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Effects of Shear Rate, Blood Hematocrit, and Cell Stiffness on Circulating Tumor Cell Transport in a Microfluidic Device MICHAEL HOOD, JIFU TAN, Department of Mechanical Engineering, Northern Illinois University — Though circulating tumor cells (CTCs) are rare in comparison to red blood cells (RBCs), microfluidic devices (MFDs) have shown promising results in isolating CTCs from blood samples. MFDs isolate CTCs from blood samples by exploiting adhesion between CTCs and microposts coated with a selected ligand. Computational modeling is employed in this work to understand MFD performance, where cell membranes are modeled using a coarse-grained molecular approach, fluid is modeled using the lattice Boltzmann method, and the immersed boundary method is used to couple the fluid and solid. MFD performance is strongly related to flow in the device, in particular to shear rates near microposts. High shear regions generally prohibits lasting adhesion, whereas low shear regions generally promote lasting adhesion. Further studies are needed to fully understand these relationships over an extended range of shear rates. The effect on performance from cell stiffness for both RBCs and CTCs is not known, as well as the role that blood hematocric levels play in device performance. Thus, further studies of these variables and their effect on CTC transport within the device and overall device performance.

Michael Hood
Department of Mechanical Engineering, Northern Illinois University

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