

Internship proposal (6 months, LAAS-CNRS, Toulouse, France)

Biophysic study of a gut epithelium on a 3D-printed scaffold and interaction with nanoplastics

Subject:

The external layer of the gut is composed of a tight monolayer of cells, called an epithelium, whose function is to absorb the nutrients while avoiding the translocation of pathogens or particles from the lumen of the gut to the blood network. In the light of the worrying increasing of micro and nanoplastics presence in the environment and food, *in vitro* models of the gut barrier have to be set up to study in more details the possible translocation of nanoplastics through the gut epithelium. One of the main obstacles is the need of substrates for this epithelium, with a high density of pores large enough for the translocation of micro-nanoplastics with dimensions $< 3\mu\text{m}$. To answer that need, we are building 3D-printed nets made of micrometric or sub-micrometric fibers (see Figure 1) using high resolution, two-photon polymerization of acrylate resins (Nanoscribe 3D printer). On these nets, the diameter of the fibers, their orientation and the pore size could be tightly controlled. We are able to culture gut cells (Caco-2 cell lines) on these nets and to obtain promising monolayers of cells after 3 weeks of culture (see Figure 2). However, depending on the net parameters (pore size, fiber diameter, orientation), the organization of the epithelium is drastically modified. In this internship, we propose first to study the influence of these parameters on the creation of a tight epithelium, on its organization and on the differentiation of the cells toward enterocyte-like phenotypes, and then to test the translocation of fluorescent model of nanoplastics.

Tasks and techniques:

During this internship, training on several techniques will be offered, including:

- Two-photon 3D printing in a clean-room environment
- Electronic microscopy
- Cell culture and staining
- Confocal microscopy

Profiles with skills and knowledge in cell biology, micro/nanofabrication and/or microfluidics are welcome.

Location and duration:

The ELiA team is a research team specialized in *in vitro* systems for the study of the cell and tissue microenvironment, hosted in the LAAS-CNRS laboratory in Toulouse, France. The LAAS-CNRS is a large academic laboratory with 700 researchers, engineers, PhD students and interns and large facilities including a large clean room (equivalent to the MESA+) and biology cell culture areas. The internship is planned for a 6 months duration, starting on September 2023 with a monthly allowance around 600€. Continuation as a PhD is possible.

Contacts

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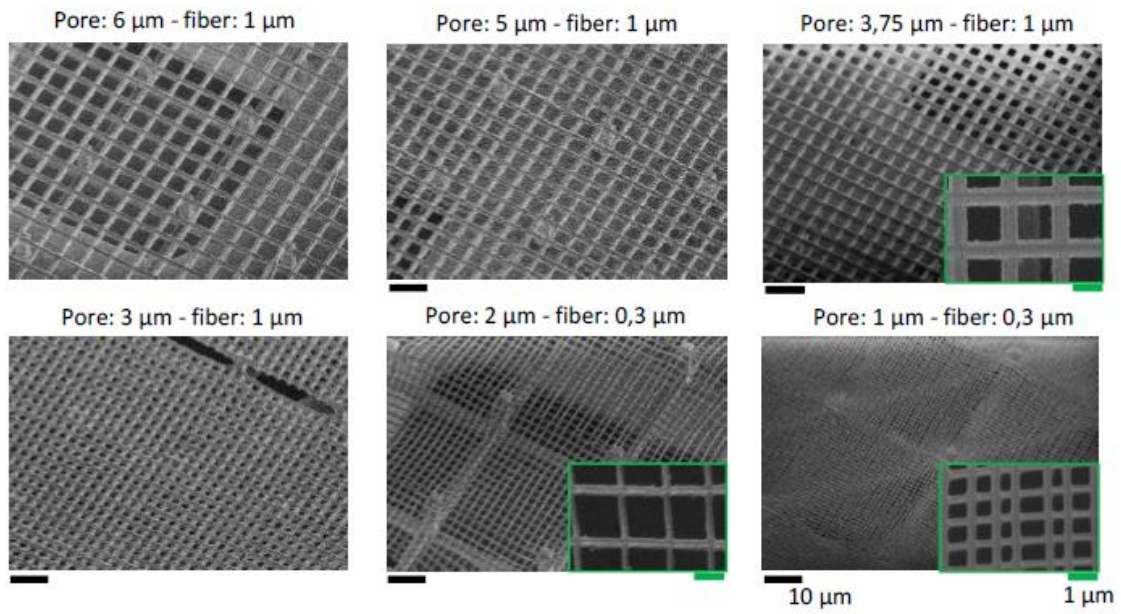


Figure 1 : details of 2D nets on SU-8 frames

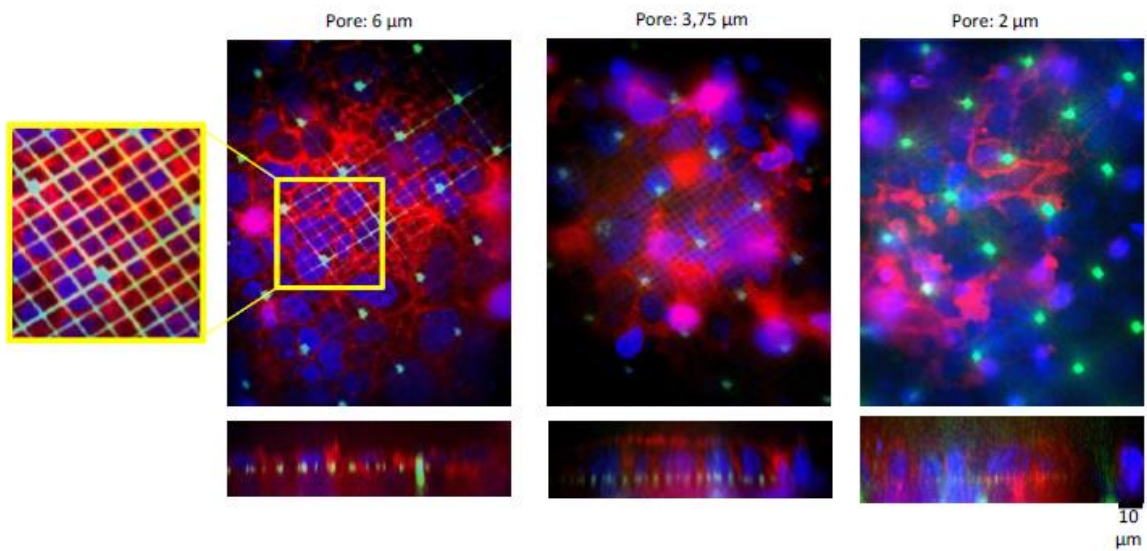


Figure 2 : culture of Caco-2 cells on nets, staining (blue: nucleus, red: membrane, green: net) and confocal microscopy