Good morning, Mr. Chairman and members of the Committee. Thank you for the opportunity to appear before you today. I am Philip Bell, Associate Professor of the Learning Sciences in the College of Education at the University of Washington. I served as a co-chair of the Committee on *Learning Science in Informal Environments* of the National Research Council.

I was asked to describe the work of my research group and to summarize the conclusions and recommendations of the recent NRC consensus study. I participate in a large-scale, interdisciplinary research effort called the Learning in Informal and Formal Environments Center—or the LIFE Center—a collaboration between the University of Washington, Stanford University, and SRI International. It is funded through NSF's Science of Learning Center program. In LIFE we study the social foundations of how people learn across a broad range of learning environments—from classrooms, science centers, aquaria, and zoos to afterschool programs, Internet sites, videogame environments, and in the midst of family life.

My research group investigates how youth and families from multicultural, urban communities develop science and technology related expertise across different settings. In our research, we have found a surprising and troubling pattern where children pursue and engage in sophisticated STEM learning outside of school but those interests and early competencies are not recognized or built upon in the classroom. Just one example: we followed an elementary school-aged boy who had developed significant expertise related to mechanical engineering—from building robotic kits at home to designing solutions to complex puzzles at the science center—but at school he was not perceived as being interested in academic subjects. Such disconnects in learning between home and school are putting these particular children at a higher risk of academic failure in STEM. Our research further indicates that ***STEM academic achievement, although crucial, is only part of what is needed to cultivate expertise in STEM—people's activities in informal environments are an equally crucial platform for learning***.

Efforts to enhance the scientific capacity of society typically focus on formal schooling. LIFE center researchers developed the diagram here on the easel to roughly characterize the amount of time individuals spend in informal and formal learning environments—with *life-long learning* on the horizontal and *life-wide learning* as people go across different settings along the vertical. What is often overlooked or underestimated is the potential for STEM learning in non-school settings. Each year, tens of millions of Americans, young and old, explore and learn about science by visiting informal learning institutions, participating in programs, and countless more use media to pursue their interests. From a life-long, life-wide perspective it is imperative that we leverage informal learning environments to support workforce development, civic participation in STEM issues and policy, and to promote scientific literacy among all citizens.

The Informal Science Education program at the NSF funded a consensus study with the Board on Science Education at the NRC with the goal of synthesizing the existing research about how people learn science in informal environments.

The interdisciplinary committee that was convened organized its analysis by looking at the various "places" where science learning occurs. These included: *everyday experiences*—like hiking in a national park with your family, pursuing a hobby, or learning how to farm; as well as *designed settings*—such as visiting a science center, zoo, aquarium, or botanical garden; and participating in *educational programs*—such as summer science programs for youth, environmental monitoring experiences for citizens, or Elderhostel programs related to science. The committee found abundant evidence that ***informal learning environments routinely support significant science learning for individuals of all ages from a broad variety of backgrounds in ways that uniquely serve their personal and professional interests—and the broader STEM-related interests of society as well.***

However, the field was lacking a clear statement of goals that are appropriate for these settings and which can be measured. The committee developed and used a "strands of science learning" framework that articulates science-specific capabilities supported by informal environments. The six, interrelated strands reflect the field's commitment to getting learners to participate and connect to science in stimulating, interactive, contemporary, and personally relevant ways.

In closing, I wanted to mention some high-priority policy considerations from the report:

- ***First, in terms of broadening participation in STEM, studies do suggest that informal learning environments may be particularly effective for youth from historically non-dominant communities.*** However, there is variability in the success of these environments in attracting and engaging diverse audiences. We believe that a better understanding of the naturally occurring science learning in a diverse range of communities is needed to inform basic theory about how people learn and to inform the design of learning experiences tailored these communities.
- Secondly, we believe there should be sustained support for high-quality informal programs and experiences that focus on STEM. Informal learning environments represent a crucial part of our society's infrastructure for STEM education. Significant and unique science learning occur in these venues.
- Thirdly, although it is important to understand the impact of informal environments, *a more* important question may be how science learning occurs *across* the range of formal and informal

environments. The science learning literatures and fields are segmented in ways that are at odds with how people routinely traverse settings and can engage in learning activities across those settings.

- And finally, *Science media*, in the form of radio, television, the Internet, videogames, and handheld devices, are increasingly pervasive and are fundamentally changing people's engagement with science. They offer new ways to support science learning. Although the evidence is strong for the impact of educational television on science learning, substantially less empirical evidence exists at this time on the impact of other media with respect to specific aspects of science learning (e.g., the six strands).

Thank you for the opportunity to be here.