

Food for the Twenty-First Century  
Bioprocessing and Biosensing Center

# Fall 2009 Seminar Series

**PRESENTER:** Dr. Michael A. Hill, Research Investigator and Professor  
University of Missouri, Medical Pharmacology and Physiology

**TITLE:** Sensing Forces in the Microcirculation - Methodological Approaches and Physiological Relevance

**ABSTRACT:**

The ability of small arteries to respond to changes in intravascular pressure (myogenic response) is crucial for the setting of vascular resistance and for providing a level of tone upon which vasodilators can act. Despite its physiological importance, questions remain regarding the underlying signaling mechanisms of the arteriolar myogenic response. Does an increase in pressure within an arteriole exert its effects via the extracellular matrix, an action on cell membranes and/or deformation of cytoskeletal structures? Recent advances in methodology, particularly involving sophisticated imaging approaches, are enabling the study of forces at single-cell and even subcellular levels. Atomic force microscopy (AFM) not only enables detection of cell morphology and stiffness but also allows discrete forces to be applied to single smooth muscle cells and subsequent responses to be observed. Importantly, the repertoire of approaches involving AFM can be expanded by using it in combination with other imaging approaches – including fluorescence imaging for cellular signals such as  $Ca^{2+}$ , and total internal reflectance fluorescence, fluorescence resonance energy transfer and confocal microscopy for probing cellular contact function. Combinations of these advanced imaging and nanomechanical approaches will be instructive to studies of intact vessels and the circulatory system in general.

**BIOGRAPHICAL:**

Dr. Michael Hill obtained his Ph.D degree in Physiology from the University of Melbourne, Australia in 1988. His Ph.D dissertation related to the development of vascular dysfunction in an experimental model of diabetes. He then undertook postdoctoral research at Texas A&M University where an emphasis developed on control of microvascular blood flow and how small arteries respond to physical forces. He subsequently held academic positions at Eastern Virginia Medical School, RMIT University and University of New South Wales before taking up his current position at MU. His current research continues to focus on the response of vascular cells to physical forces using techniques such as  $Ca^{2+}$  imaging, patch clamping, atomic force microscopy and confocal microscopy.

**DATE • TIME • LOCATION:**

September 29, 2009, 4:00 PM, 105 Agricultural Engineering Building

The Food for the 21st Century (F21C) program at the University of Missouri (MU) was established in the mid-1980's through state funding. The overall goal of the program is to help Missouri food producers and processors maintain their competitive edge in the global marketplace by conducting cutting-edge research in a number of food-related areas. The program involves faculty researchers from multiple colleges including College of Agriculture, Food and Natural Resources; College of Arts and Sciences; College of Engineering; School of Medicine; College of Human Environmental Sciences; and College of Veterinary Medicine. Based on the research emphases, the researchers are grouped into four Clusters: Plant Biotechnology; Animal Reproduction; Bioprocessing and Biosensing Center; and Human Nutrition.

Bioprocessing and Biosensing Center was formed in 1986. The Center currently consists of 27 faculty members, plus collaborators, support staff, and graduate students from six departments in the College of Agriculture, Food and Natural Resources and College of Engineering. These departments include Biological Engineering; Food Science; Animal Sciences; Chemical Engineering; Electrical Engineering; and Mechanical and Aerospace Engineering. This seminar is one of the educational activities in the Bioprocessing and Biosensing Center.

**Cluster Co-Leaders:** Drs. Fu-hung Hsieh and Jinglu Tan

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