SIBLEY SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING
COLLOQUIUM SERIES

T Red cell-resolved blood flow modeling in physiologically realistic microvascular networks AND *Modeling amoeboid cell motility through 3D tissue-like matrices*

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Tuesday, September 17, 4:00 pm | B11 Kimball Hall
Refreshments at 3:30 pm | 116 Upson Hall

ABSTRACT

In this talk, I will present two topics from biofluid mechanics. First, a high-fidelity model of blood flow in microcirculation will be discussed. Microvascular networks in human body are made of the smallest blood vessels, or the capillaries. They are responsible for gas and nutrient transport to tissues, and regulation of blood flow in individual organs. The architecture of a microvascular network is very complex and characterized by constantly bifurcating, merging and tortuous vessels. Blood in such small vessels behaves as a concentrated suspension primarily made of red blood cells (RBC) which are extremely deformable. To date, most modeling studies of RBC flow have been limited to simple geometries, such as, straight tubes and single bifurcations. We have developed a 3D model of flow of deformable RBCs in physiologically realistic microvascular networks that are comprised of multiple bifurcating and merging vessels. The model is versatile, and can consider networks irrespective of topological/geometrical complexities. It provides fully 3D and detailed information of hemodynamic processes and quantities, such as RBC partitioning at vascular bifurcations, cell-free layer, and wall shear stress. These results and the underlying hydrodynamic mechanisms will be presented.

The second topic is on modeling amoeboid locomotion. A variety of cells within the human body, such as immune cells, epithelial cells, embryonic cells, and even metastatic cancer cells migrate using the amoeboid phenotype. Amoeboid locomotion is a complex and multiscale process, where cell deformation, protein biochemistry, both cytosolic and extracellular fluids, and cell-substrate interactions are involved. In this work, we present a 3D model of amoeboid migration through extracellular matrix.

BIOGRAPHICAL SKETCH

Prosenjit Bagchi *is a professor in Mechanical and Aerospace Engineering Department at Rutgers University in New Jersey. He completed undergraduate education in India, and PhD from the University of Illinois at Urbana-Champaign. He joined Rutgers in 2003 after his post-doc at Johns Hopkins University. His research interest is in computational fluid dynamics, and biofluid mechanics. Current projects in his group include high-fidelity modeling of blood flow in the microcirculation, and cellular motility in 3D. He is a recipient of the Andreas Acrivos dissertation award from the American Physical Society, and NSF CAREER award.*