, Michigan; hospital pharmacy.

Course Descriptions

Courses for Undergraduates

Medicinal Chemistry

MEDCH 350 Medicinal and Poisonous Plants (3) A *Brady* Review of the history/ethnobotany, chemistry, and physiological activity of selected higher plants that are used medicinally or are poisonous. A perspective for the current popular use of herbal remedies is provided. For majors and advanced-level nonmajors. Prerequisite: BIOL 212 or equivalent.

MEDCH 400 Biophysical Medicinal Chemistry (2) Sp *Trager* Principles of physical organic chemistry; chemical bonding, stereochemistry, acids/bases, and reaction mechanisms relevant to processes of drug distribution, binding, specificity, metabolism, and elimination. Prerequisite: CHEM 236.

MEDCH 413 Immunizing and Antimicrobial Agents (3) Sp *Brady, Elmer* Chemical and biologic properties of agents used to prevent or treat infectious diseases, including diagnostic prophylactic, and therapeutic uses of immunizing biologicals and spectrum, action mechanisms, resistance patterns, toxicity, and therapeutic applications of antibiotics. Prerequisites: MICRO 301, 302.

MEDCH 435 Diagnostic Medicinal Chemistry (3) W *Edwards, S. Nelson* Examination of clinical diagnostic tests with regard to the chemical or biochemical rationale of the testing method, interpretation of test results, and major factors influencing test values with special emphasis on the effects of medications. Clinical laboratory data from patients considered in light of these factors. Prerequisite: BIOC 406.

MEDCH 440, 441, 442 Medicinal Chemistry (3,3,3) A,W,Sp *Baillie, Elmer, Meier, S. Nelson, W. Nelson, Trager* Study of the various classes of medicinal compounds with particular emphasis on biological activity, mechanism of action, biotransformation, and the structural and physical properties governing absorption, distribution, and excretion. Prerequisites: CHEM 236 and P BIO 360.

MEDCH 490 Metabolism of Drugs (3) W *Baillie, Trager* Processes of drug metabolism, their mechanisms, and their implications in modern therapy. Bioactivation of prodrugs and biotransformations in the inactivation and elimination of drugs, and the relationship to drug toxicity and drug design. Prerequisite: CHEM 236 or equivalent.

MEDCH 499 Undergraduate Research (*, max. 6) AWSpS Research problems in medicinal chemistry, pharmaceutical chemistry and pharmacognosy. Prerequisites: cumulative grade-point average of 2.50 and permission of instructor.

Pharmaceutics

PCEUT 310 Drugs in Our Society (3) S Designed to develop a general knowledge of drugs and an understanding of their proper use. Discussion of drug problems and methods for their control. For nonmajors only.

PCEUT 311 Drugs in Our Society: Special Projects (2) S For nonmajors only. The student undertakes a worthwhile in-depth project on some aspect of drug-abuse prevention or education and submits a satisfactory report in the form of a term paper on the findings of the study. Prerequisites: 310, which may be taken concurrently, and permission of instructor.

PCEUT 331 General and Physical Principles (4) A *Toothaker* Introduction to scientific bases of pharmacy, with emphasis on physical processes important in the manufacture, stability, and characteristics of various drug dosage forms. Prerequisite: CHEM 236.

PCEUT 332 Pharmacy Compounding (2) W Extemporaneously compounding pharmaceutical dosage forms. Theory and problems involved in incorporating chemicals into forms suitable for administration in human medication and stable enough to be transported and stored. Prerequisites: 331, PHARM 333, which may be taken concurrently.

PCEUT 405 Biopharmaceutics and Pharmacokinetics (3) A *Slattery* Drug release from dosage forms, absorption from different routes of administration, the resulting concentration time curves in blood and urine, and the role of these factors in bioavailability and drug product selection. Prerequisites: PHARM 333, 369.

PCEUT 406 Clinical Pharmacokinetics (4) W *Levy* Basic principles of pharmacokinetics and their application to the clinical setting, including: single-dose intravenous and oral kinetics, multiple dosing, nonlinear pharmacokinetics, determination of patient-specific dosage regimens, role of disease in drug requirements for the major pharmacologic classes of drugs, and mechanisms and importance of drug requirements. Prerequisite: 405.

PCEUT 499 Undergraduate Research (*, max. 6) AWSpS Research problems in biopharmaceutics and clinical pharmacokinetics. Prerequisites: cumulative grade-point average of 2.50 and permission of instructor.

Pharmacy Practice

PHARM 301 Drugs and Your Health (3) Sp *Dawson, Staff* Consumer-oriented approach addressing a broad range of health-related issues, emphasizing rational use of prescription and nonprescription medications. Topics include general health care, how to use drugs appropriately, economic factors that impact upon health care, and use of self-help medications. Offered on credit/no credit basis only.

PHARM 304 Profession of Pharmacy (3) A Overview of the profession of pharmacy emphasizing practice opportunities; specializations; professional associations and publications; laws; ethics and professionalism; terminology; and basic pharmacotherapeutics of prescription and nonprescription drugs. Prerequisite: pharmacy majors; prepharmacy students by permission of instructor.

PHARM 305 Clinical Dispensing Pharmacy (1-3, max. 3) AWSpS Preparation and dispensing of prescriptions at Rubenstein Memorial Pharmacy in Hall Health Center and University Hospital outpatient pharmacy. For students with little or no experience in pharmacy wishing experience prior to internship, externship, or didactic course work. Under direct supervision of the Student Health Service pharmacist and University Hospital pharmacists. Offered on credit/no credit basis only. Prerequisites: pharmacy major and permission of instructor.

PHARM 315 Introduction to Pharmacotherapeutics (3) W *Plein* Drug therapy, principles of pharmacology; pharmacologic-therapeutic classes of drugs; clinically important prototype drugs; drug information resources. Recommended: prior or concurrent courses in anatomy, physiology, and microbiology.

PHARM 330 Pharmaceutical Calculations (1) A Self-study workshop reviewing practical calculations used in pharmacy. Offered on credit/no credit basis only. Prerequisite: first-year standing.

PHARM 333 Dispensing Practice (3) W *Fassett* Dispensing of drug products on prescription order. Includes laboratory exercises, patient drug profiles, and patient counseling. Familiarization with commercial drug products. Prerequisites: 330 and competency in pharmaceutical calculations.

PHARM 340 Pharmacy, Health, and Society (3) A *Campbell* Overview of the health-care system, with an emphasis on factors of financing, organization, and patterns of use of pharmacy services; contemporary health issues, such as cost control, quality insurance, and national health insurance; and implications to pharmacy. Prerequisite: pharmacy major.

PHARM 389 Pharmacy Experience Project I (PEP I) (1) A *Fassett* Role of a pharmacist in practice. Overview of drug action. Students complete a practice-related project in a community or hospital pharmacy and complete a self-instructional program on introductory pharmacodynamics and pharmacokinetics. Offered on credit/no credit basis only. Prerequisite: pharmacy major standing.

PHARM 409 Applied Pharmacokinetics (2) Sp *Bauer* Pharmacokinetics of specific drugs. Influence of age, weight, sex, and disease states on patient-specific dosage regimens. Advanced kinetic concepts. Prerequisite: PCEUT 406 or permission of instructor.

PHARM 411 Non-Drug Products (3) Sp *Fassett* Study of medical devices commonly provided by pharmacists to their patients, including their selection and adaptation for specific patient needs. Lectures include display and demonstration of actual devices. Enrollment limited. Prerequisite: 333.

PHARM 412 Nonprescription Drugs and Self-Care (3) A *Fassett, Plein,* Pharmacist's counseling on self-care and use of nonprescription medications. Patient assessment, selection of nonprescription products if appropriate, advice to patients. Prerequisite: 484, which may be taken concurrently.

PHARM 413 Health Supports and Appliances Laboratory (1) Sp *Fassett* Laboratory experience to supplement 411 for those intending to include health supports and appliance fittings in their practice. Selecting and fitting medical and surgical appliances pursuant to physicians' prescriptions. Standards of national pharmacy certifying boards followed in grading. Offered on credit/no credit basis only. Prerequisite: 411, to be taken concurrently.

PHARM 435 Social and Behavioral Aspects of Pharmacy Practice (3) W *Christensen* Overview of health, illness, and sick-role behavior, patterns of drug prescribing and use, drug-taking compliance, the aging process and drug services for the elderly. Practice-based communication techniques and skills presented, demonstrated, and practiced. Prerequisite: pharmacy major standing.

PHARM 450 Pharmacy Laws (3) A *Taniguchi* Study of the laws regulating the practice of pharmacy. These include federal, state, and municipal laws and professional ethics.

PHARM 452 Contemporary Problems (1) WSp Discussion of current trends affecting the role of pharmacy in health-care delivery. Offered on credit/no credit basis only. Prerequisite: third-year standing.

PHARM 460 Principles of Professional Practice Management (3) W *Campbell, Christensen* Topics include organization of time and objectives, management of financial resources, management of inventory, and marketing management. Emphasis on developing specific skills, such as burden rate analysis, and financial ratio analysis. Primarily for students who are interested in managerial careers in community pharmacy practice. Prerequisite: 340.

PHARM 461 Seminar in Professional Practice Management (3) Sp *Campbell, Christensen* Selected application of management skills in pharmacy. Practitioners discuss third-party reimbursement programs, inventory control, and professional communications. Individual speakers are selected on the basis of demonstrated expertise in one or more areas of pharmacy management. Seminar format. Prerequisite: 460 or permission of instructor.

PHARM 465 Computer Applications in Pharmacy Practice (2) A *Fassett, Koup* Computer applications in pharmacy practice. Microcomputers, including elementary computer concepts, with introduction to programming (Applesoft/Microsoft BASIC) and applications (e.g., GPSS, RIM) languages. Programs used in clinical and administrative pharmacy functions (kinetics, prescription processing, and similar applications). Recommended: 460 and third-professional-year standing.

PHARM 470 Externship in Community Practice (8) Closely supervised study-experience periods in community pharmacies. Students rotate through two periods of five weeks each and participate in active community pharmacy under the supervision of clinical preceptor. Conferences on selected topics supplement work experience. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PHARM 471 Externship in Institutional Practice (4) Closely supervised study-experience periods in hospital or other institutional pharmacies. Students rotate through two periods of five weeks each and participate in active institutional pharmacy under supervision of clinical preceptor. Conferences on selected topics supplement work experience. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PHARM 472 Advanced Externship in Pharmacy Practice (*, max. 16) Advanced level externship in pharmacy in a community, institutional, long-term care, or specialty practice setting under direct supervision of a clinical preceptor. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

PHARM 481 Introduction to Clinical Pharmacy (3) W Consideration of principles of patient monitoring and provision of drug information. Instruction in approaching a patient chart, interviewing patients, and medication counseling techniques. Consideration of variables affecting patient behavior. Prerequisites: PHCOL 401, 402.

PHARM 483 Introduction to Hospital Pharmacy (2) W *Burkhart* Practice of hospital pharmacy, systems utilized, and basis they provide for patient care. Prerequisite: third-professional-year standing.

PHARM 484 Clinical Pharmacy (4) Sp Clinical roles of the pharmacist and study of more common diseases and their drug therapy. Methods of drug therapy monitoring, drug histories, laboratory tests, drug administration, and case method studies of drug therapy. The pharmacist's professional responsibilities for inpatient and outpatient care. Prerequisites: 481.

PHARM 485 Clinical Pharmacy (3) A Continuation of 484 with emphasis on disease states and their drug therapies. Lectures stress assessment of drug therapy and application of basic pharmaceutical sciences to selection of drugs in patient care. Prerequisite: 484.

PHARM 487 Clinical Pharmacy Clerkship (4) AWSpS Supervised experience in the clinical roles of pharmacy practice. Students participate in daily rounds, take drug-use histories, monitor drug therapy of patients, instruct patients about discharge medications, and provide drug therapy consultation to other health-care professionals. Offered on credit/no credit basis only. Prerequisites: 481, 484, and permission of instructor.

PHARM 488 Advanced Clinical Pharmacy Clerkship (*, max. 16) Advanced-level clinical pharmacy experience in institutional (hospital, nursing home, long-term care facility) and ambulatory patient-care facilities under direct supervision of a clinical preceptor. Offered on credit/no credit basis only. Prerequisites: 487, permission of instructor.

PHARM 489 Drug Information (4-8) AWSpS *Malone* Supervised experience in performing clinical roles of pharmacist relating to retrieval and analysis of drug information from library resources; preparation of answers to consultation requests presented to Drug Information Service; techniques of preparing written and verbal drug information reports; participation in preparation of a pharmacy newsletter. Prerequisite: permission of instructor.

PHARM 490 Fluid and Electrolytes and Parenteral Nutrition (2) Sp *Edwards, Ivey* Principles of fluid and electrolyte therapy, including saline, water, and acid-base balance. Carbohydrate, protein, lipid, vitamin, and mineral requirements in parenteral nutrition. Nutritional assessment, complications of parenteral nutrition, stability and compatibility of intravenous solutions, modifications of parenteral nutrition in pediatrics and specific disease states. Prerequisite: 481.

PHARM 492 Pharmaceutical Services for Long-Term Care (2) W *Plein* Scope of pharmaceutical services for long-term care (LTC) and systems for services. Responsibilities of the pharmacist for distributive, administrative, and clinical pharmacy services for nursing homes and other long-term care facilities. Economic considerations in provision of LTC pharmaceutical services. Role of the consultant pharmacist for home-health-care organizations. Pharmaceutical services for independently living elderly. Prerequisite: pharmacy major standing.

PHARM 495 Special Studies in Pharmacy (*, max. 6) AWSpS Special studies of professional topics in pharmacy. An opportunity to expand the breadth and depth of understanding in specific pharmaceutical areas. Students usually undertake independent study under the individual direction of a faculty member. Prerequisite: permission of instructor.

PHARM 499 Undergraduate Research (*, max. 6) AWSpS Pharmaceutical research problems. Prerequisites: cumulative grade-point average of 2.50 and permission of instructor.

Courses for Graduates Only

Medicinal Chemistry

MEDCH 501, 502, 503 Advanced Medicinal Chemistry (4,4,4) A,W,Sp *Baillie, Elmer, Meier, S. Nelson, W. Nelson, Trager* Advanced study of the various classes of medicinal compounds, with particular emphasis on biological activity, mechanism of action, biotransformation, and the structural and physical properties governing absorption, distribution, and excretion. Prerequisite: permission of instructor.

MEDCH 520 Seminar (1, max. 5) AWSp Graduate students attend seminars and make one formal presentation per year while in residence; 1 credit per year is allowed. Offered on credit/no credit basis only.

MEDCH 521, 522 Advanced Medicinal Chemistry (3,3) W,Sp *Baillie, Elmer, Meier, S. Nelson, W. Nelson, Trager* Application of integrated data from the physical and biological sciences to problems of chemotherapy, including transport of drugs to site of action, biotransformation of drugs, interaction of drugs with enzyme systems, and recent advances in drug design. Prerequisites: CHEM 457, 531, and BIOC 442, or permission of instructor.

MEDCH 527 Drug Metabolism (3) W *Juchau, Nelson* Considerations of the biochemical mechanisms for the biotransformation of drugs and foreign compounds. Includes reaction mechanisms, ultrastructural considerations, induction mechanisms, methodology, kinetics of inhibition and activation, steroid and amine metabolism. Offered jointly with PHCOL 527. (Offered alternate years; offered 1984-85.)

MEDCH 582 Topics in Medicinal Chemistry (1, max. 10) AWSp Discussion of pertinent articles from current literature. Offered on credit/no credit basis only.

MEDCH 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

MEDCH 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

MEDCH 800 Doctoral Dissertation (*) Offered on credit/no credit basis only.

Pharmaceutics

PCEUT 501 Advanced Pharmacokinetics (4) S *Gibaldi* Drug absorption, distribution, excretion, metabolism, and effects in mammalian systems. Compartmental model and model-independent approaches examined. Drug disposition is studied in a physiologically realistic context taking nonlinear events into account. Aimed at development of innovative methods for data analysis and evaluation in biological systems. Prerequisites: 405 and 406 or equivalent, introductory calculus.

PCEUT 506 Pharmacokinetics (2) W Discussion format in which students are given reading assignments prior to class in the area of basic pharmacokinetics and examined orally over the material in class. Offered on credit/no credit basis only. Prerequisite: 406.

PCEUT 520 Seminar (1, max. 5) AWSpS Graduate students attend seminars and make one formal presentation per year while in residence; 1 credit per year is allowed. Offered on credit/no credit basis only.

PCEUT 524 Advanced Pharmaceutics (2) Sp *Toothaker* Theoretical concepts in physical pharmacy with applications to pharmaceutical systems. Mass transport, reaction kinetics, surface phenomena, rheology, solid dosage forms, and sustained-release drug delivery. Prerequisite: CHEM 456.

PCEUT 583 Topics in Pharmaceutics (1, max. 15) AWSp Discussion of pertinent articles from current literature and recent laboratory results. Offered on credit/no credit basis only.

PCEUT 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

PCEUT 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only.

PCEUT 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only.

Pharmacy Practice

PHARM 505 Clinical Pharmacokinetics (3) W *Koup* Clinically oriented introduction to advanced pharmacokinetic theories. Didactic presentation of the above materials of particular drugs or classes of drugs. Prerequisites: 484, 530, PCEUT 405, and permission of instructor.

PHARM 506 Clinical Pharmacokinetics (3) Sp *Koup* Continuation of 505. Discussion sessions regarding the pharmacokinetics of a drug or class of drugs are required. An original research proposal developed by each student and presented in class. Prerequisites: 484, 530, 505, PCEUT 405, and permission of instructor.

PHARM 507 Topics in Clinical Pharmacokinetics (1, max. 12) AWSp *Gibaldi* New and important findings and trends in pharmacokinetics, biopharmaceutics, drug metabolism, and drug toxicity, with particular emphasis on clinical significance and applicability. Offered on credit/no credit basis only. Prerequisite: PCEUT 405 or equivalent.

PHARM 520 Seminar (1, max. 5) AWSp Graduate students must attend seminars and make one formal presentation per year while in residence; 1 credit per year is allowed. Offered on credit/no credit basis only.

PHARM 530 Seminar: Research Methods in Pharmacy Practice (3) Sp *Christensen* Research methods and protocols designed to help develop skills in preparing research proposals and conducting research in pharmacy practice. Selected research methods, sources of data, analysis designs, and statistical methodologies. Prerequisites: graduate standing in pharmacy; one statistics course or permission of instructor.

PHARM 550 Pharmacotherapeutics for Older Adults (2) W *Plein* Clinical use of drugs for older adults. Discussions of current knowledge of age-related pharmacokinetics, pharmacodynamics, and pharmacotherapeutics as applied to selecting and monitoring drug regimens for elderly patients. Includes problem solving regarding drugs of choice for older people with multiple pathologies requiring multiple-drug treatment. For advanced pharmacy students and others with backgrounds in pharmacotherapeutics. Prerequisite: 485 or equivalent.

PHARM 582 Primary Care Pharmacy II (2) A *Erickson, Fuller, Kradjan* Introduction to the use of protocols for monitoring chronic disease states, with practice in development of specific protocols for anticoagulation, diabetes, hypertension, and others. Prerequisite: permission of instructor.

PHARM 583 Advanced Clinical Pharmacy and Therapeutics I (5) Lecture-discussion format with extensive reading assignments for each topic. Disease states with current therapeutic approaches are the major emphasis. Infectious diseases, oncology and chemotherapy, and gastrointestinal diseases are covered. Prerequisite: graduate standing in pharmacy practice.

PHARM 584 Advanced Clinical Pharmacy and Therapeutics II (5) Lecture-discussion format with extensive reading assignments for each topic. Basic disease states with current therapeutic approaches are the major emphasis. Cardiovascular diseases, psychiatry and psychotropics, pulmonary diseases, renal diseases, and fluid and electrolytes are covered. Prerequisite: 583.

PHARM 585 Advanced Clinical Pharmacy and Therapeutics III (5) Lecture-discussion-demonstration format with extensive reading assignments for each topic. Basic assessment skills important to the advanced pharmacy practitioner, protocol development and implementation, neurological diseases, endocrine diseases, obstetrics and gynecology, pediatrics, and geriatrics. Prerequisites: 584.

PHARM 587 Advanced Clinical Clerkship: Inpatient Care (*, max. 15) AWSpS Under faculty supervision, students participate in medical and pharmacy patient rounds in hospitals or long-term-care facilities, monitor drug therapy, instruct patients concerning proper use of medications, and provide drug consultation to other health-care providers. Offered on credit/no credit basis only. Prerequisites: 484, 485, or equivalent, and permission of instructor.

PHARM 588 Advanced Clinical Clerkship: Outpatient Care (*, max. 15) AWSpS Under faculty supervision, students refine skills in developing and maintaining a drug-use data base for ambulatory patients. Activities include taking drug histories, developing patient medication profiles, and documenting drug-use experience. Offered on credit/no credit basis only. Prerequisites: 484, 485, or equivalent, and permission of instructor.

PHARM 589 Advanced Clinical Clerkship: Drug Information Services (*, max. 15) AWSpS Under faculty supervision, students refine skills in the retrieval, analysis, and clinical use of drug information from library resources. Students receive training in the Drug Information Service, where they receive and respond to information requests. Offered on credit/no credit basis only. Prerequisites: 484, 485, or equivalent, and permission of instructor.

PHARM 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only.

Graduate School of Public Affairs

Dean

Hubert G. Locke
M253 Smith

The Graduate School of Public Affairs is a graduate professional school providing education and research for the public service. The school offers a program of study leading to the degree of Master of Public Administration, designed to prepare professional practitioners of management and policy analysis for all levels and areas of the public service. Graduates serve throughout the public sector as foreign service officers; city managers; city and county administrative officers; staff assistants to elected officials; program and policy analysts with budget offices, legislative staff units, and city and county councils; administrators for the performing arts; and line and staff officers for a multitude of state and federal agencies. In addition, a number of alumni are employed in the private and not-for-profit sectors, although usually in positions that involve substantial and continuing contact with the public sector.

Master of Public Administration Degree

The degree of Master of Public Administration is awarded upon satisfactory completion of 60 credits of course work, including a degree project. Students without prior public service work experience also are expected to complete a supervised twelve-week internship. The program normally requires two full academic years, and, for those requiring an internship, the intervening summer. Foreign-language proficiency or thesis is not required for the M.P.A. degree.

Program of Study

The school's curriculum provides a flexible framework within which students can develop a program of study consistent with their previous training, experience, and career goals. All students are required to complete a core curriculum of seven one-quarter courses (3 credits each) covering political institutions and processes, economic and social institutions and processes, techniques of analysis, organizational and administrative concepts, and the management of human and financial resources. After completion of the core course requirements, students are assisted, through advising, in utilizing their remaining courses to advance their respective career objectives. In so doing, students are encouraged to select a functional field of concentration consisting of a minimum of four courses in a given area, such as personnel and labor relations, budget and finance, organizational development, health policy, social welfare, urban affairs, natural resources, science policy, law and justice, education, or international affairs. With the approval of the program adviser, the student selects courses from those offered by the school and by other University units. Central to the program are courses offered by numerous other schools and colleges throughout the University, and courses taught by cooperating and participating faculty serve as an integral part of the school's curriculum.

In addition to the basic course work and internship, students have the opportunity to participate in seminars at which distinguished public servants appear, in workshops, in conferences sponsored by the school, and in the activities of the Institute for Public Policy and Management.

Midcareer Education

A substantial number of students in the school are public servants with several years of public service who, on a part- or full-time basis, take graduate work at midcareer to prepare themselves for new and broader policy and managerial responsibilities. The University is one of eight institutions participating in the Education for Public Management program sponsored by the U.S. Office of Personnel Management. Under this program, a number of state and federal officials enroll each year in the Graduate School of Public Affairs for a special midcareer educational program emphasizing the administration of public policy.

Tribal Administration Program

The Graduate School of Public Affairs, in cooperation with the United Indians of All Tribes Foundation, has developed a Tribal Administration Program leading to a Master of Public Administration degree. The program combines the core of the existing M.P.A. program with course work and experiences directed at the specific needs of tribal and native corporation administrators.

Institute for Public Policy and Management

The Institute for Public Policy and Management constitutes the major research arm of the school. It performs a variety of roles concerned with problems of public policy and administration in the state of Washington, the Pacific Northwest, and the United States. The Institute develops and administers programs to increase opportunities for cooperative interdisciplinary research by faculty and graduate students on problems of public policy that have lasting significance. The Institute publishes quarterly *Washington Public Policy Notes*, which is distributed to more than two thousand officials and organizations, as well as occasional papers, monographs, and reports. The Institute also sponsors workshops, conferences, and symposia to enhance the abilities of those in the public sector and in the community at large to understand and address major public policy issues and to make public management decisions.

Admission Requirements

Admission to the program requires formal application to the University of Washington Graduate School and to the Graduate School of Public Affairs. The school invites applications from students with such varied academic backgrounds as political science, economics, business administration, history, philosophy, social work, engineering, public health, or other fields in the social and physical sciences and the humanities. Admission is subject to the approval of the school's admissions committee. Consideration is given to the applicant's academic record, Graduate Record Examination test scores, a written statement of interest in a public service career, employment or other experience, letters of recommendation, and, where feasible, a record of personal interview.

In selecting students for admission, three basic standards are used: (1) The academic record must demonstrate the applicant's ability to do the graduate-level work required by the program. (2) The applicant must give evidence of clear commitment and strong motivation to seek a career in the public service. (3) The applicant must show promise of achievement in a professional career as well as potential to make a contribution to the public service.

Although there is no formal requirement with respect to specific undergraduate courses, each applicant's undergraduate preparation is carefully considered during the admissions process. It is highly recommended that students seeking entry take courses in mathematics and statistics, economics, and government. Ideally, an entering student will have had at least two courses in each of these three areas. A student who lacks sufficient preparation in these areas may be required to demonstrate an aptitude or ability in a given area prior to admission or may be required to take appropriate courses in addition to the minimal course requirements for the degree.

A limited number of new students can be admitted to the program each year, and a new class is normally admitted for the year beginning each Autumn Quarter. Applications for Autumn Quarter that are completed by March 15 will be ensured full consideration. Applications received after that date will be considered on a space-available basis.

Financial Aid

Limited assistance is available in the form of research assistantships, fellowships, scholarships, and part-time employment with public agencies. Among the opportunities available are the George A. Shipman and Robert J. Lavole Public Affairs scholarships, the Association for Public Policy Analysis and Management minority fellowships, and the Scottish Rite Foundation of Washington Public Service fellowships. Students who wish to be considered for financial assistance should complete the appropriate section of the school's supplementary information form. Financial assistance is based on merit. Other forms of financial assistance, awarded primarily on the basis of financial need, are also available through the University. If possible, students interested in being considered for merit-based financial aid should notify the school by December 15 of the year prior to the year for which they seek to enter the program and should submit their completed application not later than March 15. Students applying for need-based financial support must comply with all relevant established deadlines of the University, which in some cases may be earlier than March 15.

Additional information and a detailed description of the program may be obtained by writing to the Graduate Program Coordinator, Graduate School of Public Affairs, DP-30, University of Washington, Seattle, Washington 98195.

Faculty

Professors

Crutchfield, James A. (Emeritus), (Economics), Ph.D., 1954, California (Berkeley); natural resource utilization and public policy.

Denny, Brewster C.,* Ph.D., 1959, Fletcher School of Law and Diplomacy; American foreign and defense policy, science and public policy.

Kroll, Morton,* (Political Science),† Ph.D., 1952, California (Los Angeles); organizational theory, comparative bureaucracy, ethics.

Locke, Hubert G.,* M.A., 1961, Michigan; criminal justice, urban policy, race and ethnic relations.

Lyden, Fremont J.,* Ph.D., 1960, Washington; organizational and systems theory, personnel management, program design and budgeting.

Miles, Edward L.,* (Marine Studies),† Ph.D., 1965, Denver; international law and organization; science, technology, and international relations; marine policy and ocean management.

Pealy, Robert H. (Emeritus), Ph.D., 1956, Michigan; natural resources, public finance, urban affairs.

Wenk, Edward M., Jr. (Emeritus), (Civil Engineering), Ph.D., 1950, Johns Hopkins; technology policy, public and science policy, marine affairs, decision theory.

Williams, Walter,* Ph.D., 1960, Indiana; policy analysis, macroeconomics, business.

Wolfle, Dael L. (Emeritus), Ph.D., 1931, Ohio State; science and public policy, development of human talent.

Zerbe, Richard O.,* Ph.D., 1969, Duke; economics of regulation, cost-benefit analysis, economic history, environmental regulation.

Associate Professors

Elmore, Richard F.,* Ed.D., 1976, Harvard; policy analysis, education policy, implementation.

Miller, Ernest G.,* Ph.D., 1959, Princeton; management and organizational development, organization theory, administrative behavior.

Assistant Professors

Hall, Mary D.,* Dr.P.H., 1976, North Carolina (Chapel Hill); manpower, budget and finance, personnel management, health policy.

May, Peter J.,* (Political Science),† Ph.D., 1979, California (Berkeley); policy analysis, quantitative methods, federal disaster policy.

Lecturers

Brown, Marsha D.,* Ed.D., 1980, Harvard; statistics, quantitative analysis, education policy.

Wolters, M. Eric, M.P.A., 1967, Washington; government regulation, public policy, urban affairs.

Course Descriptions

Courses for Graduates Only

PB AF 500 General Seminar (1, max. 9)

PB AF 501 Public Policy and Administration (3) Interaction between the bureaucracy and those institutions, organizations, and groups involved in the policy process. Analysis of current policy problems is made from this perspective. Offered jointly with POL S 570.

PB AF 502 The Administrator and the Policy Process (3) Context of public administration from the perspective of the administrator. Through case and research materials, field inquiries and interviews, the manifold roles and functions of the administrator are examined, particularly in relation to the process of implementing, making, and changing public policy. Offered jointly with POL S 571.

PB AF 503 Administrative and Executive Leadership (3) Nature of executive life in the public sector, the function of leadership in implementing, making, and changing policy. Leadership styles, the relation of leadership to its constituencies and communities. Offered jointly with POL S 572.

PB AF 504 Administrative Ethics (3) Moral dilemmas that confront public managers. Critical view of societal and political values that prescribe moral behavior. Organizational and professional ethics. Ethical problems of public organization managers. Systematic means for understanding, analyzing, and coping with moral issues that appear in a career.

PB AF 505 The Law of Public Administration (3) Legal framework of public administrative action in the United States, emphasizing constitutional requirements; operation of the administrative process; management of personnel, funds, and contracts; and judicial review of administrative activity. Primarily for students in the Graduate School of Public Affairs; others by permission of instructor.

PB AF 507 International Organizations and Ocean Management (3) Survey of the manner in which international organizations attempt to manage and regulate the uses of the ocean. Primary emphasis on the analysis of processes that support or constrain these organizations and on the search for alternative policies and organizations. Offered jointly with IMS 507. Prerequisite: IMS 500 or permission of instructor.

PB AF 509 Public Organizational Theory (3) Approaches to the study of organizational behavior in a changing society, including consideration of formal and informal organization, personality needs, role playing, client relations, and sociopolitical and technological environment.

PB AF 510 Governmental Organizations (3) Survey of the theory, current practice, and experience relating to governmental organizations and their program objectives. Comprises a synopsis of subject matter covered in 511, 512. No credit allowed if 511 and 512 taken for credit.

PB AF 511 Administrative Problems: Micro-Organization (3) Analysis and solution of problems involving the interaction of individuals and groups within organizations. Emphasis is placed upon the differences between the traditional approach and the behavioral approach to the understanding of the governmental organization, the motivation of the persons involved in the decision to produce, the nature of the decision to participate, the nature of conflict and innovation, and the limits of rationality.

PB AF 512 Administrative Problems: Macro-Organization (3) Analysis and solution of problems inherent in the characteristics and behavior of large-scale organization and multiagency complexes. Systems approaches are interrelated with social systems theory; functional problems are interrelated with types of organizations resulting from the public purpose served; and information flows are analyzed. Emphasis is given to concepts of organizational effectiveness and change.

PB AF 513 Public Policy Analysis (3) Sp *Elmore, May* Production and use of analysis to support public decisions. For people pursuing careers as public analysts or managers. Defining problems, devising alternative solutions, clarifying stakes in choices, predicting impacts of choices. Skills developed by working on specific policy problems. Assumes familiarity with statistics, microeconomic theory, and institutions and processes of American government.

PB AF 514 Policy Implementation (3) Provides working knowledge of how policies are implemented and a set of analytic skills for anticipating and diagnosing implementation problems. Primarily for students who plan to become public-sector policy analysts or managers. Mastery of basic literature on implementation and its application to solving problems of public policy, including estimating feasibility of policy alternatives and identifying the sources of implementation failure, is expected. Prerequisites: microeconomics, organization theory.

PB AF 515 Decision Theory (3) Examines the use of formal models and quantitative methods as an aid to decision making in the public sector. Both deterministic and probabilistic models are explored. Formal decision-analysis techniques are used to examine how uncertainty can be formally dealt with in a quantitative approach to decision making. Cost-benefit analysis and discounting and present value estimations are stressed. Prerequisite: basic statistics and economics course.

PB AF 516 Microeconomic Policy Analysis (3) A Ways in which microeconomic analysis bears on issues of public policy, identification of relevant economic analyses for their strengths and weaknesses in relation to microeconomic principles involved and to comprehension and assessment of what professional economists can contribute to the analysis of public-sector issues. Prerequisite: principles of economics; recommended: ECON 400 or equivalent.

PB AF 517 Macroeconomic Policy Analysis (3) W Macroeconomic institutions and processes that influence formulation and implementation of public policy and provide context within which much of public management occurs. Particular attention given to application of macroeconomic and public finance theory to formulation and implementation of public policy. Prerequisite: principles of economics; recommended: 516, ECON 400.

PB AF 519 Policy Analysis Workshop (3) Examines the techniques and methods required in social policy analysis, including the technical issues in developing, using, and interpreting research relevant for social policy and bureaucratic problems in using research and analysis in the policy process. Designed to aid future administrators and analysts in performing policy analysis and in working with researchers to develop relevant studies and with the agency bureaucracy to integrate research and analysis. Prerequisite: permission of instructor.

PB AF 520 Federal Delivery Systems and Domestic Policy (3) Comparative study of the existing and proposed methods by which the federal government may deliver services or benefits. Students examine service programs administered by the federal government, grant programs, direct-payment systems, voucher systems, block grants, revenue sharing, and tax deduction and credit systems. Selected programs are examined to determine probable impact on beneficiaries, intergovernmental relations, and program accountability. Political and constitutional limitations are also discussed. Prerequisite: permission of instructor.

PB AF 521 Public Management: Program Planning and Design (3) Topics include the policy context of planning and programming, the institutionalization of purpose, the planning process, activity design, work scheduling and measurement, and program evaluation.

PB AF 522 Public Management: Budgeting (3) Budgeting as a management process. Study of formulation and administration of government budget, including the role of budgeting in the policy process, the approaches to budget formulation and analysis, the development of the PPB approach, and the aspects of budget administration, such as revenue estimating, allotment control, and cost accounting.

PB AF 523 Public Management: Personnel (3) Study of line-staff decision making in acquisition and use of human resources in public organizations, including evaluation of job responsibilities, establishment of compensation levels, collective bargaining, selection and placement, performance appraisal, incentive management, and training.

PB AF 525 Organizational Development in Public Agencies (3) Examination of the philosophies, theories, and models of behavioral science interventions in organizational diagnosis and development (OD). In addition to a review of the basic literature dealing with the OD approach, emphasis is placed on examination of case studies and class experience in OD applications, including organizational diagnosis, problem confrontation, and team building. Prerequisite: permission of instructor.

PB AF 527 Quantitative Analysis (3) Provides a nontechnical approach to statistical analysis, the logic of statistical testing, and data presentation as applied to the field of public policy and administration. Covers such commonly used techniques as tests concerning means, binomial distribution, cross tabulations, and simple regression. Student's understanding is deepened by a required interpretive or critical study.

PB AF 528 Advanced Quantitative Methods in Public Administration (3) Provides in-depth coverage of the techniques of analysis of variance, multiple regression, chi-squared and nonparametric versions of statistical tests as applied to the field of public policy and administration. Practical, analytical, and interpretive skills covered include the use of SPSS computer packages. In addition to a critical study, each student completes a statistical research project of his or her choosing, generally requiring more advanced use of an SPSS package. Prerequisite: 527 or equivalent.

PB AF 529 Quantitative Applications in Public Affairs (3) Examines specific public policies by utilizing quantitative methods to evaluate the evidence and data upon which such policies are based. Evidence on real public issues and programs is analyzed by students, who are expected to explain and critique the statistical techniques employed and measurements taken, to make recommendations for improvements, and to identify and assess other relevant factors. Policy issues are drawn from such functional areas as education, manpower, law enforcement, natural resources, and experiments in negative income tax. Prerequisite: 528 or equivalent.

PB AF 530 Financial Management in the Public Sector (3) Exploration of the managerial uses of accounting and other processes of financial management in the public sector. Topics covered include: financial planning and control, fund accounting, cost accounting, asset accounting, internal controls, auditing, financial analysis, and financial reporting. Prerequisite: permission of instructor.

PB AF 532 Economic Theory of Regulation (3) Develops a political framework for analyzing regulations and regulatory reform; influence of legal history; theories of regulation and regulatory behavior. Offered jointly with ECON 532 and SMT 532. Prerequisite: 516 or ECON 400.

PB AF 533 Regulatory Policy (3) Principles of regulation applied to case studies; transportation, environmental safety, communication, monopoly regulation; issues of deregulation and substitutes for regulation. Offered jointly with SMT 533. Prerequisite: 532 or ECON 532 or SMT 532.

PB AF 534 American Foreign Policy Formation (3) American foreign policy viewed whole, including defense policy, the relationships of foreign policy to domestic policies and priorities, and the full range of historical, constitutional, institutional, political, and theoretical questions related to the formation and the execution of foreign policy in this broad sense. Offered jointly with POL S 534.

PB AF 535-536 Seminar in American Foreign Policy (3-3) Foreign policy and defense policy formation and execution. Administration of national security programs, White House, Congress, state and defense departments, special problems, and case studies. Prerequisite: 534.

PB AF 537-538-539 Tribal Administration Seminar (3-3-3) A,W,Sp Historical and contemporary role of Indian tribes and policies, including legislation; Indian treaties, tribal constitutions; tribal government structure; role of Bureau of Indian Affairs; federal Indian policies; tribal relationships with federal, state, and local governments; current policy issues; role of tribal members and community in tribal affairs. Readings, speakers, site visits, and working materials used to examine exterior forces impacting tribes.

PB AF 540, 541, 542 Social Management of Technology I, II, III (3,3,3) A,W,Sp Interaction of technology and society through general principles and case studies of contemporary issues. Systems analysis of technological enterprise, its scientific base, roles of capital, specialized manpower, organizational structure and management; decision making and institutional behavior; goal generation; strategies, risk assessment, and policy planning. 540: policy process; 541: policy analysis; 542: policy design. Offered jointly with CIVE 540, 541, 542 and SMT 540, 541, 542. Prerequisites: permission of instructor for 540; 540 for 541; 541 for 542.

PB AF 543 Social Research and the Public Policy Process (3) Social science methods used in assessing policy problems and social interventions. Consumption of applied social research in learning to judge appropriateness of such research for policy making. Written exercises, class discussions, and lectures.

PB AF 545 Systems Theory and the Public Policy Process (3) Survey of systems theory approaches to the study and the analysis of public organizations and their environments, including systems analysis, cybernetics, information theory, and general and social systems theory.

PB AF 548 Economics of Labor and Human Resources (3) Economic analysis of policy-related topics in human resources. Topics include labor demand and supply, education and occupation, wage structures and income inequality, discrimination, and poverty. Offered jointly with ECON 548. Prerequisite: equivalent of ECON 400, or permission of instructor; not open to economics majors.

PB AF 551 Comparative Administrative Systems (3) Methodological problems of research in comparative administration. Theoretical and substantive aspects of administrative systems in urban-industrial and developing nations. Offered jointly with POL S 579.

PB AF 552 Administrative Problems of Development (3) Problems of administering developing nation-states and regions, including theoretical aspects of development administration, bureaucratic change, administrative-political interaction in policy making, organizational development, political impact of administering major programs. Prerequisite: permission of instructor.

PB AF 553 Applied Cost-Benefit Analysis (3) Familiarity developed through problems and applications. Techniques of use stressed. Offered jointly with SMT 553. Prerequisite: ECON 300 or 400 or 516 or permission of instructor.

PB AF 554 Advanced Seminar in Cost-Benefit Analysis (3) Techniques of, and theoretical foundation for, cost-benefit analysis as applied to the public sector. Offered jointly with ECON 554 and SMT 554. Prerequisite: 553 or permission of instructor.

PB AF 556 Public Policy, Administration, and Political Theory (3) Examines the meaning of democracy in the context of American public policies and administration. The perspective of individual and group participation in the policy process, the individual's role in organization, the functions of the public servant in the making of policy decisions, and the realities of policy formulation in relation to political values. Enables the student professionally committed to public activity to reflect in a discussion setting upon his or her position as a participant in the society in which he or she works. Offered jointly with POL S 567.

PB AF 557 The Politics of Collective Bargaining in the Public Sector (3) Seminar explores purposes served by establishment of collective bargaining, the benefits and beneficiaries of

the bargaining process, and implications of bargaining for the political power of managers, union leaders, union rank and file, unorganized workers, and citizen-consumers. Both private and public sectors are discussed with focus on collective bargaining in government agencies. Participants need some background in organizational theory and are expected to engage in fairly extensive reading and in a research project.

PB AF 561-562 Policy Development and Administration: Urban Affairs (3-3) A two-quarter graduate course in the structures, functions, and processes of government in cities, with special emphasis on the origin, content, and implementation of public policies. Major focus is on the political process at the municipal level: the distribution of influence, the political actors, the decision-making machinery, and the policy outputs. Of special interest to graduate and professional students preparing for careers in urban government.

PB AF 565 Seminar in Urban Public Policy Analysis (3) The use of methodology from public administration, political science, and economics to examine urban public policies. Emphasis on the relationships between research and public policy. Prerequisite: ECON 416.

PB AF 567 The Administration of Justice: Policy, Law, and Politics (3) Contemporary problems, trends, and issues in American policing within the context of the history, role, and function of law enforcement in urban America. Emphasizes the external tensions between the stated ideals of a democratic society and the realities of institutionalized crime-control methods and procedures, internal conflicts between the quest for professionalization of the police function *vs.* the demand for organizational effectiveness and accountability, and current efforts toward institutional change and functional reorganization.

PB AF 568 Seminar in Law and Justice (3) The current volatility in American law enforcement revolves around a number of policy issues that have emerged in the past decade and are considered crucial to the future role, organization, and function of urban policing. Nine of these issues are explored, with emphasis on their historic settings, the "actors" who shape their articulation, and the parameters of the debate, legal constraints on, and sociopolitical considerations in, the development of policy alternatives, and emerging patterns of resolution. Prerequisite: 567 or equivalent.

PB AF 569 Race and Public Policy (3) Way in which the persistent problem of race is expressed in the formation and implementation of social and public policy.

PB AF 571, 572, 573 Public and Educational Policy Issues in the Development of Human Talent (3,3,3) Higher education and the nation's human resources; trends, projections, policy issues, problems and goals in the relation between education and utilization of professional and specialized personnel. Offered jointly with EDEPS 571, 572, 573. Prerequisite: permission of instructor.

PB AF 577 Risk Assessment for Environmental Health Hazards (3) A Context, methodologies, types of data, uncertainties and institutional arrangements for risk assessment. Both qualitative and quantitative approaches to the identification, characterization, and control of environmental hazards to health emphasized through didactic and case studies. Offered jointly with ENV S 577, ENVH 577, and CEWA 577. Prerequisites: ENV S 415, BIOST 511, EPI 511, or permission of instructor.

PB AF 583, 584, 585 Seminar in Science and Public Policy (3,3,3) Issues and problems relating to the interaction of science and scientists with the public policy-making process. Science *vs.* the nature and values of political processes, and the continuing tensions between the two. The evolving interaction between scientific and technical knowledge and political power; scientific *vs.* ethical judgments. Role of science in the establishment of national goals. Plans and proposals for increasing governmental competence to deal with public policy issues involving science and technology.

PB AF 588 International Science and Technology Policy (3) Seminar is designed: first, to analyze the relationships between research and development policy, capabilities, and national technological strategies for advanced industrial and less-developed countries; second, to deal with the international implications of particular technologies as countries try to make policy for them in regional and global organizations. Examples of specific technologies are chosen from such fields as space telecommunication, weather and climate modification, airline transportation, nuclear energy, and seabed exploitation.

PB AF 590, 591, 592 Midcareer Seminar (3,3,3) Interdisciplinary seminar in public policy for midcareer executives. Open to participants in the Education for the Public Management Program; others by permission of instructor.

PB AF 593-594-595 Policy Development and Administration: Natural Resources (3-3-3) Interdisciplinary research seminar in natural resources policy development and administration. Major concern is with the processes of natural resources policy formulation and analysis, and the role of various sectors in influencing policy development and administration. Open to graduate and professional students in varied disciplines who are emphasizing preparation in natural resources fields. Prerequisite: permission of instructor.

PB AF 599 Special Topics (2-6, max. 6) Systematic study and analysis of special subject matter in public policy. Topic for each quarter varies, depending upon the needs of the school and the interests of student and faculty. May be repeated for credit. Prerequisite: permission of instructor.

PB AF 600 Independent Study or Research

PB AF 604, 605, 606, 607 Degree Project (2-6,2-6,2-6,-2-6)

School of Public Health and Community Medicine

Dean

Gilbert S. Omenn
F350 Health Sciences

Associate Dean

Timothy A. DeRouen

The School of Public Health and Community Medicine offers graduate programs leading to the degrees of Master of Public Health, Master of Science, and Doctor of Philosophy. In the M.P.H. program, the student may select an area of emphasis in one of three fields: environmental health, epidemiology, or health services. These programs are directed particularly at preparing individuals for research, academic, or professional practice careers.

Admission requirements vary according to the field in which the student wishes to major and are given in the departmental descriptions that follow. Prior consultation with the departments is recommended. Applicants holding doctoral degrees have three options: one of the master's programs, research fellowship, or two-year residency in general preventive medicine, public health, or occupational medicine. For the medical student, a concurrent M.D.-M.P.H. program is offered. A Ph.D. program is offered in epidemiology, and a proposal for a Ph.D. program in pathobiology is being prepared. Doctoral opportunities in health services in collaboration with other school and campus departments are available.

Other opportunities include training in biostatistics through the Biomathematics Group of the Graduate School, which leads to an M.S. or Ph.D. degree, and in the Radiological Sciences Group, which offers the M.S. degree. The Master of Health Administration degree is offered by the Health Services Administration Group. These programs are described elsewhere in this bulletin. The school also offers a nontraditional Extended M.P.H. Program in the Department of Health Services for midcareer students who cannot relocate and participate in the regular master's programs.

Biostatistics

F600 Health Sciences

The Department of Biostatistics awards its master's and Ph.D. degrees through the Biomathematics Group (see description of the Biomathematics Group in Interdisciplinary Graduate Degree Program section of this catalog).

Faculty

Chairperson

Norman E. Breslow

Professors

Bell, Charles B., Jr.,* Ph.D., 1953, Notre Dame; applications of stochastic processes to biomedical problems; nonparametrics.

Breslow, Norman E.,* Ph.D., 1967, Stanford; clinical trials, epidemiology, survival and categorical data.

DeRouen, Timothy A.,* Ph.D., 1971, Virginia Polytechnic; applications to the epidemiology of cardiovascular and sexually transmitted diseases.

Feigl, Polly,* Ph.D., 1961, Minnesota; application of statistics to biomedical studies and cancer patient data systems.

Fisher, Lloyd D., Jr.,* Ph.D., 1966, Dartmouth; cardiovascular data analysis, clinical trials, multivariate statistics, longitudinal data analysis.

Kronmal, Richard A.,* Ph.D., 1964, California (Los Angeles); nonparametric density estimation, computer algorithms, cardiovascular data analysis.

Martin, Donald C.,* Ph.D., 1968, Florida State; statistical computing, randomization tests, approximations for probability functions.

Prentice, Ross L.,* Ph.D., 1970, Toronto; survival analysis, case-control and cohort study methods, biostatistical consulting.

Thompson, Donovan J. (Emeritus), Ph.D., 1951, Iowa; sampling, community trials, community health surveys.

van Belle, Gerald,* Ph.D., 1967, Toronto; clinical trials, applied statistics, screening, epidemiology.

Associate Professors

Blumenstein, Brent, Ph.D., 1974, Emory; computer applications in biostatistics, cancer clinical trials, applied statistics.

Crowley, John J.,* Ph.D., 1973, Washington; survival analysis: cancer clinical trials and carcinogenesis studies, statistical methods in epidemiology.

Davis, Kathryn,* Ph.D., 1974, Washington; density estimation, cardiovascular data analysis, clinical trials.

Diehr, Paula,* Ph.D., 1971, California (Los Angeles); application of statistics to health services research, multiple regression.

Farewell, Vernon T.,* Ph.D., 1977, Imperial College; analysis of survival data, case control studies, statistics in cancer research.

Hallstrom, Alfred P. (Research), Ph.D., 1968, Brown; application of statistics to biomedical data; cardiovascular applications; emergency medical services.

Peterson, Arthur V., Jr.,* Ph.D., 1975, Stanford; survival data methodology, competing risks, design of medical studies, random number generation.

Polissar, Lincoln* (Research), Ph.D., 1974, Princeton; cancer data analysis, epidemiologic methods, medical care.

Wahl, Patricia W.,* Ph.D., 1971, Washington; multivariate statistical techniques, especially regression analysis applied to cardiovascular data.

Assistant Professors

Benedetti, Jacqueline K.* (Research), Ph.D., 1974, Washington; clinical trials methodology, categorical data.

Kopecky, Kenneth J.* (Research), Ph.D., 1977, Oregon State; clinical trials design and analysis, survival data analysis, epidemiologic methodology, goodness of fit, biomedical and cancer-related applications.

McKnight, Barbara,* Ph.D., 1981, Wisconsin; survival analysis and competing risks, statistical applications animal carcinogenesis testing, epidemiology, and diabetes research.

Temkin, Nancy R.,* Ph.D., 1976, State University of New York (Buffalo); clinical trials, recovery models, statistical modeling of epileptic phenomenon, survival analysis.

Course Descriptions

Courses for Undergraduates

BIOST 472 Introduction to Statistics in Health Sciences (4) Description and examples of common concepts in biostatistics. Probability, point and confidence interval estimation, hypothesis testing including two-sample and paired t and chi-square tests, introduction to simple linear regression. Examples in health sciences stressed.

BIOST 473 Application of Statistics to Health Sciences (4) Standard statistical techniques with examples drawn from health sciences literature. Critical interpretation of research results, and introduction to the computer for data processing and statistical analysis. The sequence 472, 473 is the equivalent of 511. Prerequisite: 472 or equivalent.

Courses for Graduates Only

BIOST 511 Medical Biometry I (4) AS Presentation of the principles and methods of data description and elementary parametric and nonparametric statistical analysis. Examples are drawn from the biomedical literature, and real data sets are analyzed by the students after a brief introduction to the use of standard statistical computer program packages (e.g., SPSS, BMDP, MINITAB). Statistical techniques covered include description of samples, comparison of two sample means and proportions, simple linear regression and correlation.

BIOST 512 Medical Biometry II (4) W Further analysis of qualitative data, including basic epidemiologic statistics, life table, log rank test. Introduction to one- and two-way analysis of variance; fixed, random, and mixed models; multiple comparisons. Examples from the biomedical literature and computer analyses of real data. Prerequisite: 511 or 473 or equivalent.

BIOST 513 Medical Biometry III (4) Sp Factorial and other experimental designs. Multiple regression; analysis of covariance, discriminant analysis; use of transformations, dummy variables, variable selection procedures, detection of outliers; elements of multiple logistic and Cox regression. Examples from biomedical literature, computer analyses of real data, and report writing. Prerequisite: 512 or permission of instructor.

BIOST 522 Applications of Vital and Health Statistics (3) Analysis of routinely collected data on the health status and care of populations, with emphasis on the potential and limitations of this approach. Stressed are the importance of such data for the development and the evaluation of programs and the recognition of new hazards. Offered jointly with EPI 522. Prerequisite: 472 or equivalent or permission of instructor.

BIOST 523 Computer Applications in Biostatistics (4) Multiple regression emphasized. Other topics (analysis of variance, analysis of covariance, path analysis, and discriminant analysis) treated in less detail as subsets of multiple regression. Factor analysis and automatic interaction detector also used. Examples from the health services and social science literature stressed. Modified case-method approach used, with each student assigned a data set to analyze throughout the class. Prerequisite: 511 or 473.

BIOST 524 Design of Medical Studies (3) Design of medical studies, with emphasis on randomized controlled clinical trials. Bias elimination, controls, treatment assignment and randomization, precision, replication, power and sample size calculations, stratification, and ethics. Suitable for graduate students in biostatistics and research-oriented graduate students in other scientific fields. Offered jointly with STAT 524. Prerequisites: 511 or equivalent, and one of 513, STAT 421, 423, 512, or EPI 512; or permission of instructor. (Offered even-numbered years.)

BIOST 527 Statistical Models for Epidemiologic Analysis (4) Introduction to the multivariate analysis of survival and categorical data using multiplicative models. Applications to cohort and case-control studies in epidemiology. Familiarity with available computer programs and packages gained by analysis of *bona fide* sets of clinical and epidemiological data. Offered jointly with EPI 527. Prerequisite: 513 or EPI 513 or permission of instructor.

BIOST 529 Sample Survey Techniques (3) Design and implementation of selection and estimation procedures in sample surveys. Emphasis on the sampling of human populations, although principles apply to other sampling problems. Topics include simple, stratified, and cluster sampling, multistage and two-phase procedures, optimal allocation of resources, estimation theory, replicated designs, variance estimation, national samples and census materials. Offered jointly with QMETH 529 and STAT 529. Prerequisite: 511, STAT 421 or 423, Q METH 500 or equivalent; or permission of instructor.

BIOST 570 Linear Models (3) Review of linear algebra and matrix manipulations. Statistical distribution theory for quadratic forms of normal variables. Fitting of the general linear model by least squares. Computer-data analysis for classical experimental designs. Offered jointly with STAT 570. Prerequisites: STAT 421, 423, or 513; and STAT 513; and a course in matrix algebra.

BIOST 571 Applied Regression Analysis (3) Advanced statistical methods course for biostatistics and other graduate students already familiar with the general linear hypothesis. Develops extensions of usual linear least squares theory and discusses effects of departures from this theory. Examples of analyses for nonstandard problems are presented and computers are used for homework assignments. Analyses of residuals, use of transformations, polynomial models, methods of model selection, and robust methods. Offered jointly with STAT 571. Prerequisites: 513, 570 or STAT 570, a matrix algebra course, or permission of instructor.

BIOST 572 Multivariate Statistical Methods (3) W Use of multivariate normal sampling theory, linear transformations of random variables, one- and two-sample tests, profile analysis, partial and multiple correlation, multivariate ANOVA and least squares, discriminant analysis, principal components, factor analysis, robustness, and some special topics. Some computer use included. Offered jointly with STAT 572. Prerequisite: 570 or permission of instructor.

BIOST 573 Statistical Methods for Categorical Data (3) Sp Exact and asymptotic methods of analysis for 2 × 2 contingency tables. Maximum likelihood estimation of logistic regression models for binary response variables, and selected examples of the use of these models in epidemiologic and clinical research. Introduction to the theory and applications of log linear models for discrete data. Selected special topics. Offered jointly with STAT 573. Prerequisites: 571 and STAT 581, or permission of instructor.

BIOST 574 Statistical Computing (3) Introduction to topics in statistical computing: application of numerical methods to statistical problems; generation of pseudorandom numbers; design and execution of Monte Carlo studies; comparative evaluation of statistical algorithms; matrix methods and least squares; computation of probabilities; data structures; and data base management. Offered jointly with STAT 574. Prerequisites: STAT 511 and programming, or permission of instructor.

BIOST 575 Population Models (3) Models in demography, using real and simulated data. Estimation of demographic rates, the life table; stationary, stable, and quasistable populations; determinants of the age structure of a population; age-specific models of mortality, fertility, and nuptiality. Offered jointly with STAT 575. Prerequisite: permission of instructor.

BIOST 576 Statistical Methods for Survival Data (3) Statistical methods for censored survival data arising from follow-up studies on human or animal populations. Parametric and nonparametric methods, Kaplan-Meier survival curve estimator, comparison of survival curves, log-rank test, regression models including the Cox proportional hazards model, competing risks. Offered jointly with STAT 576. Prerequisites: STAT 581 and either 513, STAT 423, Q SCI 383 or equivalent. (Offered alternate years.)

BIOST 577 Advanced Design and Analysis of Experiments (3) Concepts important in experimental design: randomization, blocking, confounding. Application and analysis of data from randomized blocks designs, Latin and Graeco-Latin squares, incomplete blocks designs, split-plot and repeated measures, factorial and fractional replicates, response surface experiments. Offered jointly with STAT 577. Prerequisite: 570 or STAT 421 (minimum 3.0) or permission of instructor.

BIOST 578 Special Topics in Advanced Biostatistics (*, max. 3) Advanced-level topics in biostatistics offered by regular and visiting faculty. Offered jointly with STAT 578. Prerequisite: permission of instructor.

BIOST 579 Advanced Data Analysis (4) Resampling methods; jackknife, bootstrap, cross-validation. Smoothing techniques; local averages; projection-pursuit regression; recursive partitioning regression. Selected aspects of linear regression. Robust-resistant methods. Density estimation. Clustering techniques. The EM-algorithm. Graphical exploratory methods. Prim -81. Offered jointly with STAT 579. Prerequisites: 571 and STAT 513 or permission of instructor.

BIOST 580 Seminar in Biostatistics (*, max. 9) AWSp Presentation and discussion of special topics and research results in biostatistics. Speakers include resident faculty, visiting scientists, and advanced graduate students. Required of students in the biostatistics pathway of the Biomathematics Group.

BIOST 590 Biostatistical Consulting (*) AWSpS Training in consulting on the biostatistical aspect of research problems arising in the biomedical field. Students, initially under the close supervision of a faculty member, participate in discussions with investigators leading to the design and/or the analysis of a quantitative investigation of a problem. With experience, independent associations of student and research worker are encouraged, with subsequent review by faculty of resulting design and analysis. Required of doctoral students in the biostatistics pathway of the Biomathematics Group. Prerequisite: permission of instructor.

Environmental Health

F463 Health Sciences

Undergraduate Program

Bachelor of Science Degree

This curriculum focuses on environmental conditions in the community and workplace that affect the health and well-being of people, and the means by which these conditions may be eliminated or controlled. Traditional public health topics are covered, including water, wastewater, food protection, housing, vectors, and epidemiology. Other subject matter covered includes industrial hygiene, toxicology, hazardous waste management, and environmental health law.

Admission Requirements: Junior standing. CHEM 140, 150, 151, 160, 231, 232, 241, 242; BIOL 210, 211, 212; MATH 124; MICRO 301, 302; and ENGR 331.

Graduation Requirements: 36 credits in environmental health; BIOST 472, 473, EPI 420; one-quarter internship.

Correspondence and Information

Undergraduate Program Adviser
F461 Health Sciences

Graduate Program

The Department of Environmental Health offers two graduate degrees: Master of Science and Master of Public Health. In seeking the M.S. degree, the aspirant has two program options: (1) industrial hygiene and safety and (2) environmental health science with emphasis on toxicology. The M.P.H. degree program is for physicians seeking education and training in occupational medicine.

The industrial hygiene and safety option focuses on technical, psychological, and administrative aspects relevant to the prevention or control of industrial disease and accidental injury. Students in this option develop professional expertise in hygiene and safety.

The environmental health science option focuses on research on the health effects of toxic substances and on community problems associated with toxic substances and their control, hazardous waste disposal, and traditional areas of environmental health, such as water and wastewater treatment.

The Department of Environmental Health cooperates with the Department of Health Services, which offers an extended Master of Public Health degree in Community Health Management. This provides for environmental health professionals to receive training in health program management with an environmental health emphasis while continuing their employment. This program provides an exposure to management training in accounting, finance, economics, organization behavior, and program evaluation. It also includes technical material in environmental health law, occupational health, toxicology, and hazardous materials management. Students are required to attend one-month summer sessions for three years, to complete assignments at their place of employment, and to meet at the University for four weekends during the academic year.

The occupational medicine option provides physicians clinical experience, didactic instruction, and participation in field studies involved with industrial or work-related health problems. Research efforts focus on the etiology and prevention of occupational disease.

Admission Requirements

Prerequisites for admission to the graduate program options in industrial hygiene and safety and environmental health science include Bachelor of Science or equivalent degree in environmental health, a physical science, a biological science, or engineering, and submission of Graduate Record Examination scores.

Prerequisites for admission to the occupational medicine option include graduation from a Class A medical school in the United States or Canada (or equivalent), one year of clinical training (PGY1), and submission of Graduate Record Examination or Medical College Admission Test scores.

Graduation Requirements

Each option is designed as a six-quarter program of study, including field applications and research, requiring completion of a minimum of 60 credits plus 9 credits of thesis, and submission of an acceptable thesis.

Financial Aid

Traineeships and tuition support are available for a limited number of students. This support comes from federal and private sources awarded to the department or school. A few research assistantships are available to second-year students.

Research Facilities

Specialized laboratories exist for research in industrial hygiene chemistry, trace organics and heavy metals; environmental microbiology, electron microscopy, controlled exposure to environmental factors, toxicology, and radiological sciences. Field research is facilitated through an extensive consultation or service program conducted by this department for labor and industry in Washington State.

Correspondence and Information

Graduate Program Coordinator
Department of Environmental Health, SC-34

Faculty

Chairperson

Sheldon D. Murphy

Professors

Boatman, Edwin S.,* Ph.D., 1967, Washington; morphology and ultrastructure of microorganisms and structure of the lungs.

Jackson, Kenneth L.,* Ph.D., 1964, California (Berkeley); physiological and biochemical mechanisms in radiation biology.

Mottet, N. Karle,* (Pathology), M.D., 1952, Yale; effects of trace elements, especially methylmercury and arsenic, on growth and development.

Murphy, Sheldon D.,* Ph.D., 1958, Chicago; metabolic and mechanistic aspects of pesticide toxicology, toxic interactions, toxicology of environmental contaminants, risk assessment, and standards for environmental quality.

Omenn, Gilbert S.,* M.D., 1965, Harvard, Ph.D., 1972, Washington; genetic predisposition to environmental and occupational hazards.

Robkin, Maurice A.,* Ph.D., 1961, Massachusetts Institute of Technology; bionuclear engineering, biological effects of environmental pollution.

Wilson, John T., Jr.,* M.D., 1950, Columbia, Sc.D., 1956, Cincinnati; environmental and occupational medicine, industrial toxicology.

Associate Professors

Breysse, Peter A. (Emeritus), M.P.H., 1957, Pittsburgh; exposure of population to contaminants.

Covert, David S.* (Research), (Civil Engineering), Ph.D., 1974, Washington; atmospheric chemistry, aerosol physics, air pollution, meteorology.

DeRoos, Roger L., M.P.H., Ph.D., 1974, Minnesota; institutional environmental health, environmental management and manpower.

Dewalle, Foppe B.* (Research), Ph.D., 1973, Washington; toxic trace pollutants in the environment, advanced waste-treatment process, small water and wastewater treatment systems.

Geraci, Joseph P.,* Ph.D., 1972, Washington; neutron radiobiology, biochemical mechanisms of radiation injury.

Hatlen, Jack B. (Emeritus), M.S., 1958, Washington; community environmental health problems and programs.

Horstman, Sanford W.,* Ph.D., 1971, Cincinnati; industrial hygiene.

Koenig, Jane Q.* (Research), Ph.D., 1963, Washington; respiratory physiology, health effects of air pollutants.

Luchtel, Daniel L.,* Ph.D., 1969, Washington; electron microscopy, cell biology.

Milner, John E.,* M.D., 1961, Washington; dermatology and cancer immunology.

Wetzler, Theodore F.,* Ph.D., 1965, Michigan; environmental microbiology, zoonotic diseases.

Woods, James S.* (Research), Ph.D., 1970, Washington; biochemical toxicology and environmental chemicals, chemical effects of heme and porphyrin metabolism, occupational and environmental epidemiology.

Assistant Professors

Costa, Lucio (Research), Dott.Pharm., 1977, Milano; neurotoxicology and neuropharmacology, receptor modification in response to chemical exposures.

Eaton, David L.; Ph.D., 1978, Kansas; toxicology.

Faustman-Watts, Elaine M.,* Ph.D., 1980, Michigan State; molecular mechanisms of teratogenesis, mutagenesis, and carcinogenesis; reproductive toxicology, N-nitroso compounds; risk assessment methodology.

Fish, John O.,* M.P.H., 1959, Michigan; solid-waste and institutional environmental controls.

Kalman, David A.,* Ph.D., 1978, Washington; chemical processes in the environment.

Kraning, Kenneth K. (Research), Sc.D., 1964, Pittsburgh; cutaneous and environmental physiology.

Omiecinski, Curtis J.,* (Pharmacology), Ph.D., 1980, Washington; biochemical toxicology and pharmacology, molecular mechanisms of carcinogenesis.

Ongerth, Jerry E., Ph.D., 1973, Michigan; hazardous material management, water-quality treatment, geological modeling of waste treatment, and water quality.

Van Dusen, Karen A., M.S.P.H., 1974, Washington; performance objectives for environmental health personnel, accidental injuries, housing.

Lecturers

Darcy, Felix J., Ph.D., 1982, Minnesota; occupational hazards to health-care workers.

Freeman, Stanley H., M.A., 1958, New York; industrial safety, program organization and administration.

Frohlich, Rolf W., Ph.D., 1968, Munich; Ph.D., 1977, Washington; media analysis of commercial magazines; psychologic scripts; human resource skills, organization development, marketing.

Hibbard, Richard P. (Emeritus), B.S., 1949, Toledo; industrial ventilation, controlling airborne contaminants.

Kleinman, Goldy K., M.A., 1946, Columbia; occupational disease surveillance.

Monteith, Lee E., M.S., 1954, Washington; development of methods of chemical analysis as applied to industrial hygiene and environmental pollutants.

Morgan, Michael S.,* Sc.D., 1972, Massachusetts Institute of Technology; respiratory physiology.

Morris, Sharon L., B.A., 1965, Reed; occupational safety and health education, continuing education.

O'Brien, Michael J., M.S., 1973, Pittsburgh; radiation safety for University programs.

Steen, Kenneth S., M.S.E., 1972, Washington; environmental protection.

Treser, Charles D., M.S.P.H., 1976, Michigan; planning, management, and objectives for environmental health services.

Course Descriptions

Courses for Undergraduates

ENVH 305 Toxic Chemicals in the Environment (3) Basic principles governing the behavior and effects of toxic chemicals released into the environment; sources, distribution, and fate of toxic chemicals in the environment; chemicals and cancer; chemicals and birth defects; ecological effects of chemicals, government regulation of chemical hazards. Offered jointly with ENV S 305. Prerequisites: BIOL 101, 102, and CHEM 102 or equivalent.

ENVH 411 Introduction to Environmental Health (3) AW *Treser* Relationship of people to their environment, how it affects their physical well-being and what they can do to influence the quality of the environment and to enhance the protection of their health. Emphasis on environmental factors involved in transmission of communicable diseases and hazards due to exposure to chemical and physical materials in our environment.

ENVH 430 Methods in Environmental Sampling and Analysis I (3) A *Wetzler* Field sampling methods and selected laboratory analyses of various waters and wastes are conducted. Official methods for characterizing physical and chemical quality of water and wastes are demonstrated. Microbiological criteria are emphasized for student participation, including: enumeration of sub groups in populations, selective inhibitor, characteristics of normal flora, rationale of "indicator" organisms, etc. Prerequisites: junior standing, 440, which may be taken concurrently, MICRO 301 and 302, and permission of instructor.

ENVH 431 Methods in Environmental Sampling and Analysis II (3) W *Wetzler* Pertinent methods for collection of food and foodstuff samples are demonstrated. The usual official analytical procedures of FDA, USDA, and/or AOAC are presented or demonstrated for foods and dairy products. Criteria for wholesomeness, safety, and inhibition of spoilage are examined in detail. Pertinent samples and analyses of typical physical environments surrounding stored foods are examined. Prerequisites: 430, MICRO 301 and 302, and permission of instructor.

ENVH 440 Water and Waste Sanitation (4) A *Hatlen* Study of the health implications of water use and sewage disposal methodology. Focal concerns include water-quality evaluation, pollution factors, individual and public water and sewage facilities, site selection criteria, and legislative and agency activities. The knowledge and skills required for effective field performance by the environmental health specialist are emphasized.

ENVH 441 Food Protection (3) *Hatlen* Protection of food products during production, processing, and distribution. Emphasis on prevention of food-borne diseases and chemical contamination of foods at the retail level. Prerequisite: MICRO 301 or permission of instructor.

ENVH 442 Vector Control (3) Sp *Hatlen* Advanced study of the impact and control of rodents and arthropod vectors of disease, including consideration of economic poisons used, their regulation, and safety measures.

ENVH 444 Institutional Environmental Health (2) Sp Examination of the environmental health and safety hazards that can adversely affect hospital and nursing home patients, staff, and surrounding community; the means by which hazards can be prevented and controlled; and the interrelationships between administrative and regulatory activities. Prerequisites: 411 and environmental health major, or permission of instructor.

ENVH 445 Solid Waste (2) W Examination of the public health, environmental, economic, and materials conservation impact of solid wastes on the environment; the amounts and sources of solid wastes, methods of storage, transportation and disposal, identification of present problems and future needs. Prerequisite: environmental health major or permission of instructor.

ENVH 449 Respiration, Circulation, and Environmental Health (2) *Morgan* Structure and function of the respiratory and cardiac systems and the changes that may be produced by specific air pollutants, such as ozone, carbon monoxide, SO_2, etc. Air-quality criteria and the economic costs of disease are discussed. Several classroom demonstrations. Prerequisites: sophomore standing, and 450, CEWA 461, or permission of instructor.

ENVH 453 Industrial Hygiene and Safety (3) A *Horstman, Morgan* Review of occupational health and safety hazards, including causes, effects, evaluation, prevention, and legislation. Prerequisite: 411 or permission of instructor.

ENVH 454 Industrial Hygiene Sampling and Instrumentation (3) W *Monteith, Schumacher* Series of laboratory experiments illustrate the use of a wide spectrum of industrial hygiene sampling equipment. Included are airflow calibration, chemical calibration, detector tubes, personnel sampling devices, both continuous and discrete reading instruments. Instrumentation for noise also covered. Prerequisite: 453.

ENVH 460 Accident Prevention (2) A *Freeman* Discussion of the accident process and the classification of accidents, including epidemiologic indices. Analysis of accident statistics and research studies relating to control planning; survey of existing programs and legislation. Term field project and report.

ENVH 479 Environmental Research Design (1) ASp Designed to assist in the development of environmental health research projects. Common research designs, methodology, principles, and problems with emphasis on effective research problem definition, implementation, and data presentation.

ENVH 480 Environmental Health Problems (*, max. 6) AWSpS Individual projects involving library, laboratory, or field study of a specific environmental health problem. Prerequisite: environmental health major or permission of instructor.

ENVH 482 Field Practice—Technology (2-6) AWSpS Assignment to a local health department for supervised application of public health practices and environmental control techniques. Offered on credit/no credit basis only. Prerequisites: environmental health major and permission of departmental adviser.

ENVH 483 Field Practice—Program Planning (6) AWSpS Assignment to a local health department for supervised observation and experience in environmental health program planning. Offered on credit/no credit basis only. Prerequisites: environmental health major and permission of departmental adviser.

ENVH 484 Field Practice—Community Resources (3) AWSpS Assignment to a local health department for training in the utilization of community resources. Offered on credit/no credit basis only. Prerequisites: environmental health major and permission of departmental adviser.

ENVH 497 Environmental Health Special Electives (*) AWSpS Off-campus course for non-environmental health majors.

ENVH 499 Undergraduate Research (*) AWSpS Individual research on a specific topic in environmental health upon which specific conclusions, judgments, or evaluation can be made or facts can be presented. Prerequisite: environmental health major or permission of instructor.

Courses for Graduates Only

ENVH 511 Environmental Health (3) A *Morgan* Consideration of the health effects of environmental exposures using a problem-oriented approach embracing the natural, community, air-pollution, and working environments. Group discussion by didactic instruction where appropriate.

ENVH 512 Hazardous Waste Disposal (3) Generation, collection, transportation, and ultimate disposal of hazardous waste on land. Alternatives include physical-chemical elimination, resource recovery, and process modifications. In-depth engineering and cost aspects of alternatives. Health and engineering implications of TSCA, RCRA, CWA, and CERCLA.

ENVH 515 Environmental and Occupational Toxicology (4) S *Eaton* Principles of toxicology, with emphasis on the biological fate and mechanisms of toxic action of chemicals encountered in the work place and general environment. Offered jointly with ENV S 515. Prerequisites: organic chemistry, introductory physiology and biochemistry, or permission of instructor.

ENVH 521 Environmental Components and Problem Identification (3) A Examination of the physical components that influence persons' health and their efficiency of performance. Application of techniques for the gathering of information and identifying environmental problems in the community or in industry. The techniques used include: questionnaire and interview schedule development, issue analysis, nominal group process, and environmental impact statements. Prerequisite: environmental health graduate student or permission of instructor.

ENVH 522 Environmental Program Planning (3) W Environmental programs are examined with regard to determination of needs, establishment of controls, and the legal and organizational framework within which they exist. The operational aspects of programs are explored, considering organization, planning, staffing, financing, and evaluation. Agencies are visited and studied, and a report is presented. Prerequisites: 521, environmental health graduate student, or permission of instructor.

ENVH 523 Environmental Health Program Management (3) Sp Examination of environmental health programs for the identification of management practices and problems. Specific problems considered include program organization, communications and coordination, supervision, decision making, and personnel recruitment, utilization, and evaluation.

ENVH 545 Drinking Water and Health (3) W Study of health implications of drinking water collection, treatment, and distribution, including presence of organic and inorganic pollutants, toxicants, and biological agents in water supplies; their entry, prevention of their entry, and removal by treatment processes. The conceptual design and operation of the system will be related to the size of the water supply (Class I-IV) and surface water or groundwater origin. Routine and incidental monitoring requirements in light of the Safe Drinking Water Act are evaluated. Intended to develop skills and knowledge for sanitarians, engineers, or operations supervisors to function effectively to ensure the community a safe water supply. Prerequisite: 440 or CEWA 456.

ENVH 550 Microscopy of Particulates (2) A *Luchtel* Modern microscopical instrumentation and the techniques used to identify, describe, and study the wide variety of particles, dusts, and fibers that occur in our societal and industrial environments. Sample preparation methods, theory, and practical use of light microscopy, transmission electron microscopy, and scanning electron microscopy. Prerequisite: permission of instructor.

ENVH 551 Environmental Cell Biology (2) Sp *Luchtel* Effects of environmental pollutants on the biochemical and ultrastructural properties of cells. Defense mechanisms of the lung and effects of air pollutants on lung cells treated as a model system for the various kinds of interactions between pollutants and cells. Validity and limitations of the scientific method for establishing exposure and safety levels. Prerequisite: permission of instructor.

ENVH 552 Presence and Fate of Toxic Chemicals (3) Chemical and physical processes determining distribution and fate of chemical hazards, detection of low levels of hazardous compounds, and environmental evaluation and prediction. Fundamental chemical concepts and measurable properties of individual compounds to interpret and relate measurements. Prerequisite: admission to graduate program or permission of instructor.

ENVH 553 Industrial Hygiene Instrument Laboratory (3) W Laboratory focuses on theory and practical use of various sampling instruments utilized to evaluate potential industrial hazards. Prerequisite: 453 or permission of instructor.

ENVH 555 Industrial Hygiene Chemistry Laboratory (2) Sp *Kalman* Laboratory focuses on theory and practical use of various chemical analytical instruments utilized to evaluate potential industrial hazards. Prerequisite: 453 or permission of instructor.

ENVH 557 Industrial Ventilation I (3) W *Hibbard* Principles of control of the industrial environment, including noise and hazardous chemicals, with special emphasis on design of exhaust-ventilation systems. Prerequisite: 453 or permission of instructor.

ENVH 558 Industrial Ventilation II (2) Sp *Hibbard* Laboratory exercises, case-study problems, and field surveys emphasize the practical application of the principles of industrial ventilation as the major control method of airborne health hazards in the industrial environment. Prerequisite: 557.

ENVH 560 Organizing Industrial Safety Programs (3) A *Freeman* Organization of safety programs in major industries is explored; governmental, management, and union motivations are related to safe working conditions; and functions and responsibilities of line and staff safety are described in detail. Industrial accident prevention plan is developed.

ENVH 561 Administering Industrial Safety Programs (3) W *Freeman* Focus on day-to-day operation of industrial safety programs with emphasis on workman's compensation, uses of statistics, protective equipment, hazard analysis, behavioral aspects of accident causation, safety communications, and accident investigation and reporting. Prerequisite: 560 or permission of instructor.

ENVH 562 Technical Aspects of Safety and Health (4) Sp *Freeman* Explores specific hazards associated with major industries, as well as the general hazards common to all industries. Fire protection, machine guarding, systems safety techniques, functional testing, and explosives safety.

ENVH 563 Psychological Foundations of Safety and Health (2) Overview of contemporary psychological models explaining accident etiology and subsequent countermeasures. The three major schools of psychological thought (psychoanalytic, phenomenological, and behavioral) discussed in relation to accident etiology. Special topics: risk taking, psychophysics, stress, attitudes, and ergonomics.

ENVH 564 Health and Safety Problems in Industry (2) A *Freeman, Horstman* Provides wide spectrum of practical examples of industrial processes and occupational health and safety problems, as practiced in an industrial milieu; serves as a case-study sequence for the didactic course work in several programs. Provides opportunity to approach and analyze health and safety problems using a multidisciplinary approach.

ENVH 566 Introduction to Ergonomics (3) W *Kraning* Basic principles of ergonomics applied to problems of worker and management of working environment. Topics include measurement of physical work capacity, problems of fatigue and heat stress, applied biomechanics, worker-machine interactions and communication, design of displays and controls. Prerequisite: basic human physiology or permission of instructor.

ENVH 567 Industrial Carcinogens (3) W *Luchtel* Emphasis on cancers of industrial significance. Classification of occupational carcinogens according to human and animal experiences, along with the concept of permissible exposure levels.

ENVH 571 Occupational Physiology and Toxicology (3) W Study of the function of bodily systems in relationship to potential occupational disease, including methods used to evaluate potentially toxic or hazardous exposures and their known effects. Prerequisites: CHEM 232, ZOOL 301, or permission of instructor.

ENVH 573 Health Problems of the Natural Environment (2) Sp *Milner* Considers the methods of prevention and treatment of environmental trauma. Major emphasis on environmental abnormalities encountered in the Pacific Northwest during sporting activities. Topics include frostbite, heatstroke, high-altitude disease, SCUBA problems, etc.

ENVH 574 Occupational Exposure to Excessive Sound and Hearing Loss (2) Sp Industrial sources of noise and the auditory and nonauditory effects of exposure. Noise standards, hearing evaluation, hearing protection, and engineering controls.

ENVH 575 Occupational Lung Diseases (2) Sp *Wilson* Reviews the epidemiology, clinical features, diagnosis, and prevention of occupational lung disorders, including pneumoconiosis, industrial bronchitis, occupational asthma, and cancer. Discussion of pulmonary function tests, health effects of smoking, irritant gases, and occupational infections. Primarily for physicians and medical students. Prerequisite: permission of instructor.

ENVH 576 Occupational Dermatology (2) A *Milner* Anatomy, physiology, and pathology of skin from the point of view of occupational health practitioners: diagnosis and treatment of a variety of industrial skin diseases; plant surveys, medical-legal problems, dermatitis prevention, and rehabilitation problems.

ENVH 577 Risk Assessment for Environmental Health Hazards (3) A *Omenn* Examines the context, methodologies, types of data, uncertainties, and institutional arrangements for risk assessment. Both qualitative and quantitative approaches to the identification, characterization, and control of environmental hazards to health emphasized though didactic and case studies. Offered jointly with ENV S 577, CEWA 577, and PB AF 577. Prerequisite: 515, BIOST 511, EPI 511, or permission of instructor.

ENVH 580 Environmental Seminar (1, max. 6) AWSpS Current environmental health research and environmental control programs. Offered on credit/no credit basis only.

ENVH 581, 582, 583 Environmental Reading (1,1,1) AWSpS Critical reading of selected basic and applied research publications on environmental health problems and programs. Must be taken in sequence.

ENVH 584 Occupational Health and Safety Legislation (2) Sp *Kleinman* Occupational health and safety legislation in the United States and other nations, the social issues leading to passage of such legislation, effectiveness of the legislation, policy issues, and proposed solutions.

ENVH 590 Selected Topics (1-6) AWSpS In-depth study of a current environmental health topic. Independent study special summer format presenting introductory material. May be taken with HSERV 590 and EPI 590. Offered on credit/no credit basis only. For more information and permission, consult department program adviser.

ENVH 599 Field Studies (2-6, max. 6) AWSpS Assignment to an environmental research or service program for application of evaluation techniques. Offered on credit/no credit basis only.

ENVH 600 Independent Study or Research (*) AWSpS Prerequisite: permission of departmental adviser.

ENVH 700 Master's Thesis (*) AWSpS Prerequisite: permission of departmental adviser.

Epidemiology

F263 Health Sciences

Graduate Program

Noel S. Weiss, Graduate Program Coordinator

The Department of Epidemiology offers three graduate degrees in the field of epidemiology for individuals intending to become academicians, highly qualified research specialists, or well-trained practitioners. The Master of Science degree requires concentration on courses and research in epidemiology as preparation for technical specialization or as a prelude to the Doctor of Philosophy program. The Master of Public Health degree requires course work in health services and environmental health in addition to epidemiology and thesis research. The Ph.D. course requirements differ from the M.S. program requirements only in the degree and complexity of research for the dissertation. Course work includes a basic series on epidemiology, one or more courses in biostatistics, and seminars. Electives are dictated by the student's special interest and experience. The department also offers postdoctoral research training and a two-year residency in general preventive medicine with emphasis on epidemiology for physicians.

Special Requirements

An applicant should have a degree in medicine, dentistry, or veterinary medicine or be a qualified holder of a master's or higher degree in a relevant field, such as nursing, microbiology, or biostatistics, or in an appropriate social science. Others who will be considered are students enrolled in medical school and recommended for the M.D.-Ph.D. program and, occasionally, individuals with a baccalaureate degree whose prior work experience is appropriate.

Financial Aid

Federally financed research training stipends are available on a limited basis. Some opportunities for work on various research projects or for aid in teaching may provide partial assistance.

Research Facilities

University facilities include well-equipped laboratories and access to computers. Various opportunities for field research are provided in Seattle and the state, including the Fred Hutchinson Cancer Research Center, which is staffed, in part, by members of the departmental faculty.

Correspondence and Information

Graduate Program Coordinator
Department of Epidemiology, SC-36

Faculty

Chairperson

Donald R. Peterson

Professors

Beasley, R. Palmer (Research), M.D., 1962, Harvard; infectious disease epidemiology, international health.

Emanuel, Irvin,* M.D., 1960, Rochester, M.S.P.M., 1966, Washington; epidemiology of maternal and child health problems.

Foy, Hjordis M.,* M.D., 1953, Karolinska Instit. (Sweden), Ph.D., 1958, Washington; epidemiology and control of infectious disease.

Gale, James L.,* M.D., 1961, Columbia; epidemiology and control of infectious disease, international health.

Grayston, J. Thomas,* M.D., 1948, Chicago; epidemiology and control of infectious disease.

Henderson, Maureen M.,* M.B.B.S., 1949, D.P.H., 1956, Durham (U.K.); epidemiology of chronic diseases.

Lee, John A. H.,* M.D., 1955, Edinburgh; epidemiology of neoplastic disease.

Peterson, Donald R.,* M.D., 1947, Oregon, M.P.H., 1958, California (Berkeley); epidemiology.

Thomas, David B.,* M.D., 1963, Washington, D.P.H., 1972, Johns Hopkins; cervix and breast carcinoma epidemiology.

Weiss, Noel S.,* M.D., 1967, Stanford, D.P.H., 1971, Harvard; chronic disease epidemiology.

Associate Professors

Daling, Janet R.,* Ph.D., 1977, Washington; maternal and child health and cancer research.

DiGiacomo, Ronald F.,*‡ (Animal Medicine), V.M.D., 1965, Pennsylvania; M.P.H., 1974, Washington; comparative epidemiology and zoonoses.

Hoover, J. Joanne* (Research), M.D., 1960, Illinois, M.P.H., 1972, Washington; cardiovascular epidemiology.

Koepsell, Thomas D.,* M.P.H., 1979, Washington, M.D., 1972, Harvard; epidemiology of chronic diseases, particularly seizure disorders, applications of epidemiologic concepts to medical practice, epidemiology approaches to health services research.

Little, Ruth E.,* Sc.D., 1975, Johns Hopkins; etiology and epidemiology of alcoholism and drug abuse—effects of these two abuses on offspring.

Assistant Professor

Davis, Scott (Research), Ph.D., 1980, Washington; cancer epidemiology, disease etiology.

Course Descriptions

Courses for Undergraduates

EPI 420 Introduction to Epidemiology (3) A Descriptive, analytic, and experimental epidemiology, as presented in examples from infectious and chronic noninfectious disease. Includes descriptive statistics as applicable in epidemiology. Prerequisite: HSERV 411, MICRO 301 or permission of instructor, or graduate standing.

EPI 497 Epidemiology Special Electives (*) AWSpS Off-campus course for medical students. Prerequisite: permission of adviser.

EPI 499 Undergraduate Research (*) AWSpS Prerequisite: permission of adviser.

Courses for Graduates Only

EPI 511 Epidemiologic Methods I (3) A *Gale, Peterson* Lectures and discussions covering evolution and meaning of epidemiology, concepts of disease causation, basic epidemiologic methods, and descriptive, analytic, and experimental epidemiology. A term paper on the epidemiology of a selected disease is required. Prerequisite: permission of instructor.

EPI 512 Epidemiologic Methods II (3) W *Weiss* Study of the principles and practices of epidemiology as applied to the noncommunicable diseases. Prerequisites: 511 and BIOST 511, or permission of instructor.

EPI 513 Application of Epidemiologic Methods (4) Sp Practical experience in analysis of data. Students analyze data sets currently on file using contemporary epidemiologic methods as taught in 511 and 512. Prerequisites: 511, 512, and epidemiology majors.

EPI 520 Infectious Diseases Epidemiology (3) Sp *Foy* Principles and practices of epidemiology, appropriate for the study of communicable diseases. Methods for epidemiological investigation of infections taught by reading and discussing classical descriptions of disease outbreaks and analyzing current papers on the subject. Term paper outlining a protocol for a research study related to infectious agents required. Prerequisite: 511 or permission of instructor.

EPI 521 Epidemiology of Maternal and Child Health Problems (3) W *Emanuel* Consideration of the contribution of epidemiology to the understanding of the etiology of various perinatal problems, including congenital malformations, fetal, infant, and maternal mortality, abortion, neonatal morbidity, complications of pregnancy, prematurity, and mental retardation, together with the evaluation of control problems. Prerequisites: graduate, medical, or dental school standing and 511, or permission of instructor.

EPI 522 Applications of Vital and Health Statistics (3) Sp *Lee* Analysis of routinely collected data on the health status and the care of populations, with emphasis on the potential and the limitations of this approach. Stressed are the importance of such data for the development and the evaluation of programs and the recognition of new hazards. Offered jointly with BIOST 522. Prerequisite: BIOST 472 or equivalent or permission of instructor.

EPI 524 Epidemiologic Studies of Cancer Etiology and Prevention (3) W *Thomas* Current knowledge of the role that chemicals, radiation, viruses, familial factors, immunodeficiencies, and benign diseases play in the etiology of various cancers, as determined from studies in human populations; the epidemiologic characteristics of most major types of cancer; applications of epidemiologic principles to planning and evaluating programs of primary, secondary, and tertiary cancer prevention. Prerequisite: 511.

EPI 525 Advanced Seminar in Cancer Epidemiology (2) Sp *Lee* Explores current areas of controversy and doubt with the aid of various faculty members: the carcinogenic properties of exogenous estrogens; the interaction between life-long and shorter-term factors in the etiology of human cancers; the relationship of microbiological agents to the etiology of carcinoma of the cervix. Offered on credit/no credit basis only. Prerequisites: 511, BIOST 511, and permission of instructor.

EPI 526 Zoonotic Diseases (3) A *DiGiacomo, Rausch* Explores the public health aspects of zoonotic diseases, their epidemiology and current approaches to control. Focuses on the major viral, rickettsial, bacterial, protozoal, helminthic, and fungal diseases transmitted from wild and domesticated animals to man in North America. Offered jointly with ANMED 526. Prerequisites: graduate standing and permission of instructor.

EPI 527 Statistical Models for Epidemiologic Analysis (4) A *Breslow, Farewell, McKnight* Introduction to the multivariate analysis of survival and categorical data using multiplicative models. Applications to cohort and case-control studies in epidemiology. Familiarity with available computer programs and packages gained by analysis of *bona fide* sets of clinical and epidemiological data. Offered jointly with BIOST 527. Prerequisite: 513 or BIOST 513 or permission of instructor.

EPI 531 Problems in International Health (3) A Survey of the relationship of the sociocultural, political, economic, and demographic characteristics of developing countries to disease occurrence and to the solution of health problems. Prerequisite: graduate or medical student standing.

EPI 542 Clinical Epidemiology (2) S *Weiss* Elaboration of selected topics introduced in 512. Offered on credit/no credit basis only. Prerequisite: 512.

EPI 583 Epidemiology Seminar (1, max. 3) AWSp Promotes critical reading of scientific papers and increases knowledge and understanding of principles and methods in epidemiology.

EPI 590 Selected Topics in Epidemiology or International Health (2-6, max. 6) AWSpS Tutorials are arranged for a small number of students for in-depth examination of an area of epidemiology or international health, usually of current nature. Seminar format. Prerequisite: 511. Also a special summer format presenting introductory material. May be taken with ENVH 590 and/or HSERV 590. For more information and permission, consult the department program adviser.

EPI 598 Teaching Methods in Epidemiology and/or Preventive Medicine (1-3) AWSpS Supervised teaching experience in public health and in epidemiology. Student formulates an outline for a course in epidemiology or related subject. Student makes one or more formal presentations to class and is encouraged to use modern educational methods and teaching media. Student constructs test questions on lecture subjects. Prerequisite: EDPSY 449 or equivalent.

EPI 600 Independent Study or Research (*) AWSpS Offered on credit/no credit basis only. Prerequisite: permission of departmental adviser.

EPI 700 Master's Thesis (*) AWSpS Offered on credit/no credit basis only. Prerequisite: permission of departmental adviser.

EPI 800 Doctoral Dissertation (*) AWSpS Offered on credit/no credit basis only. Prerequisite: permission of departmental adviser.

Health Services

F346 Health Sciences

Graduate Program

In addition to the graduate program in Health Services Administration (an interdisciplinary degree-granting program of the Graduate School described in the Interdisciplinary Graduate Degree Programs section of this catalog), the Department of Health Services offers a two-year graduate program in community medicine leading to the Master of Public Health degree. The department also offers a three-year extended degree program in community health management leading to the M.P.H. degree for employed professionals working full time. In addition, the department participates in the training of doctoral students from other departments on campus by offering a specialization in health services as part of the Doctoral Opportunities Program.

The M.P.H. program in community medicine gives priority to individuals who have completed their professional health training such as physicians, dentists, and nurses. Others who have had substantial experience in the health field are also considered. This program offers a general curriculum that includes introduction to health systems, epidemiology, current issues regarding the provision of medical care, and methodological training for research and program evaluation. Examples of areas of concentration include studies of patient and provider behaviors; evaluation of local, state, and federal health programs; and the impact of technology on medical care costs and benefits. A student's program of studies may vary according to his or her concentration of study and career objectives. Students may take courses in other departments of the University, if deemed appropriate by their advisers. Extensive use is made of community agencies and resources. Students with a background in medicine also may qualify to receive concurrent credit for residency training in preventive medicine.

The extended M.P.H. degree in community health management provides an opportunity for employed health professionals to obtain a master's degree while continuing their employment. The program provides a broad exposure to the health-care system, plus specific management training in accounting, finance, economics, organization behavior, and program evaluation. Students are required to attend one-month summer sessions for three years, complete assignments at their places of employment, and meet for four or five weekends at the University during the academic year.

Doctoral study in health services is available to qualified students on campus who are enrolled in the doctoral programs of other departments (e.g., sociology, economics, psychology, or Graduate School of Business Administration). Students in the Doctoral Opportunities Program take four courses in health services, complete a comprehensive examination, and focus their dissertation in their parent program on a health-related topic.

Certificate Program

MEDEX Northwest is a training program designed to extend the physician's capacity to provide primary care by training already experienced medical personnel as physician assistants. A fully accredited physician assistant program, conforming to standards developed and administered by the American Medical Association, MEDEX Northwest annually places twenty-four students in primary-care sites in Washington, Alaska, Oregon, Idaho, and Montana.

Presently a twelve-month program in transition to an eighteen-month schedule, the first half of the program consists of intense clinical and didactic instruction at the University. The following preceptorship is an on-the-job experience tailored to the practice of individual preceptors and emphasizing diagnosis and treatment. At the completion of the program, students are registered with their employing physician and are eligible to sit for the national certifying examination for physician assistants.

Special Requirements

Applicants to the M.P.H. program must, in addition to Graduate School admission requirements, submit at least three letters of recommendation and scores from the Graduate Record Examination. Applicants who pass the initial screening are encouraged to have interviews with the faculty or their designees. At least three years of medical or health-care experience are required. In general, applicants are accepted only for Summer and Autumn quarters of each year. The application deadline is May 1. Students interested in pursuing a doctoral-level concentration in health services should contact the Chairperson of the Department of Health Services regarding special requirements.

Financial Aid

Every attempt is made to ensure that students admitted are not prevented from pursuing graduate studies due to inadequate finances. A limited number of fellowships, assistantships, scholarships, and loans are available each year. However, students admitted should be prepared to utilize their own resources to finance their graduate education.

Research Facilities

In addition to utilizing University facilities, the program makes use of community health facilities and agencies for research and training.

Correspondence and Information

M.P.H. Program: Graduate Program Coordinator, Department of Health Services, SC-37

Extended M.P.H. Program: Graduate Program Assistant, Department of Health Services, SC-37

Doctoral Studies: Chairperson, Department of Health Services, SC-37

MEDEX Northwest, Physician Assistant Program: Program Director, HA-45

Faculty

Chairperson

Edward B. Perrin

Professors

Bice, Thomas W.,* Ph.D., 1969, Purdue; regulation in the health-care industry.

Day, Robert W.,* M.D., 1956, Chicago; M.P.H., 1958, Ph.D., 1962, California; health-information systems.

Gilson, Betty S.,* (Family Medicine), M.D., 1943, Minnesota; health-status measurement.

Perrin, Edward B.,* Ph.D., 1960, Stanford; stochastic modeling.

Richardson, William C.,* Ph.D., 1971, Chicago; alternative delivery systems.

Tompkins, Richard K.,* M.D., 1965, Colorado; clinical decision making.

Associate Professors

Bergner, Marilyn,* Ph.D., 1970, Columbia; health-status measurement.

Carter, William B.,* (Family Medicine), Ph.D., 1975, Washington; health behavior.

Conrad, Douglas A.,* (Community Dentistry),† Ph.D., 1978, Chicago; competition in health-care sector.

Inui, Thomas S.,* M.D., 1969, Sc.M., 1973, Johns Hopkins; health-related behavior.

LoGerfo, James P.,* (Medicine), M.D., 1968, Rochester; quality-of-care assessment.

Peterson, Malcolm L.,* (Medicine),† M.D., 1954, Washington, Ph.D., 1960, Rockefeller Institute (New York); health services utilization costs.

Trivedi, Vandan M.,* Ph.D., 1974, Michigan; hospital cost control.

Watts, Carolyn A.,* Ph.D., 1976, Johns Hopkins; regulation.

Assistant Professors

Altamore, Rita A., M.D., 1977, Boston; medical care for uninsured poor and unemployed.

Connell, Frederick A.,* M.D., 1972, New York; medical needs.

Durham, Mary L.,* Ph.D., 1978, Oklahoma; long-term care.

Martin, Diane K.,* Ph.D., 1979, Washington; epidemiology.

Michnich, Marie E.,* Ph.D., 1978, California; ambulatory-care organization evaluation.

Wainwright, Robert, M.D., 1966, Colorado; international health.

Lecturers

Ballweg, Ruth Ann, B.S., 1969, Southern Oregon State, MEDEX, 1978, Washington; women's health care and women's professional roles.

Callen, William B., Ph.D., 1983, Washington; utilization of physician assistants and community health workers.

Kundert, Kathryn L., B.S., 1974, California (Santa Cruz); educational development in cross-cultural settings..

Richardson, Mary, M.H.A., 1978, Washington; program evaluation.

Stoll, Henry W., B.A., 1971, Brown; physician assistant education, curriculum development and physician assistant professional issues.

Course Descriptions

Courses for Undergraduates

HSERV 411 Introduction to Health Services and Community Medicine (3) AW Broad survey of key elements in public health and personal health services. The objective is to create familiarity with major issues, terminology, and selected specific programs in the health-care field. For future health professionals and others wanting a broad exposure to health issues.

HSERV 451 Anatomy and Physiology for the MEDEX Practitioner (6) A *Stoll* Students are taught the anatomy and physiology of the following organ systems: EENT, respiratory, cardiovascular, gastrointestinal, genitourinary, gynecologic, integumentary, musculoskeletal, and neurologic. Focus on clinical examples of anatomic and physiologic principles encountered in primary-care practice. Prerequisite: admission to the MEDEX program.

HSERV 452 Basic Clinical Pathology for the MEDEX Practitioner (3) W *Stoll* Basic pathological and pathophysiological concepts of diseases commonly encountered in primary-care practice. Pathophysiology studied per organ system. Prerequisites: 451, 453, 457, or permission of instructor.

HSERV 453 Basic Clinical Skills for the MEDEX Practitioner (6) A *Ballweg* Provides the student with mastery of a screening history and physical examination and thoroughness in data-collection skills. Branching examinations of major organ systems and medical record-keeping and verbal presentation skills by the problem-oriented method are taught. Prerequisite: admission to the MEDEX program.

HSERV 454 Principles of Clinical Problem Solving for the MEDEX Practitioner (6) A *Altamore, Kundert* Students learn to define and to use a problem-solving process in performing patient assessments of common primary-care problems. These problems are covered by organ system. Prerequisite: admission to the MEDEX program.

HSERV 456 Pediatrics for the MEDEX Practitioner (5) Sp *Ballweg* Designed to acquaint students with basic primary-care pediatrics; includes pediatric physical diagnosis and history taking; child development; and common pediatric problems. Concepts of prenatal care, health maintenance of children, and well-child care are covered. Prerequisites: 451, 453, 457, or permission of instructor.

HSERV 457 Behavioral Science Skills for the MEDEX Practitioner I (3) A *Lurie* Process skills and interpersonal skills needed for primary-care practice, assessment skills needed for the diagnosis of emotional problems, and management skills used in primary-care practice to deal with these problems. Prerequisite: admission to the MEDEX program.

HSERV 458 Behavioral Science Skills for the MEDEX Practitioner II (3) W *Lurie* In-depth coverage of common emotional problems seen in primary care. Topics include crisis intervention, child abuse, death and dying, life planning, behavioral modification, human sexuality, alcohol and drugs, and family therapy techniques. Prerequisites: 451, 453, 457, or permission of instructor.

HSERV 459 Behavioral Science Skills for MEDEX Practitioner III (3) *Lurie* In-depth approaches to assessment and management of specific primary-care problems, including post-traumatic stress disorders, SIDS, violent patient, relevance of male/female issues to primary care, and emotional and sexual needs of disabled persons. Advanced interviewing skills with videotaped feedback included. Prerequisites: 457, 458, or permission of instructor.

HSERV 460 Principles of Patient Management for the MEDEX Practitioner I (2) W *Ballweg* Systematic approach to patient management applicable to a primary-care setting. Half of course devoted to drug therapy and its administration with text developed specifically for the course; other half includes record keeping by a problem-oriented system, health maintenance, risk factor identification, and nonpharmacological therapeutic modes. Prerequisite: admission to MEDEX program.

HSERV 461 Principles of Patient Management for the MEDEX Practitioner II (2) Sp *Ballweg* Drug therapy syllabus is extended, using a programmed text approach. Major chronic disease states and their comprehensive management discussed as examples of the principles enunciated in 459. Role of the primary-care practitioner in preventive practice. Prerequisites: 451, 453, 457, 459, or permission of instructor.

HSERV 462 Emergency Medicine and Technical Skills for the MEDEX Practitioner (2) Sp *Kundert* Student learns to assess emergency conditions, what immediate actions to take, and how to organize a management and referral plan for major and minor emergent conditions. Topics include life support, CPR, intravenous fluids, head injuries, respiratory distress, burns, environmental injuries, poisonings, shock, wound care, suturing, and casting. Prerequisites: 451, 453, 457, or permission of instructor.

HSERV 464 Special Clinical Topics for the MEDEX Practitioner (2) *Stoll* Lecture series in clinical medicine relevant to the practice of physician assistants, such as sexually transmitted diseases and commonly encountered endocrine disorders. Prerequisite: admission to MEDEX program.

HSERV 465 Clinical Selectives for the MEDEX Practitioner (19) S *Stoll* Full-time clinical clerkship spent in institution-based or specialty practice settings, such as occupational health, surgery, emergency medicine, psychiatry, and geriatrics. Prerequisite: admission to MEDEX program.

HSERV 466 Family Practice Clerkship for the MEDEX Practitioner I (19) A *Ballweg, Stoll* Family practice under the supervision of physicians throughout the Pacific Northwest. Common primary-care problems. Students and preceptors are educated in the utilization and management of the MEDEX in practice. Students write protocols for primary-care problems and complete a programmed text in pharmacology. Offered on credit/no credit basis only. Prerequisites: 451, 452, 453, 454, 456, 457, 458, 459, 462, or permission of instructor.

HSERV 467 Family Practice Clerkship for the MEDEX Practitioner II (19) S *Stoll* Further experience in primary-care practice with emphasis on independent patient management by the student supervised by family practitioners. Offered on credit/no credit basis only. Prerequisite: 466.

HSERV 499 Undergraduate Research (*) AWSpS

Courses for Graduates Only

HSERV 511 Health Services and Medical Care (3-4) AS Introduction to health services that includes history and structure of the health services system; interrelationships among elements and personnel in the system; and determinants of health, disease and use of health care. Prerequisite: graduate standing or permission of instructor.

HSERV 512 Health Systems: Development, Purpose, and Structure (3) A Introduction to health services for majors focusing on demographic, historical, epidemiological, and behavioral influences that have shaped development of health-care system in United States. Prerequisite: graduate standing in the health services or permission of instructor.

HSERV 513 Health Systems: Performance and Control (3) W Intensive treatment of aspects of medical care, including institutional and provider arrangements, private and public programs to supply care, access, quality, and financing of care, and issues of regulation. Prerequisite: 511 or equivalent or permission of instructor.

HSERV 514 Advanced Topics in Health Services (3) S Continuation of 513. Extensive examination of the structure, organization, financing, regulation, and outcomes of health services and analysis of how emerging technological, political, legal, and economic forces influence changes in the health-care system. Prerequisites: 512, 513.

HSERV 519 Comparative International Health Systems (2) Sp *Belcher* Guest lecturers present their experiences with various health-care systems (e.g., Canada, Sweden, United Kingdom, Ghana, Tanzania, Israel, China), including interaction between the sociopolitical setting, resources, and population health needs for each health system discussed. Students have opportunity to acquire in-depth information about one country's health system.

HSERV 527- Introduction to Health Services—Extended Degree (2-) A *Wainwright* Definition of health and its determinants, including the role of health services. Contrasting aspects of personal health services and public health. Blending of traditional public health and personal health and medical care. Prevention in health care with consideration of screening, sensitivity, and specificity. Prerequisite: registration in extended M.P.H. degree program.

HSERV -528- Provision of Health Services—Extended Degree (-3-) W *Wainwright* Consideration of factors that influence the utilization of health services, including socioeconomic and cultural. Health belief systems and health behavior, with specific consideration of the effects of these factors on utilization of services and prevention. Prerequisites: 527-, registration in extended M.P.H. degree program.

HSERV -529 Issues in Health Services—Extended Degree (-3) Sp *Wainwright* Rationale for evaluation of health services; quality control and its relation to costs. Patient protection and participation in determining medical care. Regulation of new drugs and devices. Criteria for the use of new technology. Ethical considerations, including informed consent. Prerequisites: -528-, registration in extended M.P.H. degree program.

HSERV 531 Special Studies in Community Medicine (1-12) AWSpS Experience in variable time blocks in community health activities in agencies delivering and planning health services. Sites include neighborhood clinics, health planning bodies, medical practice settings, public health agencies, special problem clinics and facilities, environmental programs and services. Prerequisite: medical student standing or permission of instructor.

HSERV 540 Ambulatory Care Organization and Management (3) A Organizational and managerial aspects of ambulatory medical services. The organizational focus relates to the ambulatory services provided within the structure of the United States health services system. The managerial aspect relates to specific administrative issues involved in the operation of health services facilities, including financial control, marketing, personnel, evaluation, and regulation. Prerequisites: 512, 513.

HSERV 541 The Organization and Role of Hospitals (3) Sp External environment and internal organization of hospitals; community-hospital relationships, hospital ownership, governing board and medical staff functions and organization; and the role of hospitals in the delivery of health services and their relationship with other elements of the health-care system. Emphasis on issues and trends. Prerequisite: 511 or 512.

HSERV 542 Long-Term Care (3) A *Winn* Provides a learning experience for graduate students in health services administration and planning and other graduate students that will increase their ability to identify and solve the problems related to long-term care with which they will be confronted in their employment. Students are exposed to available knowledge in the field; effective problem-solving attitudes and techniques for organizing information and/or developing strategies, and present actors and agencies in the field. Prerequisites: 511 or 512 and permission of instructor.

HSERV 543 Mental Health Services (3) W *M. Richardson* In-depth examination of the specific area of mental health care as it relates to all of health services delivery. Offers a descriptive as well as analytic approach to the management and organization of mental health-care delivery. Topics include costs, alternative treatment programs, current issues. Prerequisite: 511 or 512 or permission of instructor.

HSERV 544 Seminar: Health Manpower (3) S Review of current status of health manpower in the United States and growth in health professions in this century. Discusses approaches to health manpower planning. Limited to twenty students by prior arrangement with instructor.

HSERV 545 Quality of Health Care: Evaluation and Assessment (3) Sp *LoGerfo* Survey of methods used to assess components of medical care services and an analysis of their application to care by physicians, nurses, physician extenders, social services, hospitals, nursing homes, and emergency services. An overview of legal and professional quality assurance mechanisms also is presented, with analysis of their actual and potential impact. Prerequisite: 511 or 512, BIOST 511, or equivalent.

HSERV 546 Problems in Contemporary Public Health Practice (3) Sp *Wainwright* History and development of local public health departments. Traditional vs. new roles and critical interactions with public and private agencies. Examples drawn from areas of current concern (e.g., prostitution and venereal disease; health promotion and disease prevention; dental health; environmental programs; alcoholism; emergency medical services; mental health services; jail medical care). Prerequisite: 511 or 512 or permission of instructor.

HSERV 550 Economic Studies of Health Care (3) W *Garrison, Watts* Examination of health-care issues from an economic perspective, including supply and demand factors, health insurance, industry organization, and government regulation. Offered jointly with ECON 546. Prerequisite: ECON 400 or B ECON 500 or permission of instructor.

HSERV 551 Hospital and Medical Law (4) Sp *Coe* Philosophy and application of law as it relates to the hospital and other health-care facilities. Discussion of legal process and the relation of the law and public policy. Prerequisite: 511 or 512.

HSERV 552 Politics of Health Care (3) Range of health-care problems and issues dealt with by governments; conceptual frameworks for analyzing government actions; the processes involved in the formulation, implementation, and evaluation of health-care policy. Prerequisite: 511 or 512 or permission of instructor.

HSERV 553 Hospital Financial Management (3) Sp *Tiscornia* Third course in a three-course sequence dealing with the management of health services institutions and programs. Topics covered are: health services law, hospital and program policy decisions, financial planning, and hospital design and architecture; and the presentation of hospital survey and health services research project reports. Prerequisites: 511 or 512 and ACCT 500 or 501 or permission of instructor.

HSERV 554 Sociology of Health and Illness: An Organizational and Managerial Perspective (3) A *Durham* Critical examination and discussion of sociological approaches—methodological, theoretical, and empirical—in the health-care field. Particular attention is paid to applied studies in the field and, more broadly, to the implications for decision making from the sociological perspective. Offered jointly with SOC 561. Prerequisite: 511 or 512 or undergraduate major in sociology or permission of instructor.

HSERV 555 Seminar in Health-Care Finance (3) *Conrad* Practical applications (through case studies) of corporate finance principles in health-care field. Building on FIN 502, applies theoretical framework to health-care financial problems of varying complexity, including capital investment analysis, leasing vs. borrow-to-buy decision, debt capacity analysis, and bond refunding. Prerequisite: FIN 502 or permission of instructor.

HSERV 556 Quantitative Methods for Health Services (3) Sp *Trivedi* Applications of various quantitative techniques for problem solving, monitoring, controlling, and decision making in health services. Emphasis on identifying problem area, communications with consultant at a technically sophisticated level, and evaluation of the quality and applicability of analyst's work. Quantitative methods include statistical, mathematical, operations research, and industrial engineering techniques. Prerequisites: QMETH 500 or BIOST 511, and OPMGT 500 or permission of instructor.

HSERV 557 Health Behavior and Preventive Medicine (3) W *Carter* Effective delivery of preventive health services is integrally and inseparably linked to voluntary health behavior. Clinical issues and psychosocial theory related to a broad spectrum of health behaviors. Emphasized: identifying effective preventive services; psychosocial and decisional bases for health actions; provider-patient interactions; and research and clinic-based strategies for changing beliefs and behaviors. Prerequisite: 511 or 512 or permission of instructor.

HSERV 560 Advanced Seminar in Health Economics (3) Sp *Conrad, Watts* Selected topics in health economics, including risk and insurance, medical malpractice, the market for physician services, and industry regulation. Offered jointly with ECON 547. Prerequisites: 550 or ECON 546 and advanced-level microeconomic theory, or permission of instructor.

HSERV 563 Advanced Health Services Financial Management (3) Sp *Lehman* Develops financial management skills through case studies in budgeting, pricing, and monitoring the total financial requirements for health-care institutions. Topics include budgeting principles, cost analysis, rate setting, reimbursement, profit planning, short- and long-term capital financing, and financial feasibility analysis. Prerequisite: 553 or permission of instructor.

HSERV 564 Advanced Seminar on Medical Sociology (3) Sp *Cook* Development and testing of theories related to illness behavior, health occupations, and professions, and the organization of health services. Emphasis on provider-patient relationships and the sociology of health-care-delivery organizations. Offered jointly with SOC 563. Prerequisite: 554 or admission to health services doctoral opportunities program or graduate status in sociology or permission of instructor.

HSERV 570 Seminar in Health Services Management (4) W *Dowling* Examination of decision making, change implementation, and control processes in health-services-delivery organizations. Emphasizes (1) behavioral, organizational, and situational factors affecting the management role in health organizations, and (2) management strategies for analyzing problems and implementing changes to improve organizational performance. Seminar/case study format. Prerequisite: 511 or 512 or 541 or permission of instructor.

HSERV 571 Technical Planning of Health Services and Facilities (4) Sp *Jones* Basic planning model involving seven steps and five technical capabilities. Application of the model and employment of specific techniques in making decisions and programming action with respect to health services and facilities, with emphasis on inpatient and ambulatory-care programs. Prerequisite: 511 or 512 or permission of instructor.

HSERV 572 Health Planning: Implementation and Goals (4) A *Blackman* How to design realistic implementation strategies at the beginning of a planning process to optimize the impact of planning on real world of problems. Students prepare several sets of strategies dealing with planning in community, organizational, and committee settings. Course presents techniques that can be used in designing planning programs. Demonstrates relationship between change implementation strategies and development of goals for change. Students learn how change is brought about, how decisions are made, and how things get done at both the organization and community levels. Prerequisite: 511 or 512 or substantial experience in an operating setting or agency.

HSERV 573 Program Evaluation (3) A *Bergner* Theory, practice, and politics of evaluation. All types of evaluative activities considered from simple feedback mechanisms to the evaluation of large-scale ongoing programs and social experiments. Emphasis on development of familiarity with, and applications of, experimental and quasiexperimental evaluation. Case studies drawn from the health field used to illustrate the various types of evaluation. Prerequisite: background in quantitative methods.

HSERV 581- Research Design and Problem Analysis in Health Services I (2-) A *Perrin* Lecture/seminar in the application of scientific method to health services research; designed to provide a common orientation to Doctoral Opportunity Program students. Offered on credit/no credit basis only. Prerequisite: 511 or 512 or admission to Doctoral Opportunity Program or permission of instructor.

HSERV -582 Research Design and Problem Analysis in Health Services II (-2) W *Perrin* Continuation of 581-. Offered on credit/no credit basis only. Prerequisite: 581- or permission.

HSERV 590 Selected Topics in Health Services (*) AWSpS By individual arrangement, the student and faculty member(s) develop a program of reading and conference appropriate to the topic selected by the student. The topic chosen will be within the special competence of the faculty participating in the course, in the areas of health-care delivery and health-care administration. Also special summer format presenting introductory material may be taken with ENVH 590 and/or EPI 590. For more information and permission, consult department program adviser.

HSERV 591, 592 Seminar in Special Topics I, II (1-4, max. 4; 1-4, max. 4) AWSpS,AWSpS Special topics related to current issues in health services. Topics determined by expressed interest of students and faculty; also includes participation of health professionals. Prerequisite: 511 or 512.

HSERV 595, 596, 597 Field Analysis Project/Research Project (1-3,3,3) A,W,Sp Supervised research in a selected topic related to student's concentration in graduate study. Includes survey of literature, development of approach, and written paper on conclusions. Prerequisite: successful completion of first-year curriculum and internship in graduate program in health services administration and planning.

HSERV 600 Independent Study or Research (*) AWSpS Prerequisite: permission of instructor.

HSERV 700 Master's Thesis (*) AWSpS Prerequisite: permission of instructor.

Pathobiology

F161 Health Sciences

Graduate Program

George E. Kenny, Graduate Program Coordinator

The Department of Pathobiology offers a research training program leading to the degree of Master of Science. A proposal is being prepared to offer a Doctor of Philosophy degree program in pathobiology. Pathobiology is the study of pathogenic biological agents and their interaction with their host, primarily man. The agents studied, with primary emphasis on their antigenic structure, include: viruses, bacteria, mycoplasmata, chlamydiae, protozoa, parasites, and tumors. The host responses studied are primarily immunologic.

As a discipline, pathobiology stands at an interface of fundamental biology and clinical medicine. The ultimate goal is to determine means of detecting, understanding, and preventing disease. Diseases studied include: respiratory infections (viral and microbic), venereal diseases, cancer, trypanosomiasis, helminthic infections, and diarrhea. Course work includes basic courses in pathobiology, with additional courses in biostatistics, epidemiology, microbiology, and biochemistry. Electives may be selected from these fields as well as from other basic medical sciences, such as pathology and genetics. Major emphasis is placed on the production of knowledge through the research program where the thesis or dissertation ordinarily results in publication. To the holder of a doctoral degree, the department also offers postdoctoral research training. Applicants for degree programs should apply to the graduate program coordinator and applicants for postdoctoral training should apply directly to individual faculty members.

Special Requirements

The applicant for the M.S. program should have a baccalaureate degree in biological science. Courses in biochemistry and microbiology are required, and those entering the curriculum without such background will be required to correct the deficiency. Persons holding professional doctorates (medicine, dentistry, veterinary medicine) are also encouraged to enter the graduate program.

Financial Aid

Financial aid is provided through research assistantships funded primarily through federal research grants held by the faculty.

Research Facilities

Laboratories are specifically equipped for biochemical and immunochemical work. Although most students work at the University site, opportunities for training also exist at the Fred Hutchinson Cancer Research Center and the Pacific Medical Center.

Correspondence and Information

Graduate Program Coordinator
Department of Pathobiology, SC-38

Faculty

Chairperson

George E. Kenny

Professors

Boatman, Edwin S.,*‡ (Environmental Health), Ph.D., 1967, Washington; morphology and ultrastructure of microorganisms and structure of the lungs.

Buchanan, Thomas M.,* M.D., 1967, Washington; immunology of gonorrhea and leprosy.

Cooney, Marion K. (Emeritus), Ph.D., 1962, Minnesota; medical virology.

Hakomori, Sen-Itiroh,* (Microbiology and Immunology),† M.D., 1952, D.Med.Sci., 1956, Tohoku (Japan); membrane biochemistry and glycoproteins.

Kenny, George E.,* (Microbiology and Immunology), Ph.D., 1961, Minnesota; antigenic structure.

Kuo, Cho-chou,* M.D., 1960, National Taiwan, Ph.D., 1970, Washington; chlamydiae.

Rausch, Robert L.,* (Animal Medicine),† D.V.M., 1945, Ohio, Ph.D., 1949, Wisconsin; parasitology.

Sherris, John C.,*‡ (Microbiology and Immunology), M.D., 1950, London; medical microbiology, antibiotic action and resistance.

Wang, San-pin,* M.D., 1944, D.Med.Sci., 1959, Keio (Tokyo); chlamydiae.

Associate Professors

Chen, Kirk C. S.,* Ph.D., 1972, Oklahoma; protein biochemistry.

Thouless, Margaret E.,* Ph.D., 1974, Birmingham (England); gastroenteritis viruses.

Assistant Professors

Carter, William G.,* Ph.D., 1974, California (Davis); membrane biochemistry and glycoproteins.

Stibbs, Henry H.,* Ph.D., 1974, Tulane; parasitology.

Young, Douglas B., Ph.D., 1978, Oxford; molecular aspects of pathogenicity.

Course Descriptions

UCONJ 420 Biological Safety Practices (1) A *Kenny* See University Conjoint courses.

PABIO 451 Laboratory Diagnosis of Viral Infections (4) Sp *Cooney* Lecture and laboratory covering diagnostic procedures for etiologic diagnosis of viral infections; upper respiratory, lower respiratory, systemic, and central nervous system. Symptomatology; indications for specimen collection, types of specimens for examination, methods for virus isolation; identification of agents, serologic methods, interpretation of results. Prerequisites: MICRO 441, 442 or equivalent.

PABIO 497 Pathobiology Special Electives (*) AWSpS Off-campus course for medical students.

PABIO 499 Undergraduate Research (*) AWSpS

Courses for Graduates Only

PABIO 511 Pathobiological Frontiers (3) Sp *Kenny* Study and discussion of the present concepts of pathobiology as related to disease, presented in a format suitable for graduate students knowledgeable in health-related areas, but who are not in biology-oriented programs. Topic areas include: host-parasite interactions, host responses, pathogenesis, and methods of biological experimentation. Prerequisite: permission of instructor.

PABIO 521 Mammalian Cell Culture as a Tool for Virus Research (3) A *Kenny* General concepts, techniques, and applications of cell culture. The nutrition, growth characteristics, and metabolism of animal cell cultures are considered in detail. Laboratory includes a special problem of the student's choice. Prerequisite: permission of instructor.

PABIO 522 Antigenic Analysis of Microorganisms (3) W *Kenny* Theory, techniques, and strategy for antigenic analysis of microorganisms. Emphasis is placed on the use of recent electrophoretic methods for quantitative analysis of complex antigenic mixtures. Prerequisite: permission of instructor.

PABIO 524 Methods for Ultrastructure of Microorganisms (3) W *Boatman* Specific methods for the investigation of the ultrastructure of microorganisms are described following discussion of the design and operation of the electron microscope. Lectures cover the morphology and structure of bacteria, mycoplasmata, and bacterial and animal viruses. Instruction is given in operating the electron microscope, in the examination of specimens, and in producing photographic data. Students are expected to pursue a small topic of their choice. Prerequisite: permission of instructor.

PABIO 525 Cell Surface Membrane in Cell Sociology and Immunology (2) Sp *Hakomori* Structure and function of cell surface membranes in relation to various immunobiological and pathobiological phenomena (differentiation, organization, infection, cancer, etc.) are covered. Offered jointly with MICRO 525. Prerequisites: BIOC 440, 441, 442, MICRO 447, and permission of instructor.

PABIO 527 Immunology of Parasitic Diseases (2) *Stibbs* Surveys recent research into mechanisms of vertebrate immunity to pathogenic protozoa and helminths; strategies by which these parasites evade the immune response and immunosuppress; antigenic analysis; molecular cloning; and attempts and successes at immunization or other means of enhancing host immunity. Prerequisite: permission of instructor. Entry card required.

PABIO 528 Biochemistry and Physiology of Parasites (2) A *Stibbs* Review of ways in which pathogenic parasites (protozoa and helminths) of medical and veterinary importance acquire their necessary nutrients, generate and store energy, and metabolize carbohydrates, lipids, proteins, amino acids, and nucleic acids. Mechanisms of drug action. Lectures, group discussions of recent papers, and student seminars. Entry card required.

PABIO 580 Pathobiology Seminar (1, max. 9) AWSpS Research reports from both students and faculty members are presented and discussed. Topics include immunochemistry, viruses, membranes, infectious diseases, immune response. Prerequisite: permission of Kuo.

PABIO 581 Current Literature in Pathobiology (1, max. 12) AWSpS Critical evaluation of recent articles on infectious agents. Emphasis on literature dealing with immunological, biochemical, and molecular studies of selected pathogenic microorganisms and viruses. Prerequisite: graduate student standing in pathobiology; others by permission of Cooney.

PABIO 583 Seminars on Frontier Membrane Research (1, max. 4) *Hakomori* Research seminars on structure and function of cell surface membranes for postdoctoral fellows and graduate students. A detailed discussion on experimental design based on current topics of cell surface structure and function will be made among researchers in the Department of Pathobiology, and Division of Biochemical Oncology, Fred Hutchinson Cancer Research Center. This course can be regarded as advanced stage supplement to the membrane course, 525.

PABIO 590 Selected Topics (1-6, max. 6) AWSpS *Buchanan, Carter, Chen, Cooney, Hakomori, Kenny, Kuo, Rausch, Stibbs, Thouless, Wang* In-depth study of disease agents and host response, usually related to a current problem, and focusing on characteristics of the disease agent. Seminar format. Small groups of students by arrangement with faculty member. Offered on credit/no credit basis only. Prerequisites: enrollment in pathobiology graduate degree program and permission of instructor.

PABIO 598 Didactic Pathobiology (*, max. 12) AWSp *Kenny* Supervised lecture and laboratory-teaching experience for Ph.D. candidates. Teaching is in pathobiology laboratory courses, depending on interests of the student. Prerequisite: permission of instructor.

PABIO 600 Independent Study or Research (*) Offered on credit/no credit basis only. Prerequisite: permission of department Chairperson.

PABIO 700 Master's Thesis (*) Offered on credit/no credit basis only. Prerequisite: permission of department Chairperson.

Reserve Officers Training Corps Programs

Aerospace Studies

202 Clark

The Air Force ROTC program is designed to motivate, educate, and commission highly qualified students for active duty as officers in the United States Air Force. The curriculum develops the skills and attitudes an Air Force officer needs to comprehend and cope with the scientific and technological developments of the 1980s.

General Program Requirements

The freshman- and sophomore-level courses are open to all students between the ages of seventeen and twenty-six attending a state or community college full time. Any qualified male or female student may enroll in these general military courses. The junior and senior classes are open to qualified students who have received credit for the general military courses and who have been competitively selected for entry.

Commissioning Requirements

Students who successfully complete the AFROTC program and receive an academic degree from the University will be offered commissions as second lieutenants in the United States Air Force.

General Military Course

The basic division courses consists of one classroom hour and one leadership laboratory hour per week during the freshman and sophomore years. Uniforms and textbooks are provided. Students may enter the freshman class at the start of Autumn, Winter, or Spring quarters. Sophomore students may enter at the start of Autumn Quarter and take the freshman- and sophomore-level courses concurrently. A four-week field training course, taken during the summer between the sophomore and junior years, is required for entry into the professional officer courses. Students receive pay and travel costs for field training.

There is no active duty service commitment for taking general military courses, and students may drop the courses at any time.

Professional Officer Courses

Cadets selected for enrollment in professional officer courses are enlisted in the Air Force Reserve and receive tax-free subsistance pay of $100 per month. They are furnished texts and uniforms. Junior- and senior- level classes consist of three hours of academic classes and one hour of leadership laboratory per week.

Financial Assistance

The Air Force offers 3½-, 3-, 2½-, and 2-year scholarships for engineering, certain specific, and certain premedicine majors. In addition, scholarships are available for highly qualified pilot, navigator, and missile launch officer candidates. Air Force ROTC scholarships pay tuition, books, and fees.

In addition, scholarship winners receive a $100 subsistence allowance per month. To take advantage of these scholarships, students should apply directly to the AFROTC department.

Flight Training

Flight training is available to students in the AFROTC Flight Instruction Program. The Air Force pays the cost for up to twenty-five hours of flight instruction from an accredited flying school. Those who complete this program and receive commissions go on to Air Force pilot training.

Two-Year Program

To provide for those students who are unable to take the general military courses, a two-year professional officer course is available on a highly competitive basis. The two-year program is open to graduate students and other students who have two years remaining until graduation.

Students in this program are required to attend a six-week field training course at an Air Force base during the summer preceding program entry. The student is paid during the six-week period. Upon return to the campus, students pursue the professional officer course. Uniform, texts, and $100 subsistence per month are provided.

Two-year scholarships may be available for qualified students. Students interested in this program should contact the AFROTC department during the November prior to Autumn Quarter they desire to enter.

Faculty

Chairperson

Ernest L. Hansen

Professor

Hansen, Ernest L., M.A., 1967, Oregon State; aerospace studies.

Assistant Professors

Breitenbach, Peter N., M.S., 1976, Southern California; aerospace studies.

Burleson, Stephen C., M.A., 1979, Northern Arizona; aerospace studies.

Kraber, Karl G., M.A., 1981, Ball State; aerospace studies.

Simmons, Donald W., M.B.A., 1980, Chapman; aerospace studies.

Course Descriptions

Courses for Undergraduates

A S 101, 102, 103 Aerospace Studies 100 (1,1,1) A,W,Sp *Hansen, Kraber* Focuses on the basic characteristics of air doctrine; U.S. Air Force mission and organization; functions of U.S. strategic offensive and defensive, general-purpose, and aerospace support forces. One-hour leadership laboratory consisting of Air Force customs and courtesies, Air Force environment, and drill and ceremonies is mandatory.

A S 211, 212, 213 Aerospace Studies 200 (2,2,2) A,W,Sp *Burleson* Factors contributing to changes in military conflict; development of air power from beginnings through two world wars; evolution of air power concepts and doctrine; role of technology in growth of air power; history of air power employment in military and nonmilitary operations in support of national objectives; and assessment of oral communicative skills. Additional one-hour leadership laboratory is mandatory.

A S 331, 332, 333 Aerospace Studies 300 (3,3,3) A,W,Sp *Breitenbach* Study of Air Force leadership and management. Includes professional responsibilities, military justice system, leadership theory functions and practices, management principles and functions, and problem solving. Three classroom hours and one hour of leadership laboratory per week. Prerequisites: 213 or equivalent for 331; 331 for 332; 332 for 333.

A S 340 Aviation Fundamentals (2) W *Hansen* Basic aircraft systems and aviation concepts. Focus on air navigation concepts, including dead reckoning, pilotage, and radio aids to navigation. Essential elements of meteorology, communication techniques, and air traffic control of publications and regulations. Entry card required.

A S 431, 432, 433 Aerospace Studies 400 (3,3,3) A,W,Sp *Simmons* Study of United States defense policy with respect to those political, economic, and social constraints involved in its formulation and implementation. Includes an examination of the military professional, his role and civil-military relationship in a democratic society. Three classroom hours and one hour of leadership laboratory per week. Prerequisites: 333 or equivalent for 431; 431 for 432; 432 for 433.

Military Science

104 Clark

The Department of Military Science offers the college student several elective options for the attainment of an Army officer's commission in reserve or active forces through Army ROTC while pursuing the academic degree of his or her choice. The program is highly competitive for commissioning.

Traditional Four-Year Program

Open to incoming freshman men and women, this program may lead to a commission in either the Regular Army or the Army Reserve. Academic studies include courses in military history and tactics, principles of leadership, techniques of instruction, management and staff procedures, logistics, physical conditioning, and military law. Extracurricular activities include such options as Rangers, rifle team, color guard, training exercises, field trips, and related activities. There is no obligation of any kind during the first two years of the four-year Army ROTC program. Basic course grades are included in the grade-point average. Students may count up to 10 credits toward graduation for advanced courses.

Placement credit toward completion of ROTC courses may be given for prior ROTC or military training. Veterans routinely receive full credit for the first two years of Army ROTC and may enter the advanced course directly. All military textbooks and uniform items are furnished without charge. Students in the advanced course receive a tax-free stipend of $100 per month for a maximum of twenty months. In the advanced course, cadets are required to participate in the leadership development program, which is a practicum of skills and principles taught in the previous two years. Cadets attend a six-week summer camp between their junior and senior years, during which they receive varied and challenging training and for which they are paid both for the time at camp and for travel expenses to and from the camp location. Upon entering the advanced course, students agree to complete the course, to accept a commission upon graduation, if offered, and to serve on active duty for three years after commissioning or three to six months' active duty training, with the balance of service in the Army Reserve or National Guard.

Two-Year Program

This program is open to qualified undergraduate and graduate students with at least two years in school remaining and who have completed 45 credits. Students may qualify for entrance into the advanced course under this program in either one of two ways. First, they may participate in a special summer program offered on the University campus. This is a two-week program covering the freshman and sophomore years of the normal basic ROTC work (M SCI 101,102, 103, and M SCI 201, 202, 203). Fees are not charged for registration in this program, and students are free to register for and to take other University courses during Summer Quarter. Participation in the program includes individually arranged classwork to accommodate each student's summer work or academic program. Students who have taken some military science courses but who have not completed all courses in the first and second year of ROTC may also arrange to complete the remaining course requirements during this summer program.

The second alternative under this program requires attendance at a basic camp for six weeks at Fort Knox, Kentucky. Completion of this basic camp also qualifies students for direct entry into the advanced course. While at camp, student receives pay, plus travel expenses to and from the camp location, and can compete for two-year scholarships. Academic subjects covered in the two-year program are the same as those covered in the four-year programs. Both programs have the same military obligation.

Scholarship Program for Currently Enrolled Students

This program is open to students enrolled in ROTC. Selections are made on a regional level based upon the recommendation of the Professor of Military Science. The scholarship provides financial assistance during the remaining years of the student's enrollment (up to three years). Each scholarship pays for tuition and a flat rate for books and laboratory expenses and provides, in addition, $100 per month, tax free. All other advantages and obligations are the same as those of the four-year scholarship program.

Four-Year Scholarship Program

Application for this program should be made while the student is still in high school. Selection of students is made on a nationwide competitive basis. This program may lead to a commission in the Regular Army or the Army Reserve. All tuition, a flat rate for books and laboratory expenses, and uniform items, plus tax-free retainer pay of $100 per month for a maximum of four years, are provided by the Army. The program requires four years of academic study on campus, as well as a six-week advanced camp training period between the junior and senior years, for which the cadet is paid for both time and travel expense to and from the camp location. Academic studies are identical to those of the traditional four-year program. The student must sign a contract (with the consent of parents if under eighteen years of age) wherein he or she agrees to complete the program, to enlist in the Army Reserve, to accept a commission if offered, and to serve on active duty for four years after commissioning.

Additional information concerning the Army ROTC program may be obtained by writing: University of Washington; Professor of Military Science; 104 Clark, DU-20; Seattle, Washington 98195, or by visiting the Army ROTC offices at 104 Clark, telephone (206) 442-7570.

Faculty

Chairperson

Larry J. Smith

Professor

Smith, Larry J., M.A., 1975, Missouri, M.A., 1979, Pepperdine; history and management.

Assistant Professors

Finlayson, Kenneth, B.S., 1978, Colorado State; military science.

O'Connell, Phyllis C., M.S., 1974, Florida Atlantic; business—contract administration and procurement.

Simpson, James E., M.A., 1980, Puget Sound; military science.

Sutton, William L., Jr., B.S., 1977, Virginia State; military science.

Weber, Jon C., M.A., 1981, Webster; military science.

Course Descriptions

Courses for Undergraduates

M SCI 101, 102, 103 Military Science I: Basic (1,1,1) AWSp,AWSp,AWSp History, organization, and mission of the United States Army and the ROTC. Relationship to the citizen's military and civilian obligations. Functions and organization of the United States defense establishment. Fundamentals of leadership and management in military environment. Control, prevention, and treatment of combat or emergency medical situations. One-day field trip required during the year.

M SCI 201, 202, 203 Military Science II: Basic (2,2,2) AWSp,AWSp,AWSp Develops proficiency in delivering and evaluating oral instruction. Presents a perspective on the American military tradition and post-World War II, foreign policy, and strategy. Significant military conflicts are examined as they impact on the nature of warfare for the future. Fundamentals of military map reading, aerial photography, compass and field navigation are taught and applied. One weekend field trip required during the year.

M SCI 301, 302, 303 Military Science III: Advanced (3,3,3) AWSp,AWSp,AWSp Small-unit tactics, emphasizing the importance of firepower, movement, and communications. Duties, responsibilities, and methods of employment of basic military units. Leader's role in directing and coordinating individuals and military units from squad to company level. Students are introduced to the planning and conduct of individual and group physical conditioning activities, stressing positive motivation to establish high standards of morale and esprit. Principles and techniques of command, control, military management, and leadership are taught and practiced throughout the academic year. Three weekend field trips required during the year.

M SCI 401, 402, 403 Military Science IV: Advanced (2,3,2) AWSp,AWSp,AWSp The Army officer's position in contemporary world and impact on problems within the military service. Use of a developmental study to provide awareness of personal responsibilities and official relationships of an Army officer. Organization and functions of command. Staff relationships. Coordination of administration, logistics, and planning for military operations. Basic concepts of legislative and executive authority for Uniform Code of Military Justice (to include a study of UCMJ and the officer's authority and responsibility within the military justice system). Problem-solving techniques used by small-unit leaders, emphasizing coordination and planning by the junior officer. Three weekend field trips required each year.

Naval Science

305 Clark

The Department of Naval Science offers University students the opportunity to engage in study leading to a commission in the United States Navy or Marine Corps while working toward a baccalaureate degree. In general, NROTC participants are University students first and members of ROTC second. An NROTC scholarship student may select the academic major of his or her choice within certain limitations (i.e., some majors that normally lead to immediate graduate education, such a prelaw or premedicine, are not consistent with the mission of the NROTC program). Technical and engineering majors are highly recommended as the responsibilities of naval officers are becoming more and more technical in nature.

In addition to their University curricula, NROTC students attend naval science courses in history and customs, navigation, naval engineering and weapons systems, naval operations, and leadership/management. In addition, each student must attend one drill session and one Naval Science laboratory session per week. During the summer, students may have a four-to-six-week training period to put into practice earlier classroom training. All naval ROTC students take the same Naval Science classes during the first two years. Students who elect to be commissioned in the Marine Corps take Marine Corps subjects during their third and fourth years.

Two programs are offered.

Navy-Marine Scholarship Program

Each year a number of young men and women are accepted for scholarship status in the four-year and two-year Naval ROTC scholarship programs. Selection for the four-year program is based upon nationwide competition and selection by a central selection committee. Application must be made by December 1 of the academic year preceding appointment as midshipman. Those selected are provided educational benefits, including subsidy by the Navy of all tuition fees, textbooks, and uniforms, and $100 per month in subsistence pay. For the two-year scholarship program, applications from current sophomores, or juniors in five-year programs of study, must be received prior to April 15. Those selected by a central selection board attend a six-week course of instruction at the Naval Science Institute (NSI) at Newport, Rhode Island, during the summer prior to their junior year. Successful completion of NSI qualifies these students for enrollment in the advanced course in the NROTC program. NSI graduates can qualify for scholarship based on class standing. All scholarship students are appointed as midshipmen, USNR, and upon graduation are commissioned as regular officers in the United States Navy or Marine Corps.

Navy-Marine College Program

Each year a number of young men and women are accepted for four-year and two-year college programs. For the four-year program, the Professor of Naval Science accepts applications from qualified students prior to the beginning, and up through the end, of Autumn Quarter. Applications for the two-year program are accepted from current sophomores in community colleges or four-year colleges and must be received prior to April 15.

Those students selected for the two-year program attend a six-week course of instruction at the Naval Science Institute during the summer prior to their junior year. Successful completion of the NSI qualifies students for enrollment in the advanced course in the NROTC program. NROTC college program students pay their own college expenses but receive subsistence pay of $100 per month during their junior and senior years, including the intervening summer.

The Navy furnishes the uniforms and textbooks used in Naval Science courses. College program students may obtain scholarships through various avenues, including the national competition, by nominations for special competitive appointments by the Professor of Naval Science, and by superior performance at the NSI. Upon graduation, college program students are commissioned in the Navy Reserve or Marine Corps Reserve and serve on active duty for three years.

Additional information concerning the naval ROTC programs may be obtained by writing the University of Washington; Professor of Naval Science; 305 Clark, DU-40; Seattle, Washington 98195; or by visiting the NROTC unit on campus.

Faculty

Chairperson

Terrence M. Mahoney

Professors

Mahoney, Terrence M., M.S., 1967, George Washington.
Stoeckel, Anthony W., M.A., 1973, Washington.

Associate Professor

Bianchino, R. L., M.S., 1972, Pepperdine.

Assistant Professors

Dinn, Michael J., B.S., 1978, U.S. Naval Academy.
Dotterer, D. G., B.S., 1973, Oregon State.
Harrell, Gary D., B.S., 1976, U.S. Naval Academy.
Smith, J. C., B.S., 1975, Pennsylvania State.
Weyrick, Richard, B.S., B.A., 1976, Washington.

Course Descriptions

Courses for Undergraduates

N SCI 111 The Naval Service (3) A General introduction to the Navy, its organization, missions, roles, tasks, and operating methods. The relationship to the other services within the Department of Defense is emphasized.

N SCI 112, 113 Naval Ship Systems I, II (3,3) W,Sp Study of the varied ship systems operational in the Navy today, including the principles of characteristic propulsion systems and auxiliary machinery and the elements of ship stability and damage control. An introduction to nuclear propulsion.

N SCI 211 Naval Weapon Systems (3) A Concept of naval weapons systems and the systems approach, the techniques of linear analysis of ballistics and weapons; the dynamics of basic components of weapons control systems. The tools are provided for understanding the basic principles that are involved in all modern naval weapon systems.

N SCI 212, 213 Sea Power Practicum I, II (2,2) W,Sp Seminar-type course in which discussion centers on the role of sea power in the history of the United States,the current status of the various elements of the nation's sea power as they influence the development and implementation of national security policy, and the economic effects of the elements of sea power (the Navy, the merchant marine, port facilities, fisheries, and oceanographic capabilities).

N SCI 311 Navigation (3) A Comprehensive study of the science of terrestrial navigation, including dead reckoning, piloting, and electronic means. The laws for prevention of collision at sea (rules of the nautical road) are covered.

N SCI 312 Celestial Navigation (3) W Theory and practice of celestial navigation. The student performs the complete "day's work" of the ship's navigator.

N SCI 313 Naval Operations (3) Sp Introduction to naval operations, the employment of naval forces, naval tactics, formulation of operations plans and orders, employment of detection equipment, and meteorology. The subject of operations analysis as a tool for decision making is introduced.

N SCI 411 Psychology of Leadership (3) A Introduction of the theory and techniques of naval leadership based on those principles of behavioral science that are pertinent to understanding individual and group behavior of adults. It introduces the student to the management process and the relationship of management functions to leadership. Acceptance of a traditional deep sense of moral responsibility on the part of the aspiring leader is stressed.

N SCI 412, 413 Naval Organization and Management I, II (3,3) W,Sp Study of organization, systems, and techniques employed in the Navy for management of its human, financial, and material resources. Some of the work relates to the administration of discipline in the Navy under the Uniform Code of Military Justice. Emphasis is placed on the leadership and management role of the junior officer in the fleet.

MARINE CORPS OPTION COURSES

N SCI 321, 322 Evolution of Warfare I, II (3,3) A,W Introduction to the art of war, the evolution of warfare from the earliest recorded battles to the present day.

N SCI 323 Marine Corps Operations (3) Sp Introduction to the basic tactics employed by the Marine Corps. Covers the roles and the missions of the Marine Corps, its relationship to the other services, and its employment in the implementation of national policy. Familiarizes the student with Marine Corps organization.

N SCI 421, 422 Amphibious Warfare I, II (3,3) A,W Provide basic knowledge of evolution of amphibious warfare from premodern era to present. Strategic and tactical considerations in planning specific operations and amphibious landings.

N SCI 423 USMC Leadership and Administration of Justice (3) Sp Concepts, objectives, characteristic qualities, and practical techniques of leadership as exercised by the Marine Corps officer are studied. Emphasis is placed on the leadership and management role of the junior officer in the fleet marine forces.

School of Social Work

Dean

J. Scott Briar
210 Social Work/Speech and Hearing Sciences

The School of Social Work offers three degree-granting programs: one undergraduate and two graduate. The undergraduate program prepares students to receive a Bachelor of Arts degree with a major in the field of social welfare, while the graduate programs offer the Master of Social Work degree and the Doctor of Philosophy degree in social welfare. All three programs are housed in the new Social Work/Speech and Hearing Sciences Building, 4101 Fifteenth Avenue Northeast.

Undergraduate Program

The undergraduate program consists primarily of upper-division courses in social welfare, with additional requirements in economics, psychology, and sociology. Students entering the major at the start of their junior year after completing the liberal arts requirements established by the College of Arts and Sciences. Social welfare courses during a student's junior and senior years impart a basic knowledge of the social welfare system, of human behavior and the social environment, of the social work profession, of social research, and of the skills necessary to prepare for beginning social work practice. The program is accredited by the Council on Social Work Education, and graduates of the program may join social work's professional organization, the National Association of Social Workers.

The requirements and curriculum of the social welfare program may be summarized as follows: Premajor—natural sciences, 20 credits; humanities, 20; social sciences, 20; electives, 30; total: 90.

Junior year—ECON 200 (5), PSYCH 306 (5), SOC 352 (5), SOC W 419 (3), 300 (3), 320 (3), 390 (3), 310-311 (3-3).

Senior year—SOC W 415 (12), 405 (6).

Junior or senior year—Social work electives, 15; other electives, 24; total: 90.

Admission

No more than fifty juniors are admitted to the undergraduate program Autumn Quarter of each year. A selective admission procedure is used to determine entrance into the program. Applicants seeking admission should: be admitted or admissible to the University; be eligible, or nearly eligible, for junior class standing (i.e., 65 completed credits of undergraduate work) by the end of the quarter in which application is made; be in good academic standing (i.e., 2.00 minimum grade-point average); and submit a completed application to the program.

Application forms are available at the school's admissions office from January to June for entrance into the program starting the following Autumn Quarter. The school's admissions office is located in 23 Social Work/Speech and Hearing Sciences. Admission application forms also can be mailed upon written or telephoned request.

Students accepted for the major at the end of their sophomore year surrender their premajor status by transferring their files and change-of-college forms to the undergraduate social welfare office. Thenceforth, they are advised by the undergraduate social welfare adviser, whose office is in the undergraduate office.

Additional Information

The undergraduate program is described in more detail in the undergraduate social welfare program description and in the *School of Social Work Bulletin 1983-85*. These materials may be obtained by telephoning or writing to the undergraduate office. A student who wishes to discuss the program personally may arrange a private interview by telephoning the undergraduate office to schedule an appointment with the program adviser or the director of the program. Such inquiries are welcomed.

Graduate Program

The School of Social Work offers a two-year, full-time program leading to the Master of Social Work degree, as well as an evening program that allows students to take longer than two years to complete the degree requirements.

The program prepares students for professional practice. The curriculum has three major specializations: human services, community and organizational services, and research services. Special emphasis has been placed on women and mental health, services to minority persons, physical and sensory disabilities and independent living, child welfare, aging, chemical dependencies, rural mental health, and health care.

Admission Qualifications

Admission to the M.S.W. program requires formal admission to the Graduate School as well as to the School of Social Work. Applicants are required to have an undergraduate degree, a strong academic background, and some practical experience.

Financial Aid

A limited number of financial aid opportunities are available to students. Inquiries should be directed to the chairperson, Scholarship and Financial Aids Committee, School of Social Work.

Correspondence and Information

Admissions Office
School of Social Work, JH-30

Doctoral Program in Social Welfare

James K. Whittaker, Naomi R. Gottlieb
Graduate Program Coordinators

The doctoral program in social welfare prepares students to contribute to the field of social welfare and the profession of social work through research, teaching, policy analysis, and program development. The program builds on the premise that scholarship in the field of social welfare must be scientifically based, responsive to service and practice needs, and informed by developments in related fields and disciplines.

Each student's program is individually designed with an emphasis on interdisciplinary study. In the basic core of required courses, as well as in others specially selected, students have an opportunity to pursue their particular interests with faculty members in the School of Social Work and in other schools and departments.

During the first two years, the student is expected to define and develop the specialized area that will be the focus of the subsequent dissertation research. The selected area must have clear significance for the development of practice, programs, or policies in social work and social welfare. A variety of specialized areas of study are possible within the program, ranging from studies of child welfare policy, services to the aged, or income-maintenance programs, to the effectiveness of social work practice with individuals and families.

The General Examination for advancement to candidacy normally occurs at the end of the second year. After advancement to candidacy, students devote full time to completion of their dissertation research. The last step before award of the degree is the Final Examination, which consists mainly of the defense of the dissertation. Students are strongly encouraged to remain in residence at the University until the dissertation is accepted. The total program takes approximately three years.

The school maintains the Center for Social Welfare Research and operates educational and research projects in such areas as aging, child welfare, drug abuse, rural social work, and adolescent pregnancy prevention. These projects periodically change.

Admission

Applicants should have a master's degree in social work or comparable preparation in a closely related field. The applicants selected for admission are those whose scholastic achievements, previous experience, and aptitude for social welfare research and scholarship indicate the greatest promise for achieving the objectives of the program. In addition, an effort is made to maintain a balanced student group reflecting the range of concerns in social work and social welfare as well as the affirmative action goals of the University.

Financial Aid

A limited number of fellowships, teaching assistantships, and research assistantships are available for qualified doctoral students. Tuition waivers are available to some students. However, it is unlikely that the financial assistance provided to any student would be adequate to cover all educational and living expenses. Application forms for financial assistance are submitted after the applicant has been offered admission to the program.

Special Research Facilities

The Center for Social Welfare Research, the School of Social Work library, and research faculty maintain a strong research orientation in the school.

Correspondence and Information

Graduate Program Coordinator
Doctoral Program in Social Welfare, JH-30

Faculty

Professors

Austin, Michael J.,* Ph.D., 1970, Pittsburgh; management of social welfare organizations, mental health administration, long-term health care.

Borgatta, Edgar F.,* (Sociology), (Interdepartmental Doctoral Program faculty), Ph.D., 1952, New York; methodology, social psychology, demography-ecology.

Briar, J. Scott,* D.S.W., 1961, Columbia; social work practice, research methodology, family policy and practice; social welfare and social service policy, prevention.

Costner, Herbert L.,* (Sociology), (Interdepartmental Doctoral Program faculty), Ph.D., 1960, Indiana; methods, criminology.

Feigt, Polly,* (Biostatistics), (Interdepartmental Doctoral Program faculty), Ph.D., 1961, Minnesota; application of statistical methods to clinical and laboratory medical sciences.

Gottlieb, Naomi R.,* D.S.W., 1970, California (Berkeley); women and mental health, research methodology.

Hunt, Marguerite (Emeritus), M.S., 1936, Western Reserve; social work.

Jaffee, Ben Joshua,* D.S.W., 1972, Columbia; research methodology, program evaluation, needs assessment, evaluation of direct practice.

Klockars, Alan J.,* (Education), (Interdepartmental Doctoral Program faculty), Ph.D., 1967, Washington; measurement, statistics, and research design.

Levy, Rona L.,* Ph.D., 1974, Michigan; research methodology, single-case evaluation, health care, behavioral medicine, feedback.

Lewin, T. Fred (Emeritus), Ph.D., 1962; Chicago; social work.

Maier, Henry W.,* Ph.D., 1959, Minnesota; child development, group child care, direct practice with individuals, families, and groups.

Northwood, Lawrence K.,* Ph.D., 1953, Michigan; social policy and planning, research methodology, racism and social work.

Parsons, Jack R. (Emeritus), Ph.D., 1958, Chicago; social work.

Patti, Rino J.,* D.S.W., 1967, Southern California; social services administration, legislative analysis, organizational analysis.

Resnick, Herman,* Ph.D., 1970, Bryn Mawr; organizational development, group dynamics, planned change, environmental psychology, social welfare.

Robinson, Nancy M.,* (Psychiatry and Behavioral Sciences, Psychology), (Interdepartmental Doctoral Program faculty), Ph.D., 1958, Stanford; psychology.

Schinke, Steven P.,* Ph.D., 1975, Wisconsin (Madison); child welfare, adolescents, substance abuse, primary prevention.

Smith, Charles Z.,* (Law), (Interdepartmental Doctoral Program faculty), J.D., 1955, Washington; evidence and judicial administration.

Smith, Edmund A. (Emeritus), Ph.D., 1957, Harvard; social work.

Stier, Florence R.,* D.S.W., 1973, Columbia; social welfare planning and program development.

Takagi, Calvin Y.,* Ph.D., 1958, Minnesota; mental health services, child development, services to minority population.

Whittaker, James K.,* Ph.D., 1970, Minnesota; child welfare, in-home, foster family care and residential services, social treatment, social support networks, group treatment.

Woods, Nancy A. F.,* (Nursing), (Interdepartmental Doctoral Program faculty), Ph.D., 1978, North Carolina; women's health.

Associate Professors

Anderson, James R.,* A.M., 1954, Indiana; social work and health care, interdisciplinary teams in health care, growth and development, particularly in Black Americans.

Barsh, Russel L.,* (Business, Government, and Society), (Interdepartmental Doctoral Program faculty), J.D., 1974, Harvard; law and its environment.

Berleman, William C.,* M.S.W., 1960, Washington; undergraduate social welfare, social welfare policy.

Cox, Gary B.*‡ (Research), (Psychiatry and Behavioral Sciences), (Interdepartmental Doctoral Program faculty), Ph.D., 1970, Duke; psychology.

Dear, Ronald B.,* D.S.W., 1972, Columbia; welfare and income maintenance policy and programs, fiscal impact of social programs, poverty and income inequality; social legislation, social service policy and programs.

Duplica, Moya M.,* M.S.W., 1956, St. Louis; social welfare policy and history, women and social policy, values and ethics in social work practice, international social welfare.

Ellis, Jack A. N.,* M.S.W., 1955, British Columbia; social welfare administration and planning, social work and the justice system, health care in custodial settings, social work in school settings.

Hanneman, C. Fred, M.A., 1951, Indiana; aging, alcoholism, human services practice.

Hawkins, J. David,* Ph.D., 1975, Northwestern; family-, school-, and peer-focused delinquency and drug abuse prevention; social networks and social support development, community reintegration and aftercare.

Herrick, James E.,* D.S.W., 1966, Southern California; social policy, social work and the justice system, research methodology, social and cultural change.

Hooyman, Nancy R.,* Ph.D., 1974, Michigan; aging, women's issues, community and organizational development, social networks.

Ishisaka, Anthony H.,* M.S.W., 1968, California (Berkeley); social work practice, mental health services, services to minority communities, human development, community development.

Kelley, Jerry L.,* A.M., 1949, Chicago; social workers in schools, interviewing and counseling in human services.

Leigh, James W.,* M.S.W., 1954, Wayne State; social work practice with families, multiethnic and multicultural concerns, family life education.

Macdonald, Catherine J.,* B.A., 1936, Washington; admissions policy.

Miller, Sidney,* M.S., 1953, Columbia; children, adolescents, and their families, interviewing, crisis intervention, marital counseling.

Mundt, Lenora B. (Emeritus), M.S.W., 1950, Washington; family treatment.

Richey, Cheryl A.,* D.S.W., 1974, California (Berkeley); social work practice, women and mental health, clinical research.

Roffman, Roger A.,* D.S.W., 1983, California (Berkeley); alcoholism and drug abuse, research methodology, program evaluation.

Teather, Edward C.,* M.S.W., 1962, British Columbia; residential treatment of children, group work, program development.

Vasquez, James A.,* (Education), (Interdepartmental Doctoral Program faculty), Ph.D., 1973, California (Los Angeles); learning (minority youth)/bilingual education.

Weatherley, Richard A.,* Ph.D., 1977, Massachusetts Institute of Technology; social welfare policy and administration, social welfare bureaucracies.

Assistant Professors

Allen, Allethia L.,* M.S.W., 1950, Boston; social work practice, social policy, interviewing, minority women, minority families, adolescents, human sexuality.

Berger, Candyce S., Ph.D., 1983, Southern California; micro- and macro-practice in the field of health, organizational and administrative theory, research.

Briar, Katharine Hooper,* D.S.W., 1976, California (Berkeley); social policy, criminal justice, women's issues.

Catalano, Richard (Research), Ph.D., 1982, Washington; juvenile delinquency causation and prevention, research methods and statistics.

Klingbeil, Karil S., M.S.W., 1960, Washington; violence in society, particularly with reference to family violence, forensic aspects of criminal justice, health-care planning and administration, gerontology, health-care systems.

Kopp, Judy, Ph.D., 1982, Washington (St. Louis); interviewing/counseling skills, clinical research, cross-cultural practice, native Americans.

Tolson, Eleanor R.,* Ph.D., 1978, Chicago; clinical research, task-centered treatment, eclectic models for intervention.

Lecturers

Averill, Lloyd J., M.Th., 1966, Colgate Rochester Divinity School; development and continuing education director.

David, Marguerit J., M.S.W., 1973, Washington (St. Louis); disabled adolescents, sexual counseling, the independent living movement, effect of disability on family systems.

Day, Pamela, M.S.W., 1973, Washington; services to children, youth and families, preventive services, family policy, family-based practice (implementation and evaluation).

Course Descriptions

Courses for Undergraduates

SOC W 200 Introduction to Social Work Practice (5) W Introduction to the practice of social work, theoretical concepts and institutional framework that guides practice, and the conceptual organization of the discipline of social work. Three weekly lectures and two hours per week in field observation sessions. Lectures supplemented by audiovisual aids and by special guest practitioners.

SOC W 300 Historical Approaches to Social Welfare (3) AW *Berleman, Duplica* Stresses the origins and development of social welfare policy and programs, starting with the Elizabethan Poor Law (1601) and ending with the Social Security Act of 1935. The issue of poverty and the development of publicly funded income maintenance programs are central concerns. Open to nonmajors and required of social welfare majors.

SOC W 310-311 Social Welfare Practice (3-3) WSp *Duplica, Leigh* Provides a conceptual framework for social work practice with individuals, families, small groups, and communities; an introduction to the roles, tasks, and functions of the social welfare practitioner and to theories and methods of intervention; and develops skills in problem assessment, intervention, termination, and evaluation. Open only to social welfare juniors.

SOC W 320 Contemporary Approaches to Social Welfare (3) WSp *Berleman, Duplica* Policy and program developments in the social welfare field since 1935. Current income maintenance proposals, the emergence of programs to treat specific social dysfunctioning (e.g., mental health services), and the growth of a service-oriented society are typical course concerns. Open to nonmajors and required of social welfare majors. Prerequisite: 300.

SOC W 390 Introduction to Social Welfare Research (3) WSp *Roffman* Introduction to the logic of the scientific method as applied to research in social work/social welfare; a beginning understanding of the interrelated steps in the conduct of a research study; and development of skills in the critical consumption of social welfare research and the relationship of this research to social welfare practice. Open to social welfare majors; others by permission of instructor.

SOC W 405 Fieldwork Seminar (2 or 4, max. 6) Two-hour seminar meeting weekly. Student integrates social work practicum experiences with prior and concurrent course work in the social sciences, social work, and research. Includes discussion of class presentations and simulations or practice situations that combine knowledge and skill utilization. Student logs provide a basis for individual goal identification and achievement. Required for, and open only to, social welfare seniors. Prerequisites: 310-311; to be taken concurrently with 415.

SOC W 409 Readings in Social Welfare (1-5, max. 15) AWSp Prerequisite: permission of instructor.

SOC W 415 Beginning Field Instruction (4-6, max. 12) AWSp Students are placed in selected social service agencies and accept beginning social service assignments under the supervision of competent agency personnel. Offered on credit/no credit basis only. Prerequisites: social welfare major standing and 300, 310-311.

SOC W 419 Adult Development and Aging (3) A Designed to introduce the student to the field of adult development. Interdisciplinary perspective stressing the interaction of psychological, social, and physiological factors affecting the aging process. Goals are (1) to help the student understand and accept self-aging, and (2) to provide a framework of understanding for working with adult persons. Required for social welfare majors.

SOC W 421 Methods of Child Care and Treatment (3) Sp *Whittaker* Major foci include an introduction to the continuum of child welfare services, as well as some practical approaches to working with children and adolescents in a wide variety of practice settings.

SOC W 426 Conceptions of Basic Institutional Change (3) Sp *Herrick* How basic cultural change may be brought about and specifically how such change may affect the institution of social welfare. Focus on (1) a critical assessment of the dominant cultural values and particularly those values underlying social welfare; (2) prerequisites for a change to occur in these values; and (3) dangers and dilemmas in implementing such a change. Recommended: 300 and ECON 200.

SOC W 430 Child Care Work Practice (3) W *Whittaker* Specialized practice with emotionally disturbed and delinquent children in group care settings, with focus on providing child care staff with specific tools for teaching alternative behavior. Major topics include: etiology and diagnosis; observing and recording children's behavior; special problems of group living; life-space interviewing; token economies; activity programming; group interventions; parental involvement; organizational requisites and community linkages. Prerequisite: 310- or permission of instructor.

SOC W 433 Community Resources in the Treatment of Alcohol and Other Drug Problems (3) A *Roffman* Survey of available community resources. Includes the premises upon which treatment approaches are built and the desirable components of appropriate client referral. Prerequisites: upper-division standing and 20 credits in the social sciences, preferably sociology and psychology.

SOC W 475 Introduction to Social Work Practice in Health Care (3) A Social impact of illness described, including issues in service delivery and interdisciplinary team functioning. Evaluation of social workers' contribution to comprehensive health care. Prerequisite: upper-division standing.

Courses for Graduates Only

Social Work

SOC W 501 Problems of Social Welfare in Ethnic Minority Communities (3, max. 6) *Northwood, Takagi* Examination of selected social welfare problems as related to specific ethnic and racial minority groups. Attention is given to understanding of minority populations and the effective delivery of social work and social welfare services in those communities.

SOC W 502 Income Maintenance and Health Care (3) A *Anderson, K. Briar, Dear, Duplica, Herrick, Weatherley* Advanced course in policy stemming from the Social Security Act with particular reference to programs of income maintenance and health; social assistance, social insurance, unemployment insurance, and public and private approaches to health care. Emphasis on the development of analytic skills that help to address questions about benefits, comprehensiveness of coverage, financing, gaps in service, and options and alternatives for the future improvement of these programs.

SOC W 503 Social Services and Social Policy (3) W *K. Briar, Dear, Duplica, Herrick* Provides in-depth knowledge of social welfare policies and services that meet societal problems, the needs of specific client groups, and analytic tools for evaluating various policies. Understanding of the network of institutions that employ social workers to better serve their clientele is a prerequisite if needed changes and improvements are to be made by professional social workers in these institutions and if feasible options are to be selected to rectify inadequacies at the policy level.

SOC W 504 Social Problems and Social Welfare (3, max. 9) *Allen, Anderson, Berger, K. Briar, S. Briar, Dear, Ellis, Herrick, Hooyman, Roffman, Takagi, Whittaker* Analysis of major social problems and social welfare service systems providing a systematic approach to assessing the scope, causes, social cost, and public policy alternatives in the provision of services related to such problems, selected social problems such as poverty and ill health, juvenile delinquency, drug and alcohol addiction, and neglect of the aging are studied and related to the student's field experiences.

SOC W 507 Seminar (3, max. 6) AWSp *Resnick* Prerequisite: permission of instructor.

SOC W 508 Integrative Seminar (1-3, max. 12) Offered on credit/no credit basis only.

SOC W 509 Readings in Social Work (*) AWSpS May be repeated for credit. Offered on credit/no credit basis only. Prerequisite: permission of instructor.

SOC W 515 Field Instruction (2-8, max. 12) AWSpS Social work majors only. Offered on credit/no credit basis only.

SOC W 529, 530-531 Introduction to Human Services Practice (3,4-5) *Hanneman, Ishisaka, Leigh, Maier, Miller, Richey, Teather, Tolson* Topics covering various helping methods used in practice with individuals, families, and small groups.

SOC W 532 Additive Human Service Methods (3, max. 9) AWSp *Berger, DeLange, Hawkins, Klingbeil, R. Miller, S. Miller, Richey, Whittaker* Focus is either on various methodologies employed in work with clients with specific presenting problems (physical disability, chemical dependency) or on a specific counseling practice stance (behavioral therapy, group treatment). Prerequisites: 529 or 310-311.

SOC W 533 Advanced Human Services Practice (3, max. 9) *K. Briar, Hanneman, Leigh, Maier, Miller, Resnick, Richey, Teather, Tolson, Whittaker* Advanced human services practice in special areas. Intensive study of practice materials with emphasis upon development of appropriate interventive and methodological skills.

SOC W 535 Advanced Field Instruction (2-10, max. 24) AWSpS Offered on credit/no credit basis only. Prerequisite: 515.

SOC W 541 Human Behavior and the Social Environment (3) A *Duplica, Resnick, Takagi* Introduction to a social systems perspective on human behavior and social environment. Emphasis upon four social systems (the individual, group, organization, and community), their interactions, and effects upon human behavior. Required for M.S.W. degree candidates and offered only Autumn Quarter of the first year.

SOC W 543 Problem-Focused Human Development (3, max. 9) AWSp *Allen, Anderson, David, Hanneman, Ishisaka, Maier, Roffman* Focus on the social and developmental determinants of specific human problems and their impact on individual development, families, and social institutions. Some time given to examining the nature of organized social responses that are designed to deal with the specified human problem. Prerequisite: graduate standing.

SOC W 560 Introduction to Social Welfare Planning (3) A *Ellis, Stier* Methodologically based course providing for the acquisition of professional analytic and interventive skills associated with social work practice in planning and policy analysis.

SOC W 561 Introduction to Social Welfare Administration (3) A *Austin, Berger, Ellis, Weatherley* Methodologically based course considers implications of alternative organizational structures and administrative practices from differing perspectives of client, worker, and administrator. Focus on the ways structure and administrative practices may be manipulated to alter the manner in which clients are served by an agency. Prerequisite: permission of instructor.

SOC W 563 Organizational Analysis (3) *Patti* Provides conceptual base for analysis and action in human-service organizations. Emphasis on utilization of conceptual tools of organization theory for problem solving in social welfare organizations. Students team to describe and analyze selected organizational problems and contribute to their solutions. Prerequisite: permission of instructor.

SOC W 564 Group Process (3) AWSp *Resnick* Provides tools for students to understand dynamics and development of group, to increase awareness of behavior of participants and leaders, and to improve effectiveness as participants and leaders. Prerequisite: permission of instructor.

SOC W 566 Specialized Community and Organizational Services Skills (3, max. 9) AWSp *K. Briar, Dear, Ellis, Herrick, Patti, Resnick, Stier* Methodologically based course providing graduate social work students with professional analytic and interactional skills associated with administration, planning, and program development in social welfare. Content drawn from research in social work and related social science disciplines. Prerequisites: graduate status and permission of instructor.

SOC W 570 Advanced Planning Seminar (3) W *Stier* Methodologically based course for students in second-year graduate program, providing criteria and methods appropriate for designing, developing, and planning social welfare programs, including such elements as building citizen support, legislative sanction, etc.

SOC W 571 Advanced Seminar in Social Welfare Administration (3) W *Austin, Patti, Weatherley* Concepts and practice skills necessary for the management of social welfare organization, with emphasis on management practice in those settings offering clinical social services. Includes analysis of treatment settings and auspices, the management of interdisciplinary professional teams, overview of clinical practice technology, and planning, implementing, controlling, and budgeting in a human-services agency context. Builds upon material presented in 561. Prerequisites: 560, 561, and 535 taken concurrently.

SOC W 575 Special Topics in Social Welfare Policy (3, max. 6) *K. Briar, Hooyman, Stier, Weatherley* Analyzes new or expanding areas of social welfare policies and services. Emphasis on developing the student's knowledge of, and ability to assess, social welfare programs. The role of social work is examined in these expanding legislative and program directions.

SOC W 586 Statistics in Social Work (3)

SOC W 590 Social Welfare Research (3) *Hawkins, Herrick, Jaffee, Roffman* Three major objectives: (1) to introduce the student to the logic of the scientific method as applied to research in social welfare; (2) to provide the student with a beginning understanding of the interrelated steps in the conduct of research; and (3) to equip students for roles as consumers of, and participants in, social welfare research.

SOC W 591-592 Individual or Group Research Project (3-3) AWSp,AWSp Field practice in a group or individual project in lieu of 594-595 in the community and organizational services track. Includes development of research design, collection of data, tabulation and analysis, and report writing. Prerequisite: 590 or equivalent.

SOC W 594-595 Advanced Social Work Research (3-3) *Gottlieb, Herrick, Jaffee, Levy, Northwood, Roffman* Principles and procedures for the evaluation of direct practice interventions (for human services students). Research methods involved in community-needs assessment, program evaluation, and management-information systems (for community and organizational services students). Separate sections of these courses are available for students in human services and in community and organizational services.

SOC W 600 Independent Study or Research (*) AWSpS

SOC W 700 Master's Thesis (*) AWSp

Social Welfare

SOCWL 552 History of Poverty and Inequality: The Anglo-American Experience (1400-1900) (3) A *Berleman* Examines the roots of modern social welfare policy and program in two historic periods: the reign of the Tudors (1485-1603) and the evolution of welfare policy compatible with the aims of the nation-state; and the significant societal and intellectual developments preceding the English Poor Law Reform of 1834. The English welfare heritage as it subsequently shaped public and private welfare measures in the United States also receives attention, as does the relevance of these early beginnings to today's conceptualization of welfare policy.

SOCWL 553 Seminar in Contemporary Social Welfare Policy (3) W *Dear* Major American social welfare programs and some of the policies that guide their development and implementation; contemporary income maintenance policies and their effectiveness in reducing income inequality. This course is closely linked to, and built upon, 552. Selected issues and dilemmas followed in that course, which serve as the focus for policy debate, are examined in the context of current welfare programs.

SOCWL 580 Introduction to Advanced Research Methods and Design (3) A *Hawkins, Levy* Introduction to the broad scientific issues and the specific methodological strategies used in formulating and answering research questions within the field of social welfare. Required of all first-year students in the social welfare Ph.D. program; open to others by permission.

SOCWL 581 Introduction to Advanced Research Method and Design (3) Continuation of 580. Required of all first-year students in the Social Welfare Ph.D. program; open to others by permission of instructor.

SOCWL 582-583 Research Practicum (1-3, max. 3)-(1-3, max. 3) W,Sp Development of specific methodological skills in social welfare research through participation in an ongoing research project. Offered on credit/no credit basis only.

SOCWL 598-599 Research Problems and Priorities in Social Work and Social Welfare (3-3) W,SP *Briar, Patti* Seminar assesses the current state of knowledge in selected major areas of social work and social welfare, examines analytic and methodological problems in conducting research in these areas, and identifies research priorities. Emphasis on peer learning centered on the identification of central research problems in the areas of social policy, program evaluation, and intervention with individuals, groups, families, and organizations. Prerequisite: admission to social welfare Ph.D. program or permission.

SOCWL 600 Independent Study or Research (*) AWSpS

SOCWL 800 Doctoral Dissertation (*) AWSpS

INDEX

INDEX TO PREFIXES

A A: Aeronautics and Astronautics (Engineering)
AAS: Asian American Studies (Arts and Sciences)
ACCTG: Accounting (Business Administration)
ADMIN: Administration (Business Administration)
AFRAM: Afro-American Studies (Arts and Sciences)
AIS: American Indian Studies (Arts and Sciences)
AKKAD: Akkadian, Near Eastern Languages and Civilization (Arts and Sciences)
ALTAI: Altaic, Asian Languages and Literature (Arts and Sciences)
AMATH: Applied Mathematics (Interdisciplinary Graduate Degree Programs)
ANEST: Anesthesiology (Medicine)
ANIMED: Animal Medicine (Medicine)
ANTH: Anthropology, Anthropology (Arts and Sciences)
A ORG: Administrative Theory and Organizational Behavior (Business Administration)
ARAB: Arabic, Near Eastern Languages and Civilization (Arts and Sciences)
ARAM: Aramaic, Near Eastern Languages and Civilization (Arts and Sciences)
ARCH: Architecture (Architecture and Urban Planning)
ARCHY: Archaeology, Anthropology (Arts and Sciences)
ART: Art, Art (Arts and Sciences)
ART H: Art History, Art (Arts and Sciences)
A S: Aerospace Studies (Reserve Officers Training Corps Programs)
ASIAN: Asian Languages and Literature, Asian Languages and Literature (Arts and Sciences)
ASTR: Astronomy, Astronomy (Arts and Sciences)
ATM S: Atmospheric Sciences, Atmospheric Sciences (Arts and Sciences)

B A: Business Administration (Business Administration)
BA RM: Research Methods (Business Administration)
B CMU: Business Communications (Business Administration)
B CON: Building Construction (Architecture and Urban Planning)
B ECN: Business Economics (Business Administration)
BG&S: Business, Government, and Society (Business Administration)
BIOC: Biochemistry (Medicine)
BIOEN: Bioengineering (Interschool or Intercollege Programs)
BI HS: Biomedical History (Medicine)
BIOL: Biology, Biology (Arts and Sciences)
BIOST: Biostatistics (Public Health and Community Medicine)
BMATH: Biomathematics (Interdisciplinary Graduate Degree Programs)
BOT: Botany, Botany (Arts and Sciences)
B POL: Business Policy (Business Administration)
B STR: Biological Structure (Medicine)
BULGR: Bulgarian, Slavic Languages and Literature (Arts and Sciences)

CER E: Ceramic Engineering, Materials Science and Engineering (Engineering)
CESM: Structural and Geotechnical Engineering, and Mechanics, Civil Engineering (Engineering)
CETS: Transportation, Surveying, and Construction Engineering, Civil Engineering (Engineering)
CEWA: Environmental Engineering and Science, Civil Engineering (Engineering)
CHCS: Community Health Care Systems (Nursing)
CH E: Chemical Engineering (Engineering)
CHEM: Chemistry, Chemistry (Arts and Sciences)
CHID: Comparative History of Ideas (Arts and Sciences)
CHIN: Chinese, Asian Languages and Literature (Arts and Sciences)
CHSTU: Chicano Studies (Arts and Sciences)
CIVE: Core Courses, Civil Engineering (Engineering)
CL AR: Classical Archaeology, Classics (Arts and Sciences)
CLAS: Classics, Classics (Arts and Sciences)
C LIT: Comparative Literature, Comparative Literature (Arts and Sciences)
CL LI: Classical Linguistics, Classics (Arts and Sciences)
CMU: Communications, Communications (Arts and Sciences)
COM D: Community Dentistry (Dentistry)
CONJ: Conjoint (Medicine)
C SCI: Computer Science (Arts and Sciences)
CZECH: Czech, Slavic Languages and Literature (Arts and Sciences)

DAN: Danish, Scandinavian Languages and Literature (Arts and Sciences)
DANCE: Dance, Drama (Arts and Sciences)
DENT: Dentistry (Dentistry)
D HYG: Dental Hygiene (Dentistry)
DRAMA: Drama, Drama (Arts and Sciences)

ECON: Economics, Economics (Arts and Sciences)
EDADM: Educational Administration (Education)
EDC&I: Educational Curriculum and Instruction (Education)
EDEPS: Educational Policy Studies (Education)
EDHED: Higher Education (Education)
EDPSY: Educational Psychology (Education)
EDSPE: Special Education (Education)
EDUC: Independent Study, Research, and Field Experiences (Teaching Practicum) (Education)
E E: Electrical Engineering (Engineering)
ENDO: Endodontics (Dentistry)
ENGL: English, English (Arts and Sciences)
ENGR: Engineering, College Courses (Engineering)
ENVH: Environmental Health (Public Health and Community Medicine)
ENV S: Institute for Environmental Studies (Arts and Sciences)
EPI: Epidemiology (Public Health and Community Medicine)

FAMED: Family Medicine (Medicine)
FD SC: Food Science (Ocean and Fishery Sciences)
FIN: Finance (Business Administration)
FISH: Fisheries (Ocean and Fishery Sciences)
FOR B: Biological Sciences (Forest Resources)
FOR M: Management and Social Sciences (Forest Resources)
FOR P: Physical Sciences (Forest Resources)
FREN: French, Romance Languages and Literature (Arts and Sciences)

GENET: Genetics, Genetics (Arts and Sciences)
GEOG: Geography, Geography (Arts and Sciences)
GEOL: Geological Sciences, Geological Sciences (Arts and Sciences)
GERM: Germanics, Germanics (Arts and Sciences)
GPHYS: Geophysics, Geophysics (Arts and Sciences)
GRK: Greek, Classics (Arts and Sciences)
G ST: General Studies (Arts and Sciences)

H A&S: Honors—Arts and Sciences (Arts and Sciences)
HEBR: Hebrew, Near Eastern Languages and Civilization (Arts and Sciences)
HINDI: Hindi, Asian Languages and Literature (Arts and Sciences)
HRMGT: Human Resources Management (Business Administration)
HSERV: Health Services (Public Health and Community Medicine)
HSS: Humanistic-Social Studies (Engineering)
HST: History, General, History (Arts and Sciences)
HSTAA: History of the Americas, History (Arts and Sciences)
HSTAM: Ancient and Medieval History, History (Arts and Sciences)
HSTAS: History of Asia, History (Arts and Sciences)
HSTEU: Modern European History, History (Arts and Sciences)
HUBIO: Human Biology (Medicine)

I BUS: International Business (Business Administration)
INDN: Indian, Asian Languages and Literature (Arts and Sciences)
IMS: Institute for Marine Studies (Ocean and Fishery Sciences)
ITAL: Italian, Romance Languages and Literature (Arts and Sciences)

JAPAN: Japanese, Asian Languages and Literature (Arts and Sciences)

KOR: Korean, Asian Languages and Literature (Arts and Sciences)

LAB M: Laboratory Medicine (Medicine)
L ARC: Landscape Architecture (Architecture and Urban Planning)
LAT: Latin, Classics (Arts and Sciences)
LAW: Law (Law)
LIBR: Librarianship (Library and Information Science)
LING: Linguistics, Linguistics (Arts and Sciences)

MATH: Mathematics, Mathematics (Arts and Sciences)
M E: Mechanical Engineering (Engineering)
MED: Medicine (Medicine)
MEDCH: Medicinal Chemistry (Pharmacy)
MEDED: Medical Education (Medicine)
MED P: Medical Practice (Medicine)
MEIE: Industrial Engineering, Mechanical Engineering (Engineering)
MET E: Metallurgical Engineering, Materials Science and Engineering (Engineering)
MICRO: Microbiology and Immunology (Medicine)
MKTG: Marketing (Business Administration)
M SCI: Military Science (Reserve Officer Training Corps Programs)
MSE: Materials Engineering, Materials Science and Engineering (Engineering)
MUSAP: Music Applied, Music (Arts and Sciences)
MUSEN: Music Ensemble, Music (Arts and Sciences)
MUSIC: Music, Music (Arts and Sciences)

N E: Near Eastern Languages and Civilization, Near Eastern Languages and Civilization (Arts and Sciences)
NORW: Norwegian, Scandinavian Languages and Literature (Arts and Sciences)
NR: Neurological Surgery (Medicine)
N SCI: Naval Science (Reserve Officer Training Corps Programs)
NUC E: Nuclear Engineering (Engineering)
NURS: Nursing (Nursing)
NUTR: Nutritional Sciences (Interdisciplinary Graduate Degree Programs)

OB GY: Obstetrics and Gynecology (Medicine)
OCEAN: Oceanography, (Ocean and Fishery Sciences)
O ENG: Ocean Engineering (Engineering)
OPHTH: Ophthalmology (Medicine)
OPMGT: Operations Management (Business Administration)
ORALB: Oral Biology (Dentistry)
ORALM: Oral Medicine (Dentistry)
ORTHO: Orthodontics (Dentistry)
ORTHP: Orthopaedics (Medicine)
O S: Oral and Maxillofacial Surgery (Dentistry)
OTOL: Otolaryngology (Medicine)

PABIO: Pathobiology (Public Health and Community Medicine)
PATH: Pathology (Medicine)
PB AF: Public Affairs (Public Affairs)
P BIO: Physiology and Biophysics (Medicine)
PBSCI: Psychiatry and Behavioral Sciences (Medicine)
PCEUT: Pharmaceutics (Pharmacy)
PCN: Parent and Child Nursing (Nursing)
PEDO: Pedodontics (Dentistry)
PEDS: Pediatrics (Medicine)
PERIO: Periodontics (Dentistry)
PHARM: Pharmacy Practice (Pharmacy)
PHCOL: Pharmacology (Medicine)
PHIL: Philosophy, Philosophy (Arts and Sciences)
PHY A: Physical Anthropology, Anthropology (Arts and Sciences)
PHYS: Physics, Physics (Arts and Sciences)
PN: Physiological Nursing (Nursing)
POL S: Political Science, Political Science (Arts and Sciences)
POLSH: Polish, Slavic Languages and Literature (Arts and Sciences)
PORT: Portuguese, Romance Languages and Literature (Arts and Sciences)
P PSY: Physiology-Psychology (Interdisciplinary Graduate Degree Programs)
PROS: Prosthodontics (Dentistry)
PROV: Provencal, Romance Languages and Literature (Arts and Sciences)
PRSAN: Persian, Near Eastern Languages and Civilization (Arts and Sciences)
PSN: Psychosocial Nursing (Nursing)
PSYCH: Psychology, Psychology (Arts and Sciences)

QMETH: Quantitative Methods (Business Administration)
Q SCI: Quantitative Science (Interschool or Intercollege Programs)
QUAT: Quaternary Research Center (Interschool or Intercollege Programs)

RADGY: Radiology (Medicine)
RAD S: Radiological Sciences (Interdisciplinary Graduate Degree Programs)
REHAB: Rehabilitation Medicine (Medicine)
RELIG: Comparative Religion, International Studies (Arts and Sciences)
RES D: Restorative Dentistry (Dentistry)
RMN: Romanian, Romance Languages and Literature (Arts and Sciences)
ROM: Romance Linguistics and Literature, Romance Languages and Literature (Arts and Sciences)
ROMAN: Romance Literature, Romance Languages and Literature (Arts and Sciences)
ROMN: Romanian, Slavic Languages and Literature (Arts and Sciences)
R ONC: Radiation Oncology (Medicine)
RUSS: Russian, Slavic Languages and Literature (Arts and Sciences)

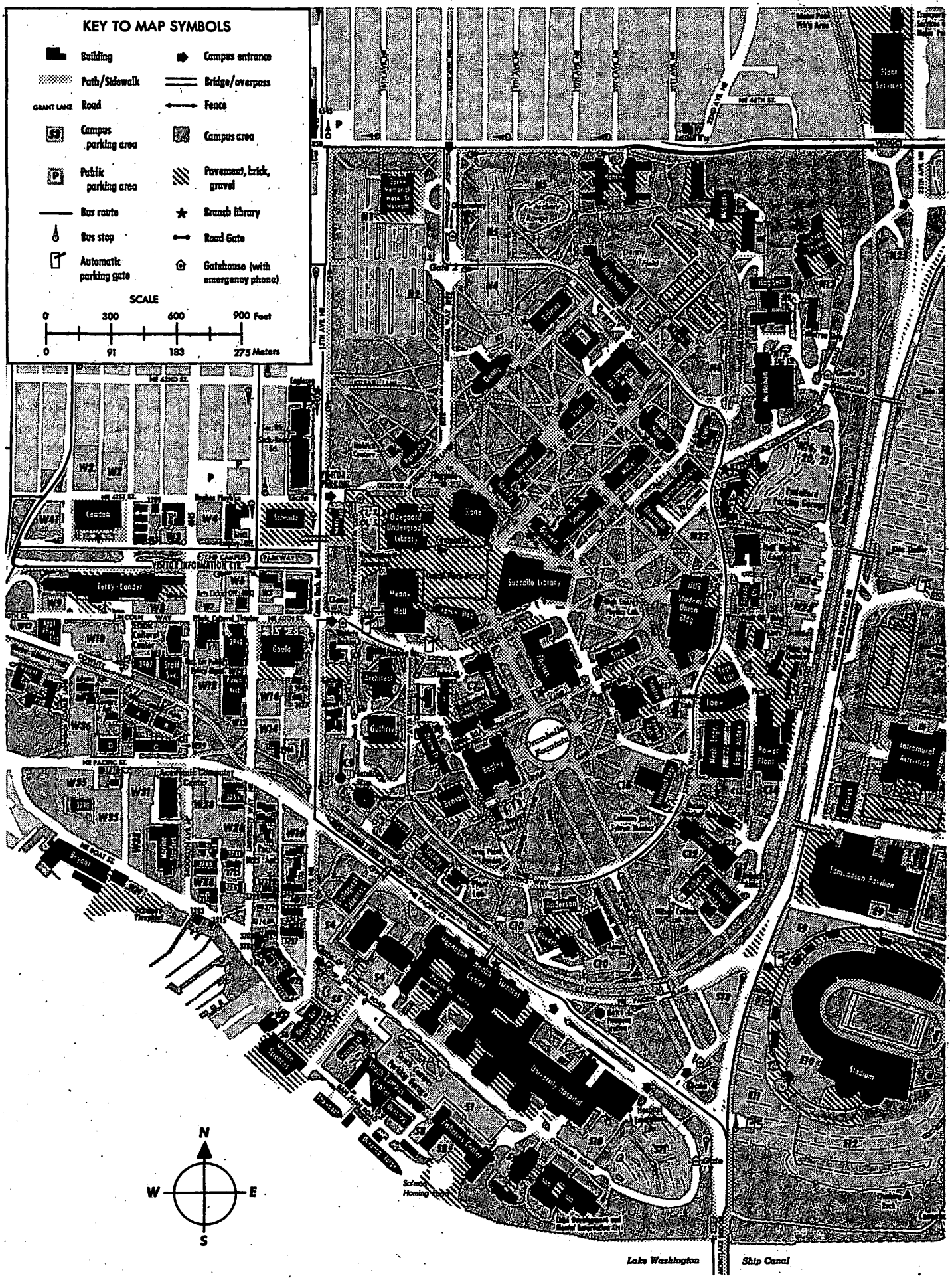
SCAND: Scandinavian, Scandinavian Languages and Literature (Arts and Sciences)
SER C: Serbo-Croatian, Slavic Languages and Literature (Arts and Sciences)
SIS: International Studies, International Studies (Arts and Sciences)
SISAF: African Studies, International Studies (Arts and Sciences)
SISEA: Chinese Regional Studies, Japanese Regional Studies, Korean Regional Studies, International Studies (Arts and Sciences)
SISJE: Jewish Studies, International Studies (Arts and Sciences)
SISME: Middle Eastern Studies, International Studies (Arts and Sciences)
SISRE: Russian and East European Regional Studies, International Studies (Arts and Sciences)
SISSA: South Asian, International Studies (Arts and Sciences)
SLAV: Slavic, Slavic Languages and Literature (Arts and Sciences)
SLAVC: Slavic Languages and Literature, Slavic Languages and Literature (Arts and Sciences)
SMT: Social Management of Technology (Engineering)
SNSKRT: Sanskrit, Asian Languages and Literature (Arts and Sciences)
SOC: Sociology, Sociology (Arts and Sciences)
SOC W: Social Work (Social Work)
SOCWL: Social Welfare (Social Work)
SO JU: Society and Justice, Society and Justice (Arts and Sciences)
SPAN: Spanish, Romance Languages and Literature (Arts and Sciences)
SPCH: Speech Communication, Speech Communication (Arts and Sciences)
SPHSC: Speech and Hearing Sciences, Speech and Hearing Sciences (Arts and Sciences)
STAT: Statistics, Statistics (Arts and Sciences)
STC: Scientific and Technical Communication (Engineering)
SURG: Surgery (Medicine)
SWED: Swedish, Scandinavian Languages and Literature (Arts and Sciences)

TAMIL: Tamil, Asian Languages and Literature (Arts and Sciences)
THAI: Thai, Asian Languages and Literature (Arts and Sciences)
TIB: Tibetan, Asian Languages and Literature (Arts and Sciences)
TKIC: Turkic, Asian Languages and Literature (Arts and Sciences)
TKISH: Turkish, Near Eastern Languages and Civilization (Arts and Sciences)

UCONJ: University Conjoint (Interschool or Intercollege Programs)
UGAR: Ugaritic, Near Eastern Languages and Civilization (Arts and Sciences)
UKR: Ukrainian, Slavic Languages and Literature (Arts and Sciences)
URB P: Urban Planning (Architecture and Urban Planning)
UROL: Urology (Medicine)

WOMEN: Women Studies, Women Studies (Arts and Sciences)

ZOOL: Zoology, Zoology (Arts and Sciences)


KEY TO MAP SYMBOLS
Building
Path/Sidewalk
GRANT LANE Road
Campus parking area
Public parking area
Bus route
Bus stop
Automatic parking gate
Campus entrance
Bridge/overpass
Fence
Campus area
Pavement, brick, gravel
Branch library
Road Gate
Gatehouse (with emergency phone)
SCALE
0 300 600 900 Feet
0 91 183 275 Meters
N
W
E
S
Lake Washington
Ship Canal