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Wednesday, November 16, 2016
Seminar Presentation: 11:00am – 12:00pm
Cymer Conference Center, SME 248

Wiring up Biology:
Natural and Bioinspired Materials for Long-Range Electronic Transport

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Abstract:

Electronic transport is predominantly the domain of man-made materials and devices. Biology, on the other hand, tends to manage charge conduction via transport of ions. Consequently, interfacing biological and synthetic systems is an imperfect and often crude endeavor. New materials to interface with specific cellular and enzymatic processes are required to address challenges to integrating biology with electronic systems. Nature provides inspiration for exactly such biointerface materials. Many microbes in anoxic soils and sediment respire using extracellular electron transfer. Some of these species, specifically of the *Geobacter* genus, synthesize fiber-like appendages, called pili, which conduct charge over distances of microns to millimeters to reach remote electron acceptors. However, the charge transport mechanism in these unique structures is a matter of intense debate. This presentation will cover our efforts to resolve this controversy and to produce conductive synthetic peptide materials through biomimetic design. Our data indicate that in live *G. sulfurreducens* biofilms, a redox-mediated conduction mechanism dominates electronic transport, but that the underlying network of pili fibers are themselves conductive and exhibit band-like electronic conduction. Based on sequence and structure motifs from native pili fibers, we have developed a new set of self-assembling *de novo* peptide fibers. These peptides self-assemble through coiled-coil interactions to form unique, antiparallel hexamers and fibers. The resulting fibers are electrically conductive, making them ideal for device applications and as an experimental platform to study structure-property relationships of long-range electronic conduction in proteins.

Biosketch:

Allon Hochbaum is an Assistant Professor in the Department of Chemical Engineering and Materials Science and the Department of Chemistry at UC Irvine. His lab aims to address challenges in energy and human health through the design and synthesis of nanoscale inorganic, biological, and hybrid materials. Prof. Hochbaum received a S.B. in Materials Science and Engineering from the Massachusetts Institute of Technology, and completed his Ph.D. in the Department of Chemistry at UC Berkeley studying electrical and thermal transport phenomena in semiconductor nanowires. He was a postdoctoral research fellow in the School of Engineering and Applied Sciences and the Department of Chemistry & Chemical Biology at Harvard University where he studied bacterial community dynamics at interfaces. Prof. Hochbaum is the recipient of the Samueli Faculty Career Development Professorship and 3M Non-Tenured Faculty award, and he is an ACS (Division of Inorganic Chemistry) and AFOSR Young Investigator.