Yale Institute for Nanoscience and Quantum Engineering

Friday-December 8, 2017

12:00-1:00 PM

BECTON SEMINAR ROOM
Light lunch will be served at 11:45 a.m.

Wenbo Shi

Department of Chemical and Environmental Engineering, Yale University

"Exceptional Capacitance in Manganese Oxide-Coated Vertically Aligned Carbon Nanotube: Applications for Energy and Environment"

Vertically aligned carbon nanotube (VACNT) arrays with hierarchical and anisotropic morphology effectively extend the intrinsic extraordinary nanoscale properties (mechanical, electrical, and thermal) of individual nanotubes to the macroscale and in an accumulative manner. Thus, VACNTs hold promise to transform a diverse set of practical applications that will ultimately enable enhanced sustainability. I will first discuss the opportunities and challenges to incorporate VACNTs into environmental and energy-engineering sectors. Further, I will present our explorations on fabrication of conformal-coating VACNT/manganese oxide (MnOx) hybrids via atomic layer deposition (ALD) and their potential applications in energy and environmental-related fields. Providing high electrolyte accessibility via well-defined intertube space and exceptionally conductive support, VACNTs were found to compensate the poor electrical conductivity and low surface area shortcomings of MnOx, resulting in a hybrid material that exhibited simultaneously high mass specific (220 F/g) and area specific (1.15 F/cm^2) capacitance. This outstanding capacitance positions them as candidate materials for energy storage devices and also exhibits promise for remarkable salt adsorption capacity (27.5 mg NaCl /g material) to enable water desalination via capacitive deionization (CDI).

Professor Scott Holley

Department of Molecular, Cellular and Developmental Biology, Yale University

"Embryonic Organizers and Mechanical Information"

Embryonic organizers are multicellular domains that govern the differentiation of adjacent cells by secreting diffusible signaling molecules. The vertebrate tail organizer functions within a flux of tailbud mesodermal progenitors and ectoderm to direct the elongation of the developing spinal column. Using pharmacological and localized transgenic perturbations, 4D live confocal imaging of the zebrafish embryo, cell tracking and systematic analysis of cell motion, we characterized role of the organizer in tailbud tissue mechanics. Cells transiting the organizer express the posterior homeobox gene *eve1* as well as *bmp2b* and *bmp4* and cease expressing these genes when they exit the organizer. Surprisingly, localized perturbation of the organizer increases the heterogeneity in cell motion many cell diameters upstream of the organizer where Bmp signaling is undetectable. We find that this long-range effect is mechanical and not via cell signaling. This mechanical information, propagated via relay through local cell-cell repulsion, can project more efficiently than diffusible signals and thus extend the organizer's sphere of influence beyond that of a canonical morphogen gradient. Mechanical information flow may represent a general mechanism for rapid and long-range orchestration of embryonic morphogenesis.

Host: Professor Corey O'Hern