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Multiscale modeling of blood flow in cerebral malaria DMITRY FEDOSOV, PhD student, Division of Applied Mathematics, Brown University, BRUCE CASWELL, Professor, Division of Engineering, Brown University, GEORGE KARNIADAKIS, Professor, Division of Applied Mathematics, Brown University — The main characteristics of the malaria disease are progressing changes in red blood cell (RBC) mechanical properties and geometry, and its cytoadhesion to the vascular endothelium. Malaria-infected RBCs become considerably stiff compared to healthy ones, and may bind to the vascular endothelium of arterioles and venules. This leads to a significant reduction of blood flow, and eventual vessel obstruction. Due to a non-trivial malaria-infected RBC adhesive dynamics and obstruction formations the blood flow in cerebral malaria is extremely complex. Here, we employ multiscale modeling to couple nanometer scales at the binding level, micrometer scales at the cell level and millimeter scales at the arteriole level. Blood flow in cerebral malaria is modeled using a coarse-grained RBC model developed in our group. The RBC adhesion is simulated based on the stochastic bond formation/breakage model, which is validated against recent experiments.

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