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Orbital drift of capsules and red blood cells[1] DAN CORDASCO, PROSENJIT BAGCHI, Rutgers, The State University of New Jersey — Experiments using deformable red blood cells (RBC) in shear flow showed that the cells orient their symmetry axis towards the plane of shear (C = ∞ orbit) in a high viscosity medium, and along the vorticity direction (C = 0 orbit) in a low viscosity medium. In contrast, rigid ellipsoids in Stokes flow exhibit degenerate trajectories. The degeneracy can be broken by inertial effects, or, deformability. To explore the orientational drift, we conduct a 3D numerical simulation of prolate and oblate capsules and RBC over a range of capillary number, asphericity, and viscosity ratio. Four types of motion are observed: a stable precessing about C = 0, a stable kayaking about C = ∞, an unstable precessing towards C = 0, and a transition from a kayaking to a drifting precession. A prolate capsule with viscosity ratio of one mostly exhibits a kayaking at low asphericity, but mostly a drifting precession at high asphericity. In contrast, an oblate capsule drifts towards C = ∞. In agreement with published experiments, we find that the RBC orients its symmetry axis to C = 0 at high viscosity ratio, and C = ∞ at low viscosity ratio. We also find that the RBC orientation is dependent on the capillary number, implying the role of deformation.

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