What can we learn from the observation of red blood cell membrane flickering?

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Red blood cells are seen to flicker under optical microscopy, a phenomenon initially described as thermal fluctuations of the cell membrane [1]. However, recent studies indicate that the membrane flickering can be shape and position dependent, and can have a contribution from non-equilibrium (active) processes [2,3]. These studies call into question most simple models used for the connection between membrane fluctuations and its mechanical properties, making the interpretation of flickering measurements unreliable. We employ realistic stochastic simulations of red blood cells to investigate the dependence of membrane fluctuations on the position of measurements and to decouple passive (thermal) and active contributions to the observed flickering. Simulations indicate that it should be possible to quantitatively extract red blood cell membrane properties, including shear elasticity, bending rigidity, and membrane viscosity. We also suggest several possibilities for the decoupling of passive and active contributions to the membrane flickering. Finally, we will discuss potential mechanism responsible for the active contribution.

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