Research Institute XLIM- UMR CNRS 7252
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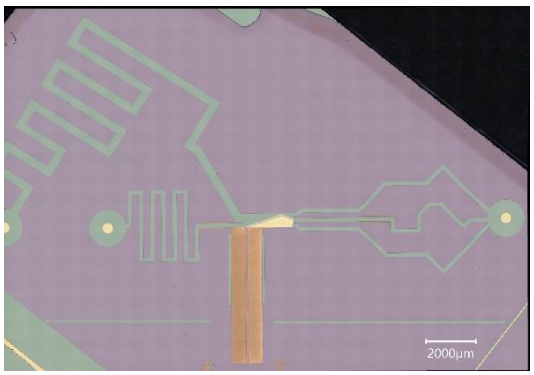
PhD thesis offer at the interface from electronic/microfluidic/biology at Limoges University

PhD subject:

Development of original Electromagnetic wave microfluidic Lab-on-chips for cancerous nanovesicle study: Setting innovative diagnosis tools for liquid biopsy analysis in cancerology.

Scientific context:

In the Frame of the European funded project **SUMCASTEC** (Semiconductor-based Ultrawideband Micromanipulation of CAncer STEm Cells) lead by Limoges University : http://www.sumcastec.eu and the **OncosomeTrack** project from the Nouvelle Aquitaine Council, a new Phd position is opened from 01 October 2019 for 3 years at XLIM research Institute. This thesis deals with the development of microfluidic systems based on the high frequency dielectrophoresis technique able to analyze the intracellular dielectric properties and to **identify cancer cells** and in particular the most aggressive ones (source of metastasis). The objective is to contribute to the emergence of new analysis strategies in oncology by studying **the influence of nanoscale vesicles** called exosomes on the aggressiveness of certain tumor cells and their role in intracellular communication. This subject with strong multidisciplinary connotation is a continuation of the research activities of two ongoing projects in the laboratory: SUMCASTEC and OncosomeTrack. It offers a work environment rich in skills and opportunities thanks to the involvement of several teams of biophysicists, biologists and a biotechnology company.



Thesis background :

Diagnosis and treatment of cancer have increased significantly in recent years. However, there is still a significant level of therapeutic failure. A breakthrough in therapeutic management would be to provide personalized care through the development of **new tools capable of performing a rapid and effective analysis of the potential aggressiveness of the tumor**.

A new mode of liquid biopsy is emerging, based on the analysis of the influence of extracellular vesicles called **exosomes** or oncosomes when they are secreted by the tumor itself. Indeed, oncosomes actively participate in the communication between the tumor and its environment. They are believed to be largely responsible for the spread of metastases and resistance to conventional treatments.

Present in the blood of cancer patients, oncosomes, if they could be easily detected and differentiated from exosomes secreted by other healthy cells, could thus provide information on the presence of a tumor in the body and its degree of aggression: information of primary importance to propose personalized treatment potentially more effective.

However, even if this new mode of biopsy seems very promising, there is currently no diagnostic tool for simply evaluating the properties of oncosomes to correlate with the potential aggressiveness of the tumor.

To answer this problem, the XLIM and CAPTUR laboratories of the University of Limoges propose two PhD thesis, which will be carried out in parallel.

- One addresses mainly biological issues through the isolation and purification of oncosomes for a study of the biological mechanisms of action of these nanovesicles.
- The other one that concerns us here, addresses the technological development, the optimization and the validation of the diagnostic tool which will be used to analyze the influence of different types of exosomes (healthy or cancerous) on the cellular properties.

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Thesis objectives :

• Design, using multiphysics simulation tools, microfluidic biochips that will used to sort the most aggressive cells of a tumor, separating them by high frequency dielectrophoresis
• Fabricate prototypes using microsystems technologies available in the XLIM laboratory clean room
• Use and develop experimental benches for testing prototypes: use of flow controllers, high speed imaging, trajectory recognition, fluorescence imaging, use of high frequency generators, automation and control of the sorting system
• Detect cells recognized as being the most aggressive and identify their dielectrophoretic signatures. The objective is to be able to quantify the evolution of the level of aggressiveness of test cells put in contact with oncosomes.
• Prepare technology transfer to industry

The candidate will have to work in close collaboration with members of the biologists teams of Captur laboratory whose doctoral student recruited by this laboratory to work on this project.

Candidate profile

The candidate will preferably be a student physicist or engineer interested in experimentation, microtechnology, modeling of electromagnetic field / biological cell interaction phenomena and interdisciplinarity. The candidate will preferably have a master's degree in the fields of biophysics, micro and nanotechnologies and / or microfluidics. A first work experience at the physical / biology interface would be good point. He / she will be able to integrate into teams of different cultures, have a taste for experimentation, be autonomous and know how to take initiatives, write and present his work in a clear and synthetic manner, both in writing than in oral (English OK).

Contacts :

The candidate will be integrated in a multidisciplinary laboratory and a dynamic team opened to international collaboration. He / she will have a unique working environment to train in different techniques (microfabrication, simulations, microfluidic experimentation, cell culture and characterization (if he / she wishes).) Through his experience in demanding scientific fields and Transdisciplinary (biophysics, micro technologies, microfluidics), he / she can follow an academic career or move towards R & D jobs in industry in the booming field of micro and nano technologies for biotechnologies, the collaborative experience will also be a plus value.

Main Advisor **:** Arnaud Pothier (Electromagnetism & microsystems), arnaud.pothier@xlim.fr

Co- Advisor**:** Claire Dalmay (Physic & microfluidic) claire.dalmay@xlim.fr

Deadline to applicate : **13 june 2019**