Department of Mathematical Sciences welcomes

Daniel Goldman
The University of Western Ontario

A dynamic, multi-scale model of oxygen transport and blood flow regulation in skeletal muscle

February 15, 2019

Hosted by:
Prof. Julia Arciero

Tea begins at 3:00 in LD 259

Research Topic begins at 3:30 in LD 229

ABSTRACT:

The microcirculation is key in maintaining normal tissue function, due to its role in both blood-tissue transport and the regulation of blood flow distribution. The function of the microcirculation, in turn, depends on both its structure and its integrated response to various local and global stimuli. While microvascular structure changes relatively slowly, regulation is a dynamic process that involves a number of interacting mechanisms and is highly dependent on network structure and flow properties. We present a flow regulation model that incorporates a number of known regulatory mechanisms and is designed to utilize arteriolar networks reconstructed from in vivo data in rat skeletal muscle. The model includes time-dependent descriptions of two-phase (plasma and red cell) blood flow, oxygen transport, and regulation of arteriolar diameters, and couples detailed tissue-level arteriolar geometry to a simplified description of local capillary oxygen delivery, tissue oxygen consumption, and feedback initiating flow changes via conducted signaling to upstream arterioles. Steady-state and time-dependent results will be presented for the model, and the latter will be discussed in the context of developing a model that can produce complex behavior similar to that observed experimentally.

ABOUT THE SPEAKER:

Daniel Goldman is an Associate Professor in the Department of Medical Biophysics at the University of Western Ontario in London, Ontario. An applied mathematician trained in fluid mechanics and numerical analysis, he began studying the microcirculation as a postdoctoral fellow in Biomedical Engineering at Johns Hopkins University. Since 2006 Dr. Goldman has been at Western where his mathematical and computational modeling has considered microcirculatory processes over a wide range of scales (intra-cellular to tissue) and has focused on blood-tissue transport and flow regulation with the support of experimental collaborators. Besides developing modeling tools and studying fundamental aspects of microvascular physiology, Dr. Goldman has applied his models to improve understanding of diseases affecting the microcirculation, including sepsis and diabetes.

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