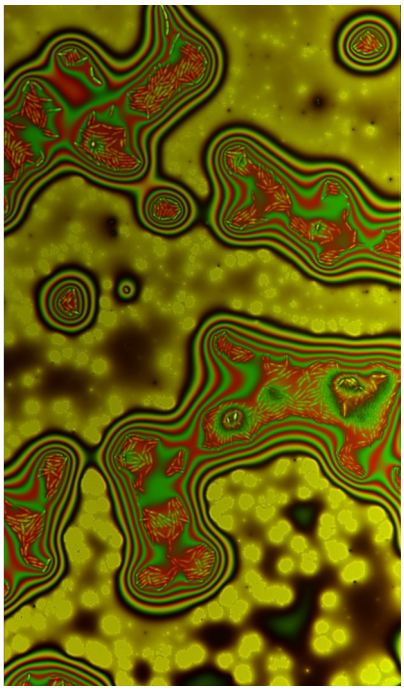
Internship proposal - Laboratory for Interdisciplinary Physics - 2025

Decontaminating surfaces without chemicals: study of bacterial resistance

At the crossroad between physics, biology and chemistry, this project aims to study and optimize the physical cleaning of surfaces to limit the use of harmful chemicals in cleaning processes.

This internship can be followed with a fully-funded PhD project.



Dissemination of pathogenic microorganisms from the surface of contaminated equipment represents a major public health issue and can cause hospital-acquired infections or harmful food spoilage. Surface contamination by bacteria involves secreted extracellular polymeric substances (EPS) that mediate adhesion and into which they embed to form biofilms. In this state, they exhibit increased resistance to chemical, pharmaceutical or mechanical assault and strategies aiming at efficient removal of surface-attached bacteria often rely on the use of environmentally hazardous chemicals (washing at extreme pH or with toxic organic compounds). In this context, there is a strong drive to devise milder and greener strategies for surface decontamination, such as processes based on the mechanical action of a moving air/liquid interface and subsequent surface drying. However, both detachment and drying may be hindered in the presence of microcolonies and EPS: why/how a fraction of the adhered bacteria may resist a moving meniscus and subsequent drying remains to be explored.

This project aims to investigate the physico-chemical aspects of bacterial resistance to mechanical decontamination. To this aim, the student will work within an experienced team to:

- Create and use a microfluidic circuit to perform drying assays.
- Learn some basics of microbiology to perform decontamination assays.
- Visualize and analyze quantitatively drying and EPS deposition by bacteria, to determine whether the presence of EPS can slow evaporation locally and contribute to bacterial survival.
- Contribute to the modelling of the data, together with experienced researchers.

For whom? This project includes microscopy, microfluidics, image analysis and microbiology and we are thus looking for a rigorous experimentalist eager to work in an interdisciplinary environment. Some knowledge in image analysis is a plus.

Where? The student will be hosted by the Laboratory of Interdisciplinary Physics (LIPhy) at Grenoble-Alps University, in the research group Mechanics of Cells in Complex Media (MC^2). LIPhy brings together biophysics, soft matter physics, optics, physico-chemistry and biology in a international environment. He/she will work together with a PhD student and an experienced post-doc to master the experimental know-how.

With whom? Dr Delphine Débarre (LIPhy - microscopy, image analysis, microfluidics) and Dr Sigolène Lecuyer (ENS Lyon - microbiology) will supervize the project.

Interested candidates should contact D. Débarre (delphine.debarre@univ-grenoble-alpes.fr) with their motivation letter, CV and transcript of university record (indicate “internship – Physical cleaning” as e-mail subject).

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