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The effect of stress-free shapes on the red blood cell dynamics¹ PROSENJIT BAGCHI, DANIEL CORDASCO, ALIREZA YAZDANI, Rutgers University — We present 3D numerical simulations on the effect of the two different stress-free shapes on the dynamics of red blood cells. We observe that in a high viscosity medium, the cell with a nearly-spherical stress-free state undergoes transition from tank-treading to tumbling at a much lower capillary number than the cell with a biconcave stress-free shape. The cell with the biconcave stress-free shape easily loses the biconcave shape and exhibits large time-periodic shape oscillation and membrane folding, while the cell with the nearly-spherical stress-free state retains the biconcave shape without any membrane folding. In a low viscosity medium, however, both stress-free shapes exhibit almost the same dynamics that is characterized by cell tumbling. We then compare the orbital reorientation of the cell for the two stress-free states. In the high viscosity medium, both cells undergo a precession motion orienting their symmetry axis towards the vorticity axis at low capillary numbers, or a kayaking motion orienting the axis towards the shear plane at higher capillary numbers. The capillary number for the precession-to-kayaking transition is observed to be higher for the biconcave stress-free shape than that for the nearly-spherical stress-free shape. At low viscosity medium, both shapes exhibit qualitative similar precession dynamics.

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