

Proposal for an interdisciplinary M2 internship in Cell biophysics

Intestinal cell growth on biomimetic scaffolds and under external magnetic fields

The goal of this internship is to grow intestinal organoids on microstructured hydrogels to study cell responses to external magnetic fields.

Laboratory:

Lyon Institute of Nanotechnology (Institut des Nanotechnologies de Lyon, INL)
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Team: Devices for Health & Environment

Group: Lab-On-a-Chip & Instrumentation

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Organs are formed from the deformation of cell layers called epithelia. The epithelium of the intestinal barrier is particularly heterogeneous along its topography¹: on the top (the villi), it mainly contains enterocytes cells, whereas on the bottom (the crypts), it represents a reservoir of stem cells. Despite extensive studies have been carried out to understand the biochemical pathways ruling the separation of these two important domains in the gut topography, little is still known about how geometrical parameters contribute to tissue functionality. By coupling hydrogel microstructuration² and magnetic field remote control, we can achieve *in vitro* microsystems with the aim to better understand heterogeneous tissue formation and maintenance.

The aim of the project is to optimize the microfabrication of the hydrogel scaffolds and to perform organoid cell growth characterization on these substrates in presence of not of an external magnetic field (see figure). Cell growth will be also characterized by fluorescence microscopy.

The duration of the internship is of **5-6 months**, starting from **February-March 2023**.

Collaborative network - The student will be supervised by Caterina Tomba and will work at the INL in the team "Devices for Health & Environment", where different projects focus on the development of microsystems for the diagnosis and for the study of mechanical properties of cells. The project is performed in collaboration with Delphine Delacour from the team Cell Adhesion and Mechanics at the Jacques Monod Institute (Paris) and with Damien Le Roy at the ILM (Institut Lumière Matière, Lyon). The internship could be followed by a PhD position of 3 years founded by the CurVEDyn project of the ANR JCJC.

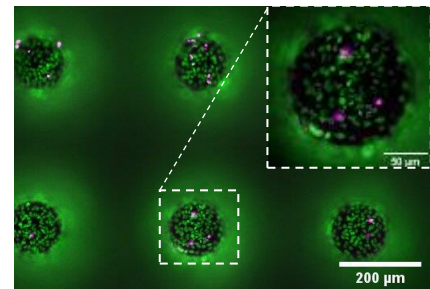
Local environment - The student will benefit from the technological infrastructures of the new INL building with more than 400m² of clean room and 65m² of cell culture.

Candidate background - We are looking for a student with a strong motivation for intestinal organoid culture combined with microfabrication tools and quantitative bio-imaging. A good background in cell biology, polymer chemistry or physiopathology would be appreciated. The student needs to have good communication skills required for a team work and an interdisciplinary project.

Keywords – Organoids-on-chip, Intestinal cells, Magnetic fields, Biophysics, Image analysis.

To apply, please **send a CV with a cover letter and with the names of referees familiar with your work to Caterina Tomba: caterina.tomba@univ-lyon1.fr**.

1. Barker, Nick. "Adult intestinal stem cells: critical drivers of epithelial homeostasis and regeneration." *Nature reviews Molecular cell biology* 15.1 (2014): 19-33.
2. Xi, W., Saleh, J., Yamada, A., Tomba, C., Mercier, B., Janel, S., ... & Delacour, D. (2022). "Modulation of designer biomimetic matrices for optimized differentiated intestinal epithelial cultures." *Biomaterials*, 282, 121380.



Live/dead (green/magenta) staining of mammalian cells growing on polymer pillars under static magnetic field – Top view.