Internship

Cancer cell migration through confined environments under fluid stresses

Context: During cancer metastasis, cells must migrate through highly confined and heterogeneous environments, including narrow extracellular spaces and microvascular networks. These confining environments impose strong mechanical constraints on the cell, while interstitial or vascular flows simultaneously generate fluid stresses. Cancer cells are known to respond actively to both geometric confinement and fluid stress, yet how these competing physical cues are integrated during migration remains poorly understood. In particular, it is unclear whether fluid stresses can promote cell penetration into progressively tighter spaces, or instead trigger stalling, repolarization, or migration reversal.

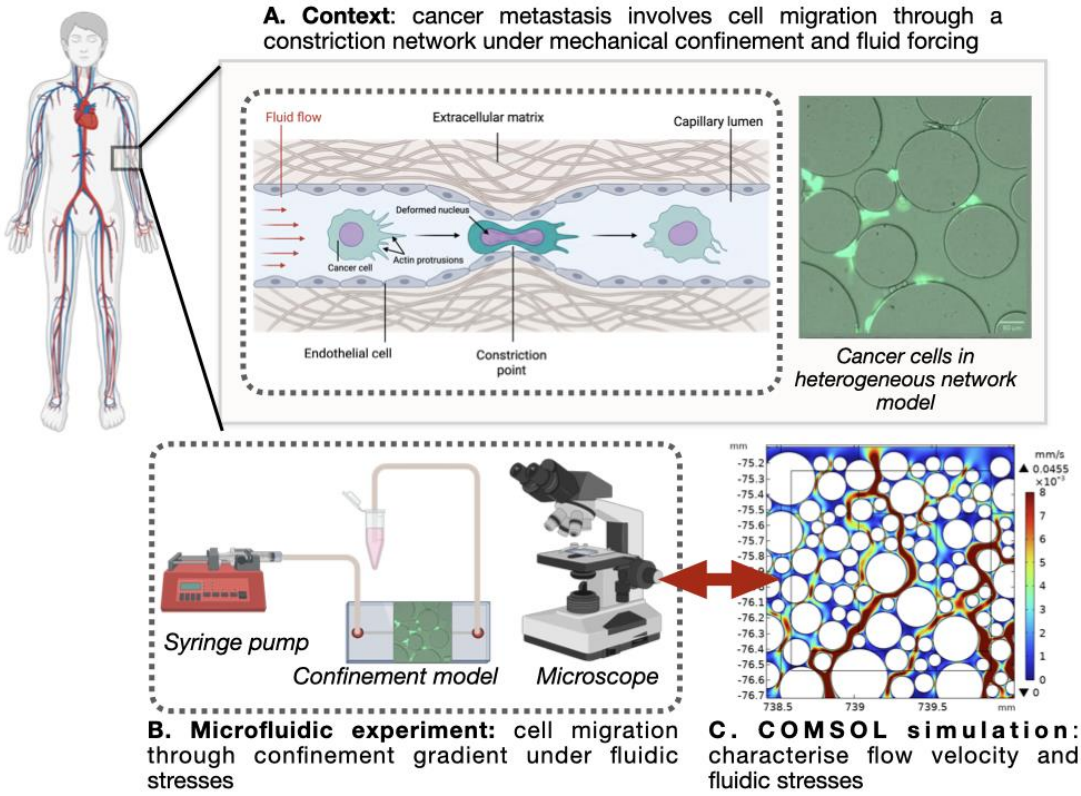


Fig. 1: A. Schematic cell migration through a confining blood capillary under fluid flow (left) and an example microfluidic model to impose heterogeneous confinement (right), B. A schematic of experimental setup involving microfluidics, C. Velocity field obtained via COMSOL simulation in a relevant network

In this context, the internship will investigate how metastatic cancer cells migrate through progressively increasing confinement under controlled fluid flow. The project will focus on designing and fabricating microfluidic devices containing arrays of micropillars creating a well-controlled confinement gradient. Using MDA-MB-231 breast cancer cells, **the intern will perform time-lapse fluorescence microscopy to quantify cell trajectories, migration speed, deformation, probability of crossing individual constrictions, stalling, and reversal under different flow conditions**. The experiments will be complemented by image analysis and COMSOL simulations to characterize the associated velocity, pressure, and shear-stress fields. The objective will be to determine how fluid forcing affects the ability of cancer cells to deform and migrate through progressively tighter constrictions. Importantly, **this internship may be considered for a PhD project continuation for an exceptional candidate**.

Duration: 5-6 months
Grant: 600 euros per month
Degree: M2, Starting from February 2026.
Location: IRPHE, 49 Rue F. Joliot Curie 13013 Marseille
Contact: Ankur Bordoloi (ankur-deep.bordoloi@univ-amu.fr)
Applications (including CV and cover letter) must be applied in English

References:

- Tavasso, M., Bordoloi, A.D., et al. Advanced Healthcare Materials, 2402715, 2024
- Yankaskas, C. L. et al., Science Advances 7, 28, 2021
- Zhao et al. Science Advances, 7, 17, 2021