Center for Fluid Mechanics, Division of Applied Mathematics
Fluids, Thermal and Chemical Processes Group, School of Engineering
Joint Seminar Series

Zhangli Peng
Department of Materials Science and Engineering
Massachusetts Institute of Technology
Cambridge, MA

Multiscale Modeling of Red Blood Cells and Related Diseases

We developed three-level multiscale models of red blood cells (RBCs) from the individual proteins to the whole cell, and coupled these models with a Boundary Element Method of Stokes flow to study healthy and diseased RBCs in various in-vitro and in-vivo conditions. First, we predicted the RBC resting shapes, and simulated the detachment of the lipid bilayer from the cytoskeleton in micropipette aspiration and studied the effect of protein unfolding. Then we investigated the different mechanical responses of healthy RBCs and spherocytes of anemia undergoing tank-treading motion in shear flow, and focused on the bilayer-skeleton interaction force in the molecular level. Finally we built models based on the 3D confocal images of malaria-infected RBCs and parasites, and explored the critical conditions for malaria-infected RBCs being filtered by the narrow endothelial slits in the spleen.

TUESDAY – SEPTEMBER 13 , 2011

4:00 PM

Barus & Holley, Room 190