POSTDOCTORAL position

Microfluidic flow of vesicle prototissues

Laboratoire Charles Coulomb, University of Montpellier (south of France)

The Soft Matter team of the Laboratoire Charles Coulomb (Montpellier) offers a post-doctoral research contract, funded by the ANR, for a **period of one year, starting ideally on September 1st 2023.** The postdoc will be supervised by Laura Casanellas (webpage).

Project description

The goal of the project is to provide a comprehensive description of tissue rheology, linking the physics at the cell and tissue scales, based on a novel biomimetic approach. In our team we have recently synthesized a prototissue based on the self-assembly of giant unilamellar vesicles (GUV). We will characterize the flow of biomimetic vesicle prototissues, as a simplified model for cellular tissue flows observed in complex physiological problems, such as morphogenesis or tumour metastasis. Thanks to the unique possibility offered by vesicle prototissues to tune the physical properties of GUVs independently, we will decipher their role on the rheology of the overall prototissue.

Postdoc objectives

The candidate will first work on the assembly of vesicle prototissues. GUV-GUV adhesion will be mediated by the incorporation of complementary DNA strands, which facilitate dynamic vesicle assembly and tunable adhesion strength. Second, he/she will tune the elastic properties of GUVs with the goal of mimicking the mechanics of cell membrane and cell cytoskeleton. This will be achieved by modifiying the lipid composition of vesicle membranes, and by encapsulating elastic gels inside GUVs, using the cDICE technique.

The flow behavior of vesicle prototissues will be investigated in microfluidic confinement (as shown in the figure) and the impact of individual GUV properties (adhesion and elasticity) on tissue rheology will be probed. Necessary image analysis tools will be implemented in order to provide a description of the flow at the local scale enabling, in particular, the identification of GUV-GUV rearrengements. Based on the experimental results a theoretical constitutive equation (viscoelastic or visco-elasto-plastic) capable of reproducing the flow of biomimetic prototissues will be established.

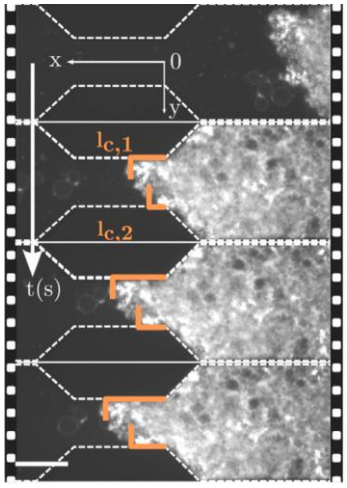

Figure : Image sequence of the aspiration of a vesicle prototissue in a microfluidic constriction, for increasing applied pressure steps. Scale bar 100 µm (adapted from Layachi *et al.*, Frontiers In Physics, 2022).

Scientific collaborations

Collaborations with the CRBM (Montpellier), Diderot University (Paris) and University of Barcelona are foreseen in the context of this project.

Postdoc Candidate

We are looking for a highly motivated candidate to join our team, willing to carry on experimental research in a multi-disciplinary framework. Candidates should hold a PhD in Biophysics, Physics, Physical Chemistry or Fluid Mechanics. Expertise on microfluidics, microscopy, and image analysis will be highly appreciated. Good communication skills and a basic knowledge on programming are required.

Application: Applicants should send as soon as possible their CV, together with a cover letter and one/two references to L. Casanellas (laura.casanellas-vilageliu@umontpellier.fr). Please, feel free to contact me for any further information.