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Department of Chemistry

Etter Memorial Lecture

9:45 a.m. Thursday, March 28, 2013 • 331 Smith Hall

Polymer Nano-Assemblies for Targeted Bioresponsive Cancer Delivery

The design of nanoparticles for the delivery of drugs to tumors and other specific regions of the body requires versatile chemistry and the ability to manipulate nanoparticle surfaces with the high level of control needed multiple kinds of targeting. Nanoparticle size-based targeting is based on the enhanced permeation and retention within tumor tissues, whereas molecular targeting using designed ligands, and environmentally triggered targeting can take advantage of the tumor microenvironment. The surfaces of polymeric nanoparticles provide a means to introduce mediated interactions with cells that lead to uptake of the nanoparticle, release of drugs in specific regions, and control of the intracellular trafficking of the nanoparticle. The means by which such nanostructured particle systems can be achieved using polyelectrolyte layer-by-layer assembly methods will be addressed. It is possible to design nanoparticles that consist of several nanolayers wrapped around a core materials system. These polyelectrolyte nanolayer assemblies can be generated to increase the half-life of the particle in the bloodstream by preventing adsorption of proteins via hydrated outer layers, and acting as a "stealth" layer that prevents recognition of the particle as a foreign body by the body's defense systems. On the other hand, nanolayers can be devised that facilitate cell entry in the hypoxic tumor microenvironment. Ultimately, the use of nanostructured particles that contain multiple drugs, some of which can be released with different times or profiles, will be discussed with respect to the potential impact on synergistic drug combinations for cancer. Finally, we have adapted these methods to include RNAi delivery that is highly effective, and have introduced existing methods of RNAi synthesis using rolling circle transcription to generate nanostructured particles that provide RNAi with high loading and low amounts of toxic carrier for in vivo delivery. The advantages that polymer self- and directed assembly bring to the area of nanomedicine will be discussed.

Margaret C. Etter Memorial Lecture in Materials Chemistry
Margaret "Peggy" Cairns Etter was born on September 12, 1943. She died on June 10, 1992, from cancer. In 1974, she received her doctorate in chemistry from the University of Minnesota under the direction of Jack Gougoutas. She taught organic chemistry at Augsburg College in 1975-76, and worked at the 3M Company from 1976 to 1983. She returned to the University of Minnesota as a postdoctoral fellow with Robert Bryant in 1984 and, within a year, had secured an independent academic appointment. Peggy rose rapidly through the ranks and in 1990 was promoted to full professor. Peggy's outstanding characteristics as a scientist were her infectious enthusiasm, uncompromising scientific standards, and creativity. Her research group made major contributions in the applications of solid-state nuclear magnetic resonance spectroscopy, the design and properties of organic non-linear optical materials, and most significantly, in the understanding and utilization of hydrogen-bonding interactions in crystals. This was reflected in nearly 80 research papers and in several landmark review articles in prestigious journals. Outside recognition in the form of fellowships from the Sloan and Bush Foundations and an Iota Sigma Pi Award for Excellence in Chemistry represent incomplete reflections of the impact of this work. One of her extramural "side projects" was to found a company called "Rochelle Crystal Corporation," for which Peggy was named Saint Paul Businessperson of the Year in 1986.

Professor
Paula T. Hammond
Department
of Chemical Engineering &
Koch Institute of Integrative
Cancer Research
Massachusetts Institute
of Technology

Research emphasizes the use of molecular aspects in the study and development of new materials and processes. Its basis is the molecular design and synthesis of self-assembling polymeric systems, and the understanding and uses of secondary interactions to guide their assembly at surfaces as well as in the bulk and solution state.

Website:
http://web.mit.edu/hammond/lab/

Host: Professors Theresa Reineke & Connie Lu
Refreshments will be served prior to the seminar.