IMNI

DISTINGUISHED LECTURE

Thursday, October 19th
Barus and Holley Rm.190
184 Hope Street
Reception: 3:30 pm
Lecture: 4:00 pm - 5:00 pm

Brown University Host
Prof. Kareen Coulombe

Giving New Life to Materials for Energy, the Environment and Medicine

Angela M. Belcher
James Mason Crafts Professor of Biological Engineering and Materials Science and Engineering
Massachusetts Institute of Technology (MIT)

Organisms have been making exquisite inorganic materials for over 500 million years. Although these materials have many desired physical properties such as strength, regularity, and environmental benign processing, the types of materials that organisms have evolved to work with are limited. However, there are many properties of living systems that could be potentially harnessed by researchers to make advanced technologies that are smarter, more adaptable, and that are synthesized to be compatible with the environment. One approach to designing future technologies which have some of the properties that living organisms use so well, is to evolve organisms to work with a more diverse set of building blocks. The goal is to have a DNA sequence that codes for the synthesis and assembly of any inorganic material or device. We have been successful in using evolutionarily selected peptides to control physical properties of nanocrystals and subsequently use molecular recognition and self-assembly to design biological hybrid multidimensional materials. These materials could be designed to address many scientific and technological problems in electronics, environmental remediation, medicine, and energy applications. Currently we are using this technology to design new methods for building batteries, fuel cells, solar cells, carbon sequestration and storage, enhanced oil recovery, catalysis, and medical diagnostics and imaging. This talk will address conditions under which organisms first evolved to make materials and scientific approaches to move beyond naturally evolved materials to genetically imprint advanced technologies with examples in lithium ion batteries, lithium-air batteries, dye-sensitized solar cells, environmental clean-up and ovarian cancer imaging.

Belcher’s interest focuses at interfaces, which includes the interfaces of scientific disciplines as well as the interfaces of materials. In her group at MIT, they are using Nature as a guide to make novel electronic and magnetic materials and to pattern materials on nano length scales. To accomplish this, Belcher’s group is integrating approaches from several scientific disciplines including materials chemistry, inorganic synthesis, surface chemistry, molecular biology, biochemistry and electrical engineering. They are adapting the conditions and control mechanisms found in nature to non-biological inorganic materials such as magnetic and semiconductor materials. Belcher and her students have pioneered a very novel self-organizational approach that utilizes evolutionarily selected and engineered peptides to specifically recognize and bind electronic and magnetic building blocks. The goal is to have a DNA sequence that codes for the synthesis and assembly of any inorganic material or device. They have been successful in using these evolutionarily selected peptides to control physical properties of nanocrystals and subsequently use molecular recognition and self-assembly to design biological hybrid multidimensional materials. They are using this technology to design new methods for building batteries, fuel cells, solar cells and medical diagnostics.