

Abstract Submitted  
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**A simple model to understand the role of membrane shear elasticity and stress-free shape on the motion of red blood cells in shear flow**<sup>1</sup>  
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CNRS, JULES DUPIRE, Microfactory company — The analytical model presented  
by Keller and Skalak on the dynamics of red blood cells in shear flow described the  
cell as a fluid ellipsoid of fixed shape. It was extended to introduce shear elasticity of  
the cell membrane. We further extend the model when the cell discoid physiological  
shape is not a stress-free shape. We show that spheroid stress-free shapes enables  
fitting experimental data with values of shear elasticity typical to that found with  
micropipettes and optical tweezers. For moderate shear rates (when RBCs keep  
their discoid shape) this model enables to quantitatively determine an effective cell  
viscosity, that combines membrane and hemoglobin viscosities and an effective shear  
modulus of the membrane that combines shear modulus and stress-free shape. This  
model allows determining RBC mechanical parameters both in the tanktreading  
regime for cells suspended in a high viscosity medium, and in the tumbling regime  
for cells suspended in a low viscosity medium. In this regime, a transition is pre-  
dicted between a rigid-like tumbling motion and a fluid-like tumbling motion above  
a critical shear rate, which is directly related to the mechanical parameters of the  
cell.

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