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Characterization of the Cell-Free Layer in a Microvessel by Computer Simulation SOL KEUN JEE, University of Texas, JONATHON FREUND, University of Illinois, ROBERT MOSER, University of Texas — The cell-free layer between the erythrocyte-rich core of a micro-vessel and the vessel wall is a significant component of the hydrodynamics of the microcirculation. To investigate the mechanics of the cell-free layer, we simulate a two-dimensional periodic blood flow in a microvessel containing numerous erythrocytes, modeled as capsules with elastic shell membranes using the boundary integral method. Cell-cell interactions are mediated with an interaction potential which represents aggregation forces. Our model successfully recreates in-vivo hemodynamic properties such as blunt velocity profile and Fahraeus effect. The cell-free layer has a thickness of order one erythrocyte radius which is consistent with experimental results. To investigate the mechanics of the cell-free layer a number of numerical experiments were conducted, in which the effects of aggregation forces, and lubrication forces are investigated, by varying the aggregation potential, introducing artificial body forces and changing boundary condition.

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