

Intracellular rheology of red blood cells

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Characterizing the rigidity of red blood cells (RBCs) and their heterogeneity in a blood sample is a key parameter in understanding erythrocyte diseases. We propose a method of intracellular rheology based on molecular rotors, viscosity sensitive fluorescent probes [1]. Experiments conducted on temperature-stiffened RBCs show that the DASPI molecular rotor is sensitive to the overall rigidity of RBCs (cf. Fig. 1) and can probe the heterogeneity of a sample at the cellular level [2]. Further examination allows to separate cytosol and membrane contributions, opening up the possibility of intracellular rheology and new diagnostic techniques, especially in the case of sickle cell disease in which hemoglobin polymerization is directly related to the stiffening of RBCs and to the development of painful vaso-occlusive crises.

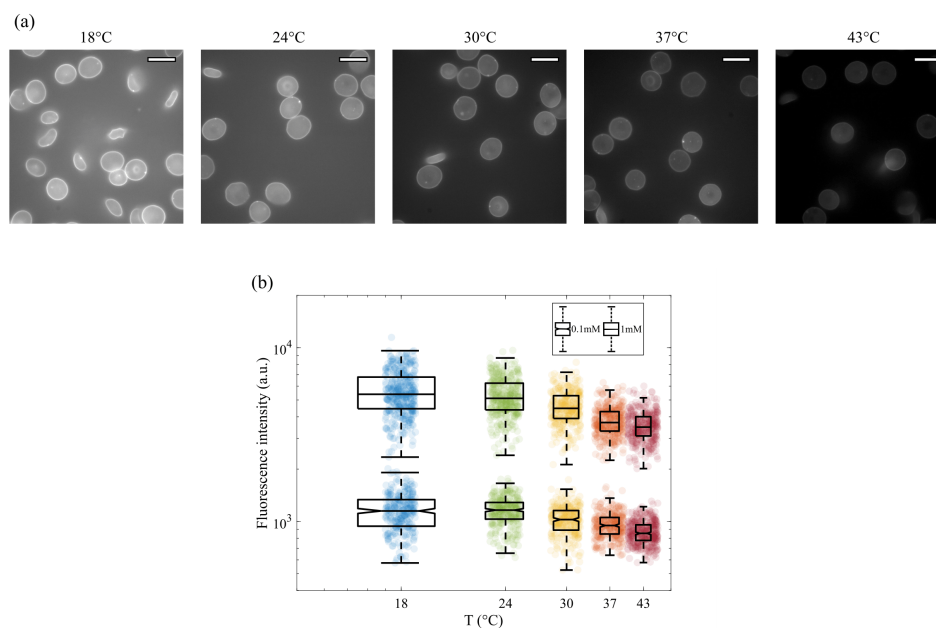


Figure 1. Fluorescence microscopy of RBCs at different temperatures (excitation $480 \pm 20\text{nm}$, emission $595 \pm 30\text{nm}$). (a) Images of RBCs with increasing temperature in a 1mM DASPI solution (scale bar: $10\mu\text{m}$); (b) fluorescence intensity of RBCs as a function of temperature in 0.1mM and 1mM DASPI solutions; RBCs come from five donors, approximately four hundred cells were imaged at each temperature and their average intensity was measured. The fluorescence intensity increases with decreasing temperature i.e with stiffening.

References

1. HAIDEKKER, M. A. & THEODORAKIS, E. A., Environment-sensitive behavior of fluorescent molecular rotors, *Journal of Biological Engineering.*, **4**, 1–14 (2010).
2. A. BRIOLE & T. PODGORSKI & B. ABOU, Molecular Rotors as intracellular probes of Red Blood Cell stiffness, *submitted to Soft Matter* (2021).