University Seminar Series

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# Tuning Surfaces for Cellular Function Using Nanolayer Assemblies

*BY Prof. Paula T. Hammond*

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**ABSTRACT:** The electrostatic layer-by-layer (LBL) process is a simple and elegant method of constructing highly tailored ultrathin polymer and organic-inorganic composite thin films. We have utilized this method to develop thin films that can deliver proteins and biologic drugs via highly tunable multi-agent delivery (MAD) nanolayered release systems. New developments include the ability to modulate drug release over periods of weeks to months in sequence through the use of nanomaterials as separating barrier layers between multilayers loaded with different delivery agents. Applications of multilayer thin films for bone tissue engineering and implant coatings as well as wound healing will be discussed. We have also designed nanoparticles that consist of several nanolayers wrapped around a core materials system, which can be generated to increase the half-life of the particle in the bloodstream by preventing adsorption of proteins via hydrated outer layers, thus acting as a “stealth” layer that prevents recognition of the particle as a foreign body by the body’s defense systems. Nanolayers can also be devised that facilitate cell entry, with the tumor microenvironment acting as a stimulus to enable the exposure of different functional layers and leading to uptake by the tumor cells. Finally, we have demonstrated the use of rolling circle transcription (RCT) to produce extremely long strands of RNA for cellular delivery, and yield active siRNA strands at significant doses, as shown in an animal model.

**BIOGRAPHY**: Professor Hammond is the David H. Koch Chair Professor of Engineering in Chemical Engineering at MIT, where she is also a member of the Koch Institute for Integrative Cancer Research, the MIT Energy Initiative, and a founding member of the MIT Institute for Soldier Nanotechnology. She recently served as the Executive Officer (Associate Chair) of the Chemical Engineering Department (2008-2011). Her research focuses on the self-assembly of polymeric nanomaterials. The core of her work is the use of electrostatics and other complementary interactions to generate functional materials with highly controlled architecture. Applications include the development of new biomaterials to manipulate the materials-biological interface with spatio-temporal control to manipulate protein interactions and cellular behavior. Her team also investigates novel responsive polymer architectures for targeted nanoparticle drug and gene delivery, and self-assembled materials systems for electrochemical energy devices such as fuel cells, batteries and photovoltaics. Hammond received the NSF Career Award, the EPA Early Career Award, and the DuPont Young Faculty Award, and is an Associate Editor for the journal ACS Nano. She is a Fellow of the Polymer Chemistry Division of the American Chemical Society, AIMBE Fellow, and a Fellow of the American Physical Society. In April 2010, Hammond was named Scientist of the Year at the Harvard Foundation’s Albert Einstein Science Conference. She was featured in 2011 as one of the Top 100 Materials Scientists by Thomson-Reuters based on her citation and overall impact, and has published over 200 papers in refereed journals.

## EVENT DETAILS

**DATE:**
January 30, 2013

**TIME:**
11:00 AM

**LOCATION:**
Babbio 122
Stevens Institute of Technology

**ATTENDANCE:**
Public