

UNIVERSITY OF CONNECTICUT



**INSTITUTE OF MATERIALS SCIENCE**

## POLYMER PROGRAM SEMINAR

**“Imaging ROS signaling pathways in-vivo at the single molecule level: optical amplification and multi-modality from carbon nanotube n-IR fluorescent sensors”**

**Prof. Michael J. Strano**  
**Massachusetts Institute of Technology**

**Friday, April 24, 2009**  
**11 AM, IMS Room 20**

Nanoscale sensing elements offer promise for single-molecule analyte detection in physically or biologically constrained environments. Single-walled carbon nanotubes (SWNT), as optical sensors, offer unique advantages such as photostable near-infrared (n-IR) emission for prolonged detection through biological media, single-molecule sensitivity and, as described herein, nearly orthogonal optical modes for signal transduction that can be used to identify distinct classes of analytes. Selective binding to the SWNT surface is difficult to engineer. Here, we show that a pair of single-walled carbon nanotubes provides at least four modes that can be modulated to uniquely fingerprint agents by the degree to which they alter either the emission band intensity or wavelength. We validate this identification method in vitro by demonstrating detection of six genotoxic analytes, including chemotherapeutic drugs and reactive oxygen species (ROS), which are spectroscopically differentiated into four distinct classes. We also demonstrate single-molecule sensitivity in detecting hydrogen peroxide, one of the most common genotoxins. Finally, we employ our sensing and fingerprinting method of these analytes in real time within live 3T3 cells, demonstrating the first multiplexed optical detection from a nanoscale biosensor and the first label-free tool to optically discriminate between genotoxins. These developments provide the material, analytical, and mechanistic groundwork for SWNT to function as single-molecule stochastic biosensors. Applications to nitric oxide and nitro-phenol detection will also be discussed.

*\*Coffee will be served at 10:45AM outside the seminar room.*

*\*For further information, please contact YH Chudy at 860.486.3582 of [yhchudy@ims.uconn.edu](mailto:yhchudy@ims.uconn.edu)*

