Proposal for an interdisciplinary Internship in Biophysics

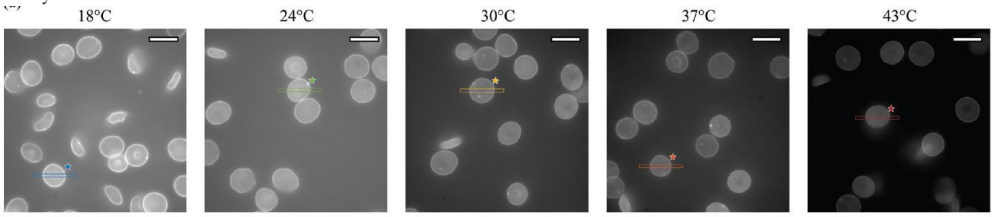
Intracellular Nanorheology with Molecular Rotors
Application to red blood cell pathologies

Keywords : red blood cells, molecular rotors, rheology, sickle-cell anemia, spherocytosis, diagnostic
Where : Laboratoire Matière et Systèmes Complexes (MSC), UMR7057 CNRS & Université Paris Cité
Collaboration : Laboratoire Biologie Intégrée du Globule Rouge (BIGR, INSERM) and Necker Hospital
Supervisor : Bérengère Abou (MSC)

Join our research project at the interface of physics, biology and clinical practice, studying pathologies that affect the deformability of red blood cells

The aim of this project is to investigate the relevance of intracellular nanorheology - an innovative approach developed at MSC laboratory [1-3]- for monitoring and characterizing red blood cell pathologies. These pathologies are generally characterised by a loss of deformability of red blood cells, leading to clinical complications and requiring regular monitoring. Our approach, based on the use of molecular rotors, fluorescent probes sensitive to viscosity, makes it possible to quantify the rheology of red blood cells or their loss of deformability. We will study the contribution of nanorheology to the monitoring of erythrocyte pathologies (sickle cell anaemia, spherocytosis) and compare this contribution with that of reference techniques used in clinical practice. This will allow the development of new rheological indicators for monitoring patients suffering from pathologies that affect erythrocyte rigidity.

You will be based at 'Matière et Systèmes Complexes', and will work in close collaboration with the 'Biologie Intégrée du Globule Rouge' laboratory (UMR_S 1134 CNRS & INSERM). Our team at MSC has particular expertise in the rheology and micro-rheology of complex and biological fluids, and the BIGR laboratory is specialist in red blood cell pathologies. You will have the opportunity to work in a stimulating interdisciplinary environment.



Images of red blood cells incubated with the DASPI molecular rotor, with increasing temperature (scale bar: 10 µm). The rotor fluorescence signal increases with RBC rigidity with decreasing temperature.

Candidate background – You are interested in physics applied to health issues, image analysis, original experimental developments. You enjoy working in interdisciplinary projects, with good communication and synthesis skills.
To apply, please send your CV and motivation to Bérengère Abou: berengere.abou@gmail.com.

1. A. Briole, T. Podgorski & B. Abou, Molecular rotors as intracellular probes of red blood cells rigidity, Soft Matter 17, 4525 (2021).
2. A. Briole & B. Abou, Molecular rotors in haemoglobin and bovine serum albumin proteins, J. Roy. Soc. Interface 19: 20220709 (2022).
3. A. Briole & B. Abou, Molecular rotors probe hemoglobin concentration in red blood cells, in preparation (2023).