Department of Chemical Engineering
Special Guest Speaker

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Host: Ming Su
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"Stochasitc Interactions and Molecular Recognition in Nanosensor Systems Based on Carbon Nanotubes"

Wednesday, Feb 4
312 Ell Hall
11:45 a.m. – 1:00 p.m.

Refreshments will be served

ABSTRACT Shrinking sensors to the nanoscale introduces novel selectivity mechanisms and enables the ultimate sensitivity limit, single-molecule detection. Single-walled carbon nanotubes, with a bright fluorescence signal and no photobleaching, are a platform for implantable near-IR sensors capable of selectively detecting a range of small-molecules including the radical signaling molecule nitric oxide, the hormone estradiol, and sugars such as glucose. Selectivity is achieved by engineering an adsorbed phase of polymers, DNA, or surfactants at the nanotube/solution interface. Understanding these sensors requires a range of modeling and simulation tools and presents a unique opportunity to learn how these phases interact with small molecules. I will discuss methods and limits to integrating data from many noisy stochastic sensors, show how we can use these sensors to monitor nitric oxide inside cells with unprecedented spatiotemporal resolution, and describe what is needed to engineer a selective adsorbed phase. I will also describe methods for other nanotube-based sensors based on stochastic ionic pore-blocking of flow through nanotubes.

BIOGRAPHY Zachary Ulissi is a PhD student in the Department of Chemical Engineering at MIT, where he uses modeling and simulations to understand carbon-nanotube based sensor systems in the research groups of Michael Strano and Richard Braatz. His PhD was supported by a Department of Energy Computational Science Graduate Fellowship. Prior to MIT, Zachary completed dual degrees in Chemical Engineering and Physics at the University of Delaware (2009), and a Masters of Advanced Study (M.A.St.) in Applied Mathematics in Churchill College at the University of Cambridge on an NSF GRFP Fellowship. In addition to his recent work in nanosensors, Zachary has worked and published in a number of research areas including biomedical optics (NIH) and catalysis (Univ. of Delaware).