

14 March 2022

Open PhD position

Subject: Ex-vivo Model of Inflammatory Bowel (Ex-MIB)

General information

Workplace: Nancy, France

Type of contract: PhD contract

Contract period: 36 months

Expected date of employment: October 2022

Proportion of work: Full time

Desired level of education: Master's degree in bioelectronics, bioengineering, material science

Missions / Activities

Inflammatory Bowel Diseases (IBD) are chronic inflammatory diseases of the gastrointestinal tract with increasing incidence worldwide. Aberrant immune response to the commensal microbiota is supposed to be a leading cause, but other factors including genetic susceptibility, 'leaky' epithelial barrier, impaired bowel movement, and environmental factors (diet, stress, or smoking) are all thought to contribute to the IBD development^{1,2}

Aims of the project: We propose to create the first IBD-specific **microfluidic gut-on-chip (GOC)** which can be personalized with biosamples of IBD patients (CHRU-Nancy) to mimic their own intestine to better understand their physiopathology. The model will be compared to surgical samples taken from IBD patients enrolled in the ongoing I-Bank project at Nancy University Hospital.

This new GOC model will allow the co-culture of epithelial and immune cells and bacteria from gut microbiota in order to model a complete intestine. Hence, the efficient biomimetic system design will be as close to the patient's gut as possible. The GOC devices will be composed of microfluidic cell cultures, fabricated from microsensor technology. Firstly, the device will be composed of continuously perfused multi-layer compartments. In all the compartments, physiological flow will diffuse for the cells nutrition and communication. Then second chip, will be considered by adding the microbiota at the top of the epithelial cells via bioprinting process. The tissues will be obtained from the co-culture of different cell types extracted from patients to generate a personalized chip whose immunophenotype can be easily characterized at the molecular level. This innovative tool will allow the deep study of intestinal function and homeostasis to test and develop new therapies that are still unknown. Microelectrodes array will be implemented in the final device by focussing in in-situ **bioimpedance analysis**³⁻⁵ (BIS) to monitor the cells growth and tissue formation.

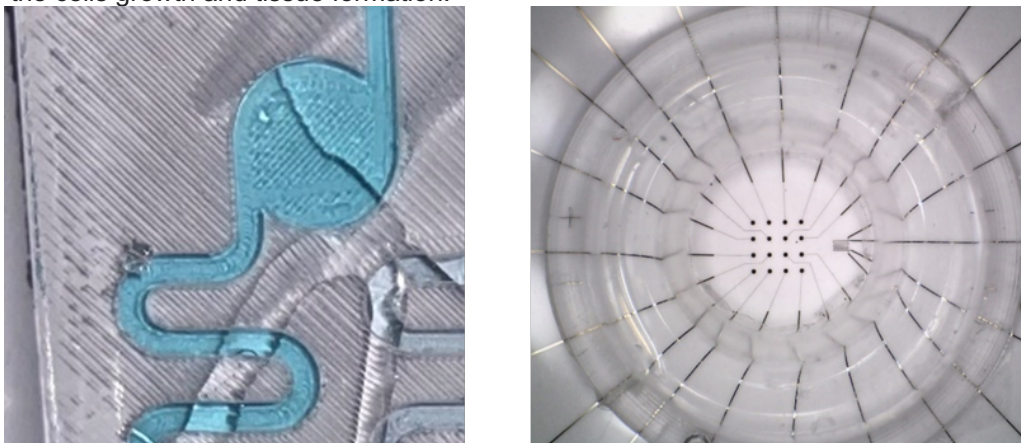


Figure 1 Example of culture chamber from our chip (under patenting) and our matrix electrodes array device that will be adapted for this project

References

- [1] Ungaro, R.; Mehandru, S.; Allen, P. B.; Peyrin-Biroulet, L.; Colombel, J.-F. Ulcerative Colitis. *The Lancet* 2017, 389 (10080), 1756–1770.
- [2] Torres, J.; Mehandru, S.; Colombel, J.-F.; Peyrin-Biroulet, L. Crohn's Disease. *The Lancet* 2017, 389 (10080), 1741–1755.
- [3] Alves de Araujo, A. L.; Claudel, J.; Kourtiche, D.; Nadi, M. *Biosensors* 2019, 9 (3), 108.
- [4] Claudel, J.; Alves De Araujo, A. L.; Nadi, M.; Kourtiche, D. *Sensors* 2019, 19 (15), 3366.
- [5] Claudel, J.; Ngo, T.-T.; Kourtiche, D.; Nadi, M. *Biosensors* 2020, 10 (12), 208.

Keywords:

Inflammatory Bowel Diseases, Gut-on-chip, bioelectronics

Work context

The PhD student will work under the supervision of Pr. Laurent Peyrin-Biroulet, Dr. Julien Claudel and Dr. Halima Alem in collaboration between **NGERE**, Nutrition, génétique et exposition aux risques (Inserm U1256) and **IJL**, Institut Jean Lamour (UMR 7198 CNRS UL)

Skills

Good knowledge of bioelectronics, bioengineering, experience in cell culture and microfabrication will be highly appreciated.

Knowledge of English (oral and written) is important and knowledge of French would be an advantage. As an enthusiastic researcher you like team work, and have a flexible approach to collaborating between different laboratories.

Taste in both experimental and theoretical work.

Constraints and risks

The position you are applying for is located in a sector relating to the protection of scientific and technical potential. It therefore requires, in accordance with the regulations, that your arrival be authorized by the competent authority of the Ministry of Higher Education, Research and Innovation.

About Institut Jean Lamour

The Institute Jean Lamour (IJL) is a joint research unit of CNRS and Université de Lorraine.

Focused on materials and processes science and engineering, it covers: materials, metallurgy, plasmas, surfaces, nanomaterials and electronics.

It regroups 183 researchers/lecturers, 91 engineers/technicians/administrative staff, 150 doctoral students and 25 post-doctoral fellows.

Partnerships exist with 150 companies and our research groups collaborate with more than 30 countries throughout the world.

Its exceptional instrumental platforms are spread over 4 sites; the main one is located on Artem campus in Nancy.

Application

Applicants are invited to send a CV and cover letter together with diploma copies and associated quote, and Master 2 internship supervisor(s) reference letter:

Laurent Peyrin-Biroulet (PUPH): laurent.peyrin-biroulet@univ-lorraine.fr

Julien Claudel (Associate Professor): Julien.claudel@univ-lorraine.fr

Halima Alem (Associate Professor): halima.alem@univ-lorraine.fr