Biomedical Engineering

Lecture Series Seminar

Integration of Cells with Silicon Devices for In vitro Tissue Engineering of Functional Neuronal and Cardiac Systems

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NanoScience Technology, Chemistry, Biomolecular Science and Electrical Engineering
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1:00 PM-2:00 PM, Friday, September 17th

Location: EC 2300

Abstract: One of the primary limitations in drug discovery research is the lack of good model systems between the single cell level and animal or human systems. This is especially true for neurodegenerative diseases such as ALS, Alzheimer's and spinal cord injury. Our research focus is the establishment of functional *in vitro* systems to address this deficit where we seek to create organs and subsystems to model motor control, cognitive function, as well as lung and cardiac function. The idea is to integrate microsystems fabrication technology and surface modifications with protein and cellular components, with the aim of initiating and maintaining self-assembly and growth into biologically, mechanically and electronically interactive functional multi-component systems. The use of surface modification techniques allows us to tailor the interface between biological/nonbiological materials, independent of the bulk composition of the nonbiological material. The ability to control the surface composition of an *in vitro* system, as well as controlling other variables for hybrid device fabrication and *in vitro* evaluation of surface modifications and their effect on cellular materials. We are using this ability to manipulate the biological systems and integrate it with silicon-based systems to create cell-based sensors for high throughput drug discovery and functional genomic assays as well as for hybrid neuronal/silicon systems to study biological computation. We are also using what we learn for a more fundamental understanding of cellular development, protein adsorption and neuronal regeneration.

Bio: James J. Hickman is the Founding Director of the NanoScience Technology Center and a Professor of Nanoscience Technology, Chemistry, Biomolecular Science, Physics and Electrical Engineering at the University of Central Florida. Previously, he held the position of the Hunter Endowed Chair in the Bioengineering Department at Clemson University. Dr. Hickman has a Ph.D. from the Massachusetts Institute of Technology in Chemistry, as well as BS and MS from Penn State University in Chemistry. He has extensive experience in surface modification and surface analysis for biological and neuroscience applications, and the integration of these systems with MEMS devices and components. He has worked at the NSF part-time as a special advisor to the Experimental and Integrative Activities Division in CISE in the area of biological computation and previously had worked with the Information Technology Office at DARPA to help develop new programs in Ultrascale computing. He has 81 publications and 16 book chapters, in addition to 16 patents. He has presented over 80 invited presentations with more than 100 total presentations. Dr. Hickman was elected a Fellow of the American Institute of Medical and Biomedical Engineers in 2004 (AIMBE) and a fellow of the AVS in 2007 and is currently a member of the Board of Directors for AIMBE. He received the NSF Director's Award for Collaborative Integration for contributions to integrating biology and information technology research in 2002, and other many awards including SAIC Publication Award and the Berman Award from the NRL.