M2 internship (Feb 2027) - with possible PhD (Sept 2027)

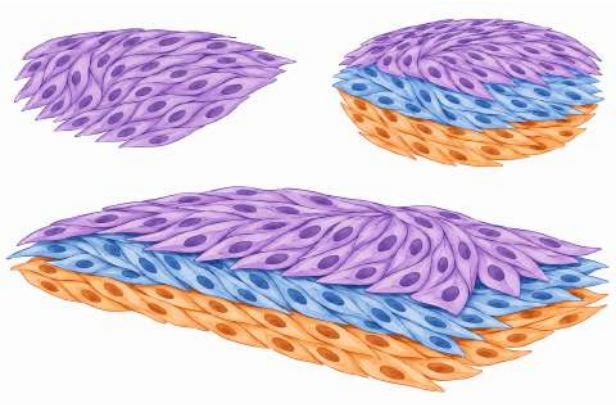
Nematics of cellular multilayers: towards a living liquid crystal

Dr Claire DESSALLES

Project

This project lies at the interface of active matter and out-of-equilibrium statistical physics. Cellular tissues are a particularly rich example of active systems: cells consume energy, interact mechanically and collectively generate stresses. When cells are elongated, they can also display a collective orientational order analogous to that of nematic liquid crystals. The overall goal is to understand how microscopic cell–cell interactions give rise to the mechanical properties and collective organisation observed at the tissue scale.

The novelty of the project is to study **cellular multilayers as living lamellar liquid crystals**: layered structures that can deform, flow and actively produce forces. The work combines experiments, development of analysis tools and theoretical modelling, in a strongly interdisciplinary approach at the crossroads of active-matter physics, biophysics and materials science.



During the internship, you will lay the foundations of the project by characterising the **structure of cellular multilayers** and starting to probe their**collective dynamics**. You will:

- Culture elongated cells and grow multilayers on substrates of controlled stiffness, geometry and adhesion
- Image the tissue by fluorescence microscopy (fixed and live) and quantify the orientation fields of each layer.

- Detect and analyse topological defects, and measure their correlations between layers.
- Characterise the relative orientation of adjacent layers (criss-cross or twist), and explore the possible role of chirality.
- Examine the transition from quasi two-dimensional to fully three-dimensional organisation.
- Reconstruct velocity and deformation fields from time-lapse movies of fluorescently labelled cells.
- Contribute to the development of Python tools to describe nematic fields and flows on curved geometries.

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, fluorescence microscopy, image analysis and data processing (Python), notions of liquid crystals. We will train you.
Soft skills: : rigour, creativity, autonomy, troubleshooting skills, 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: cell culture, live imaging, quantitative image analysis, active-matter physics and modelling.
A PhD opportunity: the internship is designed as the first step of a three-year PhD project. If the internship goes well and you wish to continue, we will support your application to the doctoral school ED PHAST.
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, including with theorists.

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 contacts are only requested for shortlisted candidates. Applications are reviewed continuously until the position is filled. Questions are welcome before applying.