Abstract Submitted
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Getting into the flow: Red cells go on a roll, two-component vesicles swing ANNIE VIALLAT, JULES DUPIRE, KAMEL KHELLOUFI, AL HAIR AL HALIFA, Aix Marseille Université, CNRS UMR7333, lab. Adhesion and Inflammation, Inserm, ADHESION AND INFLAMMATION TEAM — Red blood cells are soft capsules. Under shear flow, their two known motions were "tumbling" and "swinging-tank treading," depending on cell mechanics and flow conditions. We reveal new wobbling regimes, among which the "rolling" regime, where red cells move as wheels on a road. We show, by coupling two video-microscopy approaches providing multi-directional cell pictures that the orientation of cells flipping into the flow is determined by the shear rate. Rolling permits to avoid energetically costly cellular deformations and is a true signature of the cytoskeleton elasticity. We highlight two transient dynamics: an intermittent regime during the "tank-treading-to-flipping" transition and a Frisbee-like "spinning" regime during the "rolling-to-tank-treading" transition. We find that the biconcave red cell shape is very stable under moderate shear stresses, and we interpret this result in terms of shape memory and elastic buckling. Finally, we generate lipid vesicles with a shape memory by using two lipids with different bending rigidities. These vesicles swing in shear flow similarly to red blood cells but their non-axisymmetric stress-free shape changes the periodicity of the motion and induces specific features.

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