Deformation of a single red blood cell in bounded Poiseuille flows\textsuperscript{1}

LINGLING SHI, TSORNG-WHAY PAN, ROLAND GLOWINSKI, University of Houston — An immersed boundary method (IBM) combined with the elastic spring model is applied to investigate the deformation of a single red blood cell (RBC) in two-dimensional bounded Poiseuille flows. The equilibrium shape of the cell under flow depends on the swelling ratio ($s^*$), the initial angle of the long axis of the cell at the centerline ($\varphi$), the maximum velocity of the flow ($u_{\text{max}}$), the membrane bending stiffness of the RBC ($k_b$), and the height of the microchannel ($H$). Two motions of oscillation and vacillating breathing of the RBC are observed in narrow channel considered here. The strength of the vacillating-breathing motion depends on degree of confinement and $u_{\text{max}}$. For the different $k_b$, the RBC obtains the same equilibrium shape for the same capillary number. Parachute shape and bullet-like shape, depending on the angle $\varphi$, coexist for the elliptic shape cell with lower $u_{\text{max}}$ in a narrower channel.

\textsuperscript{1}NSF Grant No. DMS-0914788