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The flow of red blood cells in stenosed microvessels and the influence of red blood cells on wall-bounded rolling motion of microparticles KOOHYAR VAHIDKHAH, PETER BALOGH, PROSENJIT BAGCHI, Rutgers University — In the first part of this work, we consider a 3D computational study of the flow of deformable red blood cells in stenosed microvessels. We observe that the apparent viscosity of blood increases by several folds, and the rate of increase with increasing vessel diameter is also higher than that in non-stenosed vessels, implying an enhancement of the well-known Fahraeus-Lindqvist effect. The flow of the red blood cells causes time-dependent fluctuations in the blood flow rate. The RMS of the flow rate oscillations in the stenosed vessel is observed to be significantly higher than that in the non-stenosed vessel. Furthermore, several folds increase in the Eulerian velocity fluctuations and a transient flow reversal upstream the stenosed region are also observed, which would not occur in absence of the cells. In the second part, we consider the adhesive rolling motion of wall-bounded microparticles in presence of flowing red blood cells in microvessels. We observe two contradictory role of the red blood cells: On one hand, the cells facilitate the establishment of the particle–wall contact, and, thereby, initiation of adhesion. On the other hand, they augment the rolling velocity of the particles. Implications of these results on the optimal design of drug carriers are discussed.

Prosenjit Bagchi
Rutgers University

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