Master thesis proposal at NIMBE/LIONS

Development of a microfluidic system for single cell analysis of their content in tritium-labeled drugs

Context

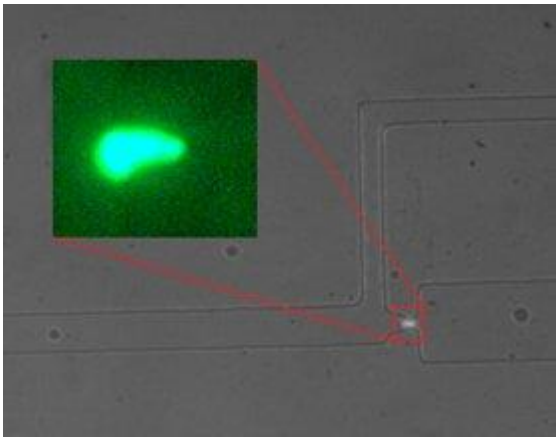
Our understanding of the mode of action of drugs involves a better resolution at the level of tissues targeted by a drug. In fact, an accurate assessment of the therapeutic index of a drug requires determining its quantity not only in each cancer cell, but also in all the cell types that make up the tumor: macrophages, fibroblasts, lymphocytes. In fact, it is a matter of quantifying a drug at the single cell level.

Today, this problem is either addressed by labelling drugs with a fluorescent group, allowing to benefit from all the advances related to the use of fluorescence, from the single cell to the whole animal. For reasons of strict quantification, which fluorescence does not allow, but also because of the very important alteration that fluorescent labelling implies on all pharmacological properties of a drug, radioactive drug labelling (3H, 14C) is a more appropriate strategy. Nevertheless, to realize the unique benefit offered by radioactive labeling, new solutions must be implemented to meet the constraints of the use of these isotopes, particularly for tritium. Being able to detect and quantify a tritium-labeled drug at the level of a cell would represent a major advance in the field.

The project MEDICA+ is a CEA collaboration composed of biologists and physicists to work on the development of a novel digital autoradiography analyzer. The final aim of the project is to build a microfluidic platform coupled to a detector prototype able to quantify the exact dose of the tritium-labeled drugs after in vivo administration to cell population.

Mission

The aim of this internship is dedicated to the microfluidic platform. We proposed an approach based on a hydrodynamic trapping to immobilize the cells (see figure). The candidate will have to optimize the existing device (tuning parameters, new design if necessary) and make the first tests with tritium-labeled cells. To do so he/she will be in close collaboration with physicists for the microfabrication/microfluidics part and with biologists for cell cultures and beta-imaging. Immobilized cells will be imaged first on a commercial beta-imager available from one of our partners and compared to the beta-imager prototype.



Profile

We are looking for applicants having a background such as Engineering/Biology/Physics, skills in microfluidics will be an asset but it is not mandatory. The applicant will be motivated by challenges in a multidisciplinary team.

Applicants will have an experimentalist profile.

Applicants shall speak English or French, and have good communication skills.

Duration: 6 months

Starting date: To be filled first trimester 2021

Localization: LIONS at CEA/Saclay, Gif sur Yvette France

Contacts CV and motivation letter should be sent to Dr. Florent Malloggi - florent.malloggi@cea.fr