Abstract Submitted
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Mechanism of vaso-occlusion in sickle cell anemia[1] HUAN LEI, GEORGE KARNIADAKIS, Brown University — Vaso-occlusion crisis is one of the key hallmark of sickle cell anemia. While early studies suggested that the crisis is caused by blockage of a single elongated cell, recent experimental investigations indicate that vaso-occlusion is a complex process triggered by adhesive interactions among different cell groups in multiple stages. Based on dissipative particle dynamics, a multi-scale model for the sickle red blood cells (SS-RBCs), accounting for diversity in both shapes and cell rigidities, is developed to investigate the mechanism of vaso-occlusion crisis. Using this model, the adhesive dynamics of single SS-RBC was investigated in arterioles. Simulation results indicate that the different cell groups (deformable SS2 RBCs, rigid SS4 RBCs, leukocytes, *etc.*) exhibit heterogeneous adhesive behavior due to the different cell morphologies and membrane rigidities. We further simulate the tube flow of SS-RBC suspensions with different cell fractions. The more adhesive SS2 cells interact with the vascular endothelium and further trap rigid SS4 cells, resulting in vaso-occlusion in vessels less than $15\mu m$. Under inflammation, adherent leukocytes may also trap SS4 cells, resulting in vaso-occlusion in even larger vessels.

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