Abstract Submitted
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Quantifying the abnormal hemodynamics of sickle cell anemia[1] HUAN LEI, GEORGE KARNIADAKIS, Brown University — Sickle red blood cells (SS-RBC) exhibit heterogeneous morphologies and abnormal hemodynamics in deoxygenated states. A multi-scale model for SS-RBC is developed based on the Dissipative Particle Dynamics (DPD) method. Different cell morphologies (sickle, granular, elongated shapes) typically observed in deoxygenated states are constructed and quantified by the Asphericity and Elliptical shape factors. The hemodynamics of SS-RBC suspensions is studied in both shear and pipe flow systems. The flow resistance obtained from both systems exhibits a larger value than the healthy blood flow due to the abnormal cell properties. Moreover, SS-RBCs exhibit abnormal adhesive interactions with both the vessel endothelium cells and the leukocytes. The effect of the abnormal adhesive interactions on the hemodynamics of sickle blood is investigated using the current model. It is found that both the SS-RBC - endothelium and the SS-RBC - leukocytes interactions, can potentially trigger the vicious "sickling and entrapment" cycles, resulting in vaso-occlusion phenomena widely observed in micro-circulation experiments.

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