Abstract Submitted
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An immersed-boundary method for modeling flow of deformable blood cells in complex geometry[1] PETER BALOGH, PROSENJIT BAGCHI, Rutgers University — We present a computational methodology for simulating blood flow at the cellular scale in highly complex geometries, such as microvascular networks. Immersed boundary methods provide the foundation for our approach, as they allow modeling flows in arbitrary geometries, in addition to resolving the large deformation and dynamics of individual blood cell with high fidelity. Different simulation components are seamlessly integrated into the present methodology that can simultaneously model stationary rigid boundaries of arbitrary and complex shape, moving rigid bodies, and highly deformable interfaces of blood cells that are governed by non-linear elasticity. This permits physiologically realistic simulations of blood cells flowing in complex microvascular networks characterized by multiple bifurcating and merging vessels. The methodology is validated against analytical theory, experimental data, and previous numerical results. We then demonstrate the capabilities of the methodology by simulating deformable blood cells and heterogeneous cell suspensions flowing in both physiologically realistic microvascular networks and geometrically intricate microfluidic devices. The methodology offers the potential of scaling up to large microvascular networks at organ levels.

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Prosenjit Bagchi
Rutgers University

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