INTERNSHIP PROPOSAL

Laboratory name: Laboratoire Matière et Systèmes Complexes (MSC)
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Internship location: 10 Rue Alice Domon et Léonie Duquet, 75013 Paris

Thesis possibility after internship: YES
Funding:-NO If YES, which type of funding:

Mechanics and mechanosensitivity of mitochondria in living cells

Cells can sense and respond to external forces and **mechanotransduction** events appear to be critical for most cellular functions. While mechanotransduction has been extensively studied at the plasma membrane and at the nucleus, the impact of forces on other **organelles** is still not clear. This M2 internship project will study mechanotransduction at **mitochondria**, the organelle which plays a key role in cell metabolism by producing energy in the form of ATP.

During this M2 internship project, we will ask whether changes in metabolism impact on mitochondrial mechanics, and conversely, whether mechanical forces applied on mitochondria modify metabolic responses. The intern will measure **mitochondria morphology and mechanics** with image analysis and optical tweezers-based intracellular microrheology (Figure). Different cell treatments (oligomycin, FCCP, rotenone, H_2O_2) will be used to perturb cell metabolism and fluorescent probes (MitoSOX, CellROX, TMRE) will report the changes in metabolism due to forces exerted on mitochondria either internally by optical tweezers or externally by microfluidic techniques.

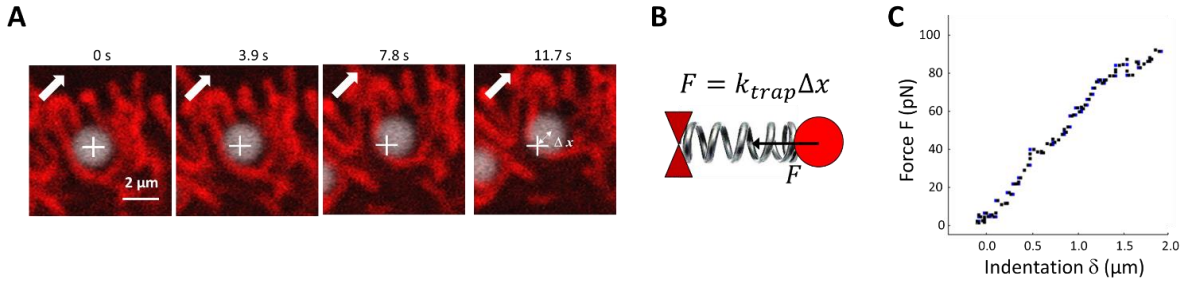

Figure: *Measurements of the* ***rigidity of mitochondria in living cells.*** *A. Images showing a typical indentation experiment of a mitochondria in retinal pigment epithelial (RPE-1) cells. The white cross represents the centre of the optical tweezers in which the 2 µm-diameter bead is trapped (grey). The mitochondria (red) is indented by moving the cell towards the top-right direction (white arrow) which displaces the bead away from the trap centre of a distance Δx. Time (in seconds) is indicated above the images. B. Scheme of the bead in the optical trap. C. Force-indentation curve showing the force F as a function of the indentation δ.*

Key words: metabolism; mitochondria; oxidative phosphorylation; ROS; optical tweezers; microfluidic; FRET; FLIM
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Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO