Medical Physics Seminar

Monday, September 26, 2016

1345 HSLC ~ 4:00 P.M.

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Collide and conquer: flow-induced margination and demargination phenomena in blood

Blood is a suspension of objects of various shapes, sizes and mechanical properties, whose distribution during flow is important in many contexts. Red blood cells tend to migrate toward the center of a blood vessel, leaving a cell-free layer at the vessel wall, while white blood cells and platelets are preferentially found near the walls, a phenomenon called margination that is critical for the physiological responses of inflammation and hemostasis. Additionally, drug delivery particles in the bloodstream also undergo margination – the influence of these phenomena on the efficacy of such particles is unknown.

This talk describes efforts to gain a systematic understanding of flow-induced segregation phenomena in blood, using a combination of theory, direct simulations and experiments. Contrasts in size, deformability and shape can all lead to segregation. A mechanistically-based mathematical model based on pair collisions and wall-induced hydrodynamic migration can capture the key effects observed in direct simulations, including a "drainage transition" in which one component is completely depleted from the bulk of the flow. Experiments performed in the laboratory of Wilbur Lam indicate the physiological and clinical importance of these observations.

1345 Health Sciences Learning Center 4:00 - 5:00 P.M.
University of Wisconsin– Madison School of Medicine and Public Health