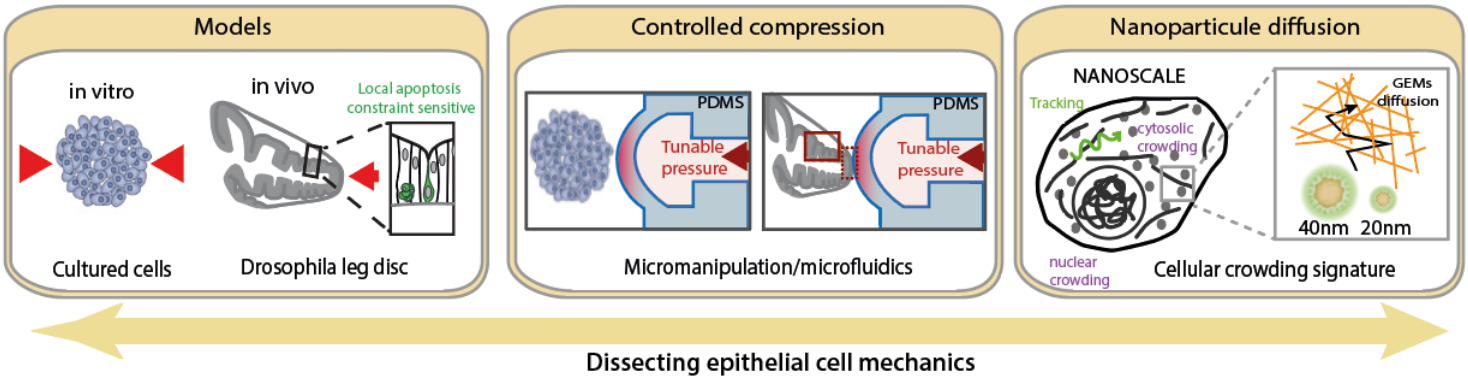
Unité de Biologie Moléculaire, Cellulaire et du Développement
MCD
Centre de Biologie Intégrative de Toulouse
CBI

M2R internship in Mechanobiology 2025

with associated PhD funding 2025-2028

Deciphering Apoptosis Mechanical Signature using nanoparticle tracking and optical tweezers

Supervision : Magali SUZANNE (CBI), Morgan DELARUE (LAAS), Wylie AHMED (LPT)



Context: In living organisms, epithelial tissues are constantly challenged by mechanical stresses, both tensile and compressive. The significance of these stresses in physiological mechanisms is an emerging field, known as mechanobiology, which has shed light on the role of tissue constraints in development, but also in tumor progression where tissue stiffness or mechanical compression has been identified as a driver of tumor aggressiveness, emphasizing the need to characterize tissue responses to mechanical stress both in normal and tumor contexts. While in vitro studies reveal the potential of tissues, in vivo studies provide insight into their actual behavior in complex living organisms. However, studies in physiological contexts have been extremely rare and limited, since it remains challenging to manipulate physical stresses with precision in a living model organism without compromising viability. Here we propose to develop original methods to address the role of mechanical stress in epithelial cell dynamics both in cancer cells and in living tissues.

Project: This project proposes to characterize intracellular rheology of epithelial cells under compressive stress. The aim is to understand the link between rheological properties, cellular activity and energy production in cells, and how these intracellular physical parameters are modified under compressive stresses, both in vitro and in integrated models (living tissues). The long-term goal is to uncover how mechanical compression could promote cell apoptosis through a modulation of intracellular rheological properties, both in vitro and in physiological integrated models. This project relies on the characterization of cellular crowding signature using particle tracking in living cells submitted to controlled compressive stress.

Expected expertise: We are looking for a very motivated student, willing to work at the interface between biology, physics and biotechnology, with either biological or physical background. An experience at the interface would be a plus.

Main methods: live imaging, microfluidics, GEMs particle tracking.

Keywords: Cancer cells, Drosophila tissues, mechanical stress, compression, rheology, apoptosis.

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