Post-doctoral position
Microfluidic chip for circulating tumor cell sorting in two steps

Duration : 12 months
Starting Date : mai 2023

Scientific context:
Isolation of circulating tumor cells (CTC) directly from blood via liquid biopsy could lead to a paradigm shift in clinical cancer care by enabling earlier diagnosis, more accurate prognosis, and personalized treatment. Nevertheless, the specific challenges of CTCs, including their rarity and heterogeneity, have so far limited the use of CTCs in clinical studies. Microfluidic-based isolation technologies are promising tools to circumvent these limitations but still fail to meet the constraints of high purity and short processing time required to ensure compatibility with clinical follow-up[1,2]. The separation methods of CTC from white blood cells (WBC) are based either on the physical properties of the cells (size, density, mechanical or electrical properties) or on the biological properties of the cells (surface masker expression). The combination of the two approaches can compensate the inherent drawback of each technique, enabling the detection of a wider range of tumor cells exhibiting different properties among them. Most multi-step isolation methods can be divided into pre-enrichment and isolation steps. We have recently demonstrated the interest of combining a size-based pre-enrichment step, using the commercial system ClearCell FX1® and an isolation step, performed in our immunomagnetic-based microfluidic device, the MagPure chip[3]. Our goal is now to develop the next generation of the MagPure chip that integrates both pre-enrichment and isolation steps onto the same chip.

PureChip Project:
The postdoctoral fellow will work on the integration of the two complementary functions on the same microfluidic chip and on the characterization of the sorting efficiency of m-CTC and patient CTC from blood cells. She/He will participate in the design and micro-fabrication of the chip, prepare the biological samples, work on the optimization of the immunomagnetic labeling step, and characterize the sorting performances. She/He will benefit from the microfluidic facilities provided by INL (Nanolyon Platform, 150 m² clean room) for device fabrication and preliminary characterization and, from biological lab at the hospital (Hospices Civils de Lyon) for biological sample preparation and microfluidic device characterization. The project is founded by ITMO Cancer PCSI 2022 – INSERM.

Key word:
Lab-on-a-chip, microfluidic, blood sample, circulating tumor cell, immunomagnetic labeling, sorting efficiency

Profile:
The project is multidisciplinary and requires that the candidate have skills or experience in one or more of the following disciplines: microfabrication, manipulation of microfluidic systems, preparation of biological samples in suspension, cell spiking, immunomagnetic labeling. The candidate should be motivated to develop the skills he/she does not have yet.
The successful applicant must also have the willingness and enthusiasm to work independently while being able to communicate with the various scientists involved in this project whether they are engineers, physicists, biologists or physicians. The ideal candidate should be curious, and should enjoy solving problems and developing new technologies with personal creativity and innovation.

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Laboratories and location:

The internship will take place at "Institut des Nanotechnologies de Lyon" (INL), in the Devices for Health and Environment group and at "Institut Lumière Matière" (ILM) in the group transport, Nanomagnetism and Materials for Energy, both located at UCBL campus (Villeurbanne, France) and at "Centre pour l'Innovation en Cancérologie de Lyon" (CICLY) at Hospices Civiles de Lyon (Saint-Genis-Laval, France)

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References :

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[2] Tadimety A et al., "Advances in liquid biopsy on-chip for cancer management: Technologies, biomarkers, and clinical analysis". Crit. Rev. Clin. Lab. Sci. 2018, 55, 140–162, doi:10.1080/10408363.2018.14259
[3] L. Descamps et al., "MagPure chip: an immunomagnetic-based microfluidic device for high purification of circulating tumor cells from liquid biopsies" Lab On a Chip 2022, DOI: 10.1039/D2LC00443G, accepted.