Post-doctoral Position - Project MIMIMed@Lyon
Development of sensors based on electroactive materials for the instrumentation of experimental organ models

MIMIMed@Lyon project is a strategic project of the Carnot Institute Ingénierie@Lyon in the field of health and medical engineering. Through a consortium of 7 research laboratories (IMP, LaMCoS, LGEF, LMFA, LMI, LTDS, MATéIS) of the Lyon campus, it aims at developing a platform of instrumented experimental models of artificial organs in order to test, under representative conditions of the human body, **Medical Devices** (MDs) under development. This project is part of a global European initiative to **reduce animal testing** by promoting research and development of alternative methods (*e.g.* synthetic skins) for the pre-clinical validation of drugs, cosmetics, etc. In the case of MDs, very few alternative methods have been proposed due to the multi-factorial complexity of the biological environment to which they are exposed. Among these, the complex mechanobiological interactions between MDs and biological tissues influence the fatigue mechanisms of the entire system. According to the current regulations, the validation of a MD requires to verify its compatibility with a biological tissue but also its durability within the biological system in order to ensure that it does not present any biological risk in the long term. An alternative method for the validation of a MD must therefore propose a representative mechanobiological environment.

MIMIMed@Lyon project brings together three experimental organ models: a mastication simulator (LMI lab), a vascular network simulator (LMFA lab) and a bio-triboreactor (LaMCoS lab). Ultimately, the objective of the project is to regroup these different models together under a common platform for the experimental validation of MDs in the fields of dentistry and vascular surgery. The mastication and vascular network simulators will enable macro-scale testing of MDs under simulated operating conditions. However, in order to reproduce and identify local mechanical stresses at the device/tissue interfaces, we need to instrument these simulators with local sensors. The bio-tribo-reactor will then allow these stresses to be reproduced at the micro-scale between the device and model biological tissues in order to study the influence of mechanobiology through different biomarkers such as tissue inflammation, cell growth, extracellular matrix properties, etc. The major obstacle in this transition from the macro to the micro scale lies in the precise measurement of these local stresses. The proposed solution is therefore to instrument these experimental models with polymer-based electroactive sensors in order to recover the necessary information.

The mission of the post-doctoral researcher in this project will therefore be to develop sensors, integrate them into the existing experimental models and verify their operation. The type of sensors envisaged are based on the piezoelectric effect, which enables mechanical energy to be converted into electrical energy. For this purpose, it will rely on the expertise and resources of the LGEF laboratory with regard to the development, characterisation and integration of such type of sensor. Different methods can be tested for the elaboration of materials (screen printing, casting, 3D printing). He/she will have to work in direct collaboration with the teams of the other involved laboratories in order to propose an optimal solution for the integration of these sensors in the associated experimental models.

Profile: The candidate should have a PhD in materials science. He/she should be autonomous, curious and have a real taste for experimental research. Experience in the development/characterisation of electroactive polymeric and composite materials, and knowledge of electrical properties would be particularly appreciated. A good level of written and spoken English is required.

Host laboratories: The post-doctoral contract will start at the beginning of 2023 for a duration of 12 months under the supervision of Guilhem RIVAL (LGEF lab). The student will be hosted in the LGEF laboratory on the La Doua - INSA Lyon campus and will have to work in collaboration with the different actors of the project (mainly on the same La Doua campus).

Contacts: To apply, please send a CV, a copy of your PhD diploma (or certificate of completion) and the contact details of one or two people who can recommend you for this position (*e.g.* thesis supervisor) to guilhem.rival@insa-lyon.fr.