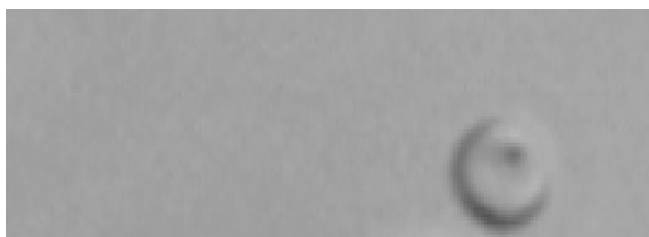# Supporting Information

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Movie S1.   Evolution of the orientation of a red blood cell (RBC) with an increasing shear rate. In the movie, "s-1" stands for the shear rate dimension, $[s^{-1}]$. For each movie part, shear rate is equal, respectively, to 2 s^{-1}, 4 s^{-1}, 6 s^{-1}, 8 s^{-1}, 10 s^{-1}, and 12 s^{-1}. The movie corresponds to the sequences in Fig. 1*B*.

Movie S1

Movie S2.   Tank-treading RBC with the rotation of a bead stuck to the membrane. Images in differential interference microscopy. In the movie, "s-1" stands for the shear rate dimension, $[s^{-1}]$. Shear rate is equal to 3 s^{-1}. The movie corresponds to the sequences in Fig. 3*A*.

Movie S2
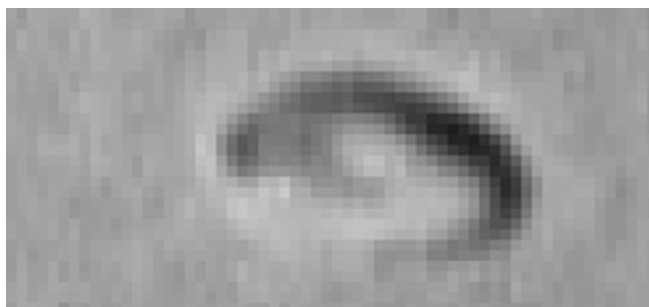
Movie S3.   Rolling-to-tank-treading transition. Images are in phase contrast. In the movie, "s-1" stands for the shear rate dimension, $[s^{-1}]$. Shear rate is equal to 3 s^{-1}. The movie corresponds to the sequences in Fig. 4*A*.

Movie S3

Movie S4. Tank-treading on a non-fully fluidized RBC, displaying knizocytal shape. Images are from differential interference microscopy. In the movie, "s-1" stands for the shear rate dimension, $[s^{-1}]$. Shear rate is equal to 6 s^{-1}. The movie corresponds to the sequences in Fig. 4*B*.

[Movie S4](#)