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Hydrodynamic interaction among blood cells in microcirculation
PROSENJIT BAGCHI, SAI DODDI, GAOZHU PENG, Mechanical and Aerospace Engineering, Rutgers University — Particulate nature of blood plays an important role in many hemodynamic events in small vessels. One example is the Fahraeus-Lindqvist effect which arises due to the flow-induced deformation and lateral migration of red blood cells away from the vessel wall. The lateral migration creates a region of cell- free layer which has a reduced local viscosity, and thus a pronounced effect on the blood rheology and many physiological events. The formation of the cell-free layer also plays an important role in the wall-bounded motion (margination) and vascular adhesion of white blood cells, which are critical steps in the body's immune response. To explore hydrodynamic interactions among various blood cells, under normal and disease conditions, we are developing 2D/3D numerical simulations of multiple deformable cells using front tracking/immersed boundary method. In this talk, we will describe some numerical results on the effect of neighboring particles on the lateral migration, and the development of the cell-free layer. We will also explore the effect of flowing red blood cells on the wall-bounded rolling motion and adhesion of white blood cells, as well as the effect of the white blood cells on the dispersion of the red blood cells.

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