

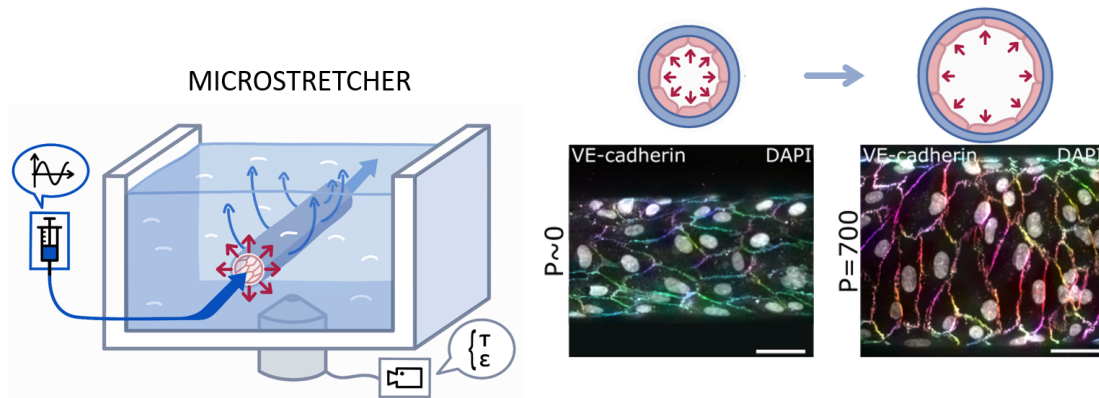
M2 internship (Feb 2027) - PhD project (Sept 2027)

ANIMATE: ANIsotropic Mechanics of Active TissuEs

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Project

This project aims to study the role of activity and anisotropy in the mechanics of cellular monolayers. Activity is found in systems which are out-of-equilibrium. They consume energy at the microscopic level, such as ATP hydrolysis in cells, which allows them to generate active stresses, such as contractile forces in the acto-myosin network in cells. Anisotropy is found in systems which have elongated particles, or cells, leading to different properties along the X or Y direction. Traditional mechanical characterization of biological tissues considers them as passive and isotropic materials. This project will close this gap using a novel in vitro system: the microstretcher.



The microstretcher is a microfluidic system which allows the application of tension at the tissue scale while manipulating the cellular activity and anisotropy (Dessalles et al., *Nature Physics* 2025). It is composed of a cellular monolayer, such as endothelial or epithelial cells, lining the surface of a cylindrical channel inside a soft hydrogel Dessalles et al., *Biofabrication* 2021). When the fluid pressure is increased in the lumen, the diameter of the cylinder increases and the cells are placed under tension.

To that end, you will perform the first long-term rheology tests of curved epithelial (MDCK, MCF-10A) and endothelial (HUVEC) monolayers, and connect their mechanical response to their orientational order. You will:

- Culture cell monolayers in hydrogel microchannels and run the microstretcher.
- Tune the initial nematic order of the tissue.
- Image the tissue live and quantify lumen deformation, cell shape and actin orientation fields, including topological defects.
- Probe the biological origin of the response with pharmacological inhibitors and immunostaining.

Candidate profile

Required: M2 student (or equivalent) in physics, biophysics, mechanics, soft matter, bioengineering or a related field; curiosity for living systems; enjoyment of experimental work.

Appreciated: cell culture, microfluidics or microfabrication (PDMS, hydrogels), fluorescence microscopy, image analysis and data processing (Python), notions of continuum mechanics, rheology or liquid crystals. We will train you.

Soft skills: rigour, dexterity, patience with long experiments, troubleshooting skills, autonomy, curiosity for interdisciplinary work at the physics–biology interface.

Working language: English (French not required); international students are welcome.

Not ticking every box? Please apply anyway. Motivation and willingness to learn across physics and biology matter most. We welcome applications from all backgrounds and are committed to equal opportunities.

What we offer

Close mentoring: daily lab presence of your supervisor, a weekly one-to-one meeting and lab meetings.

Hands on technical training: biomaterials, organ-on-chip engineering, live imaging, quantitative image analysis, active-matter physics.

A funded PhD opportunity.

A welcoming team: a interdisciplinary environment within a well-equipped biophysics group with close links to the soft-matter and active-rheology experts of ILM.

Collaborations: national and international.

How to apply

Send a CV, a cover letter (1 page, why this project, and whether you are considering a PhD) and your M1/M2 transcripts to Claire Dessalles – claire.dessalles@univ-lyon1.fr. Reference letters are only requested for shortlisted candidates. Applications are reviewed continuously until the position is filled. Questions are welcome before applying.