Abstract Submitted
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Three-dimensional numerical simulation of red blood cell motion in Poiseuille flows[1] LINGLING SHI, TSORNG-WHAY PAN, ROLAND GLOWINSKI, Dept. of Mathematics, University of Houston — An immersed boundary method based on a finite element method has been successfully combined with an elastic spring network model for simulating the dynamical behavior of a red blood cell (RBC) in Poiseuille flows. This elastic spring network preserves the biconcave shape of the RBC in the sense that after the removal of the body force for driving the Poiseuille flow, a RBC with its typical parachute shape in a tube does restore its biconcave resting shape. As a benchmark test, the relationship between the deformation index and the capillary number of the RBCs flowing through a narrow cylindrical tube has been validated. For the migration properties of a single cell in a slit Poiseuille flow, a slipper shape accompanied by a cell membrane tank-treading motion is obtained for Re ≥ 0.03 and the cell mass center is away from the center line of the channel due to its asymmetric slipper shape. For the lower Re ≤ 0.0137, a RBC with almost undeformed biconcave shape has a tumbling motion. A transition from tumbling to tank-treading happens at the Reynolds number between 0.0137 and 0.03. In slit Poiseuille flow, RBC can also exhibit a rolling motion like a wheel during the migration. The lower Reynolds number is, the longer the rolling motion lasts.

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Tsorng-Whay Pan
Dept. of Mathematics, University of Houston

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