

**Symposium on Undergraduate Nano-Education:
"Addressing the Challenges of Nanoscale Science & Engineering Education"**

Presentation:

"Not Just What, but How Students Know: a Teacher-Researcher Perspective"

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Presenter Biography:

Lincoln J. Lauhon is the Morris E. Fine Junior Professor of Materials and Manufacturing in the Department of Materials Science and Engineering at Northwestern University.

His work in nanoscience began in graduate school at Cornell University, where he first played with atoms using a scanning tunneling microscope. As post-doctoral fellow at Harvard, Prof. Lauhon developed new methods for the fabrication of semiconductor nanostructures using 'bottom-up' methods. Prof. Lauhon's group at Northwestern elucidates nanoscale structure-property relationships in one-dimensional nanomaterials through the development of advanced, integrated characterization methods. In the learning sciences, his research in the National Center for Learning & Teaching in Nanoscale Science & Engineering has focused on the establishment of foundational nanoscience concepts and the identification of key misconceptions that inhibit student understanding. He also serves as the director of the Research Experience for Teachers program in the Materials Research Science and Engineering Center. In 2006 Prof. Lauhon was named the "Teacher of the Year" in the Department of Materials Science and Engineering, and in 2008 he received the Camille Dreyfus Teacher-Scholar Award.

Abstract:

Research in nanoscience continues to expand the frontier of what students will need to know to participate in the nanotechnology revolution. At most large universities, appropriately, NSE related courses are developed and led by nanoscience and engineering researcher-teachers. In our proposals and publications, we researchers strive to highlight what is different about our nanoscience research to boost funding and acclaim. In the classroom, the novelty of nanoscience and nanotechnology boosts enrollment, but presents a pedagogical challenge. Small is different, in the sense that everyday intuition may not apply to nanoscale phenomena. But the fact that small is different should not lead students to assume that what they learned in chemistry, physics, and materials science courses is unrelated to their future work as nanotechnologists; courses in these disciplines should provide the very foundation for an education in nanoscience and engineering. Our recent research efforts to define nanoscience concepts and measure student understanding of these concepts has uncovered some limitations of education in traditional disciplines, which implicitly encourages students to compartmentalize knowledge. Specifically, the applicability of foundational concepts in nanoscience may be circumscribed by the courses in which the concepts are acquired. As a consensus emerges on what NSE concepts students need to know, we must therefore also consider how students know what they know, as the manner of knowing influences what they can do with that knowledge. I will suggest that traditional departmental degree programs and new nano degree programs can both impart useful NSE knowledge; it is more important that the student learning environment be designed emulate the interdisciplinary, hands-on, problem-solving based environment of the research and industrial laboratory.