Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Modeling of Shear-Induced Red Blood Cell Migration for Guiding Microfluidic Device Design EDEN DURANT, ADAM HIGGINS, KENDRA SHARP, Oregon State Univeristy — Through refinement and extension of a two-phase flow model previously reported for modeling blood in cylindrical flows (Gidaspow, 2009), we have developed a computational model for blood flow in complex microfluidic. Treating plasma as a Newtonian fluid and the Red Blood Cells (RBCs) as a granular phase, whose local concentrations are determined statistically, we have captured the migration of RBCs and concomitant formation of a cell free plasma layer at the channel walls. This model provides us with a three-dimensional distribution of RBCs and the development of the stead-state flow profile, and enables us to study the influence of complex microfluidic geometries, including flow obstacles and varying channel dimensions, on the rate and extent of RBC margination. Simulations on 50 and 100 micron square channels match observed trends including decreasing RBC margination rate in larger channels, increasing RBC margination rate with higher hematocrit, and decreasing cell free layer width with increasing hematocrit. This predictive capability will allow microfluidic devices to be tailored and optimized for specific biomedical applications such as separation of blood constituents..

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Date submitted: 01 Aug 2014 Electronic form version 1.4