Northeastern University
College of Engineering

Please join us for a
Special Chemical Engineering & Bioengineering Seminar

Wednesday, March 27, 2013
108 West Village H
11:45 a.m. – 1:00 p.m.

"Engineering μFNs to do Quantitative Biology"

DAVID S. DANDY, Ph.D.

Professor and Department Head
Chemical and Biological Engineering
Colorado State University, Fort Collins, Colorado

ABSTRACT

An overarching goal in biology is to develop a complete understanding of cellular mechanisms by studying the functions of intra- and inter-cellular molecular interactions that trigger and coordinate cellular events. However, the complexity of biological systems causes accurate and quantitative biology experimentation to be a significant challenge. Most biological experimentation focuses on highly detailed investigation of a single signaling mechanism, which lacks the throughput necessary to reconstruct the entirety of the biological system, while high-throughput testing often lacks the fidelity and detail necessary to fully comprehend the mechanisms of signal propagation. Experimentation in biological systems can, however, benefit greatly from progress in the development of microfluidic devices. Microfluidics provides the opportunity to study systems at both the single- and multi-cellular levels, as well as at the tissue level, with high resolution and precise localized control of experimental conditions. These devices offer the ability to work with smaller reagent volumes, extended experiment times, and the possibility of massively parallel operation. They also hold the promise of integrating an entire physiological system surrogate on a single chip (i.e., body-on-a-chip). Additionally, the capability to parallelize devices on a chip opens the door for high-throughput, high fidelity experimentation to aid in accurate and precise unraveling of the intertwined signaling systems that compose the inner workings of cells and tissues.

In this talk we focus on micro-total analytical system platform design and implementation to achieve robust, reproducible, predictable behavior in somewhat unpredictable biological systems. We examine issues associated with reagent-free sensing, solid-phase binding kinetics, fluidics control, and passive pumping. The system is applied to preliminary studies of spatiotemporal sampling from organotypic tissue slices and spatially resolved sampling of chemical gradients.

BIOGRAPHY: Professor David Dandy is the Department Head of the Department of Chemical and Biological Engineering at Colorado State University. He received his B.S. in Chemical Engineering from the University of California at Davis, and his M.S. and Ph.D. in Chemical Engineering from the California Institute of Technology. Dr. Dandy has over 75 publications, including a book on chemical vapor deposition processes, and has received multiple research and teaching awards. Prior to joining the department in 1992, Dr. Dandy spent four years as a Senior Staff Member in the Advanced Materials Department at Sandia National Laboratories, focusing on thermal and plasma assisted chemical vapor deposition (CVD) of thin films. Dr. Dandy's group continues to work in this general area, with applications in next generation high-k rare earth metal oxides and nanoscale integrated optical waveguide biosensors. Other biosensor work includes superparamagnetic nanoparticle-based detection of Category A and B bioterrorism agents, enzymatic detection of halogenated organic compounds, and microfluidic capillary electrophoretic detection of prion proteins. His group also works on application of dense medium plasma technology to contaminant degradation and inactivation of viral and bacterial agents, and the study of non-aqueous phase liquid transport in heterogeneous subsurface aquifers.

Refreshments will be served.