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Mechanistic insights into flow induced segregation in blood and other multicomponent suspensions AMIT KUMAR, MICHAEL GRAHAM, University of Wisconsin Madison — Blood is a multicomponent suspension comprising mostly of red-blood-cells (RBCs) along with trace amounts of leukocytes and platelets. Under normal flow conditions both the leukocytes and the platelets segregate near the vessel walls, a phenomenon commonly known as margination. The key physical differences between RBCs, leukocytes, and platelets are their relative size and rigidity: leukocytes are larger than RBCs and platelets smaller, but both are considerably stiffer than RBCs. In this work we study the blood flow problem using a model system of fluid-filled elastic capsule mixtures. Using boundary integral (BI) simulations we delineate the effect of size and rigidity on the segregation behavior, and relate these to the observations of leukocyte and platelet margination in blood. Further, we introduce a novel Monte Carlo simulation technique, which incorporates two of the key transport mechanisms in confined suspensions: the wall-induced migration and hydrodynamic pair collisions. The model accurately reproduces the results of BI simulations and provides a mechanistic understanding of the margination phenomena. In particular, it clarifies the important role of heterogeneous pair collisions (collisions between two different species) on the observed margination behavior.

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