Internship

Flow through deformable vascular network

Context: Metastasis remains the leading cause of cancer-related deaths. A critical step in metastasis involves circulating tumor cells (CTCs) moving through confined environment of the vascular microcirculation before colonizing distant tissues. Unlike rigid tubes, these vessels are soft and deformable, continuously reshaping under pressure and flow (Fig. 1A). **A critical yet often overlooked aspect here is how fluid flow locally deforms the vascular network, and how these deformations in turn alter the flow itself.** Capturing this two-way feedback is essential to understanding the physics of transport in living systems- insights that goes well beyond cancer metastasis.

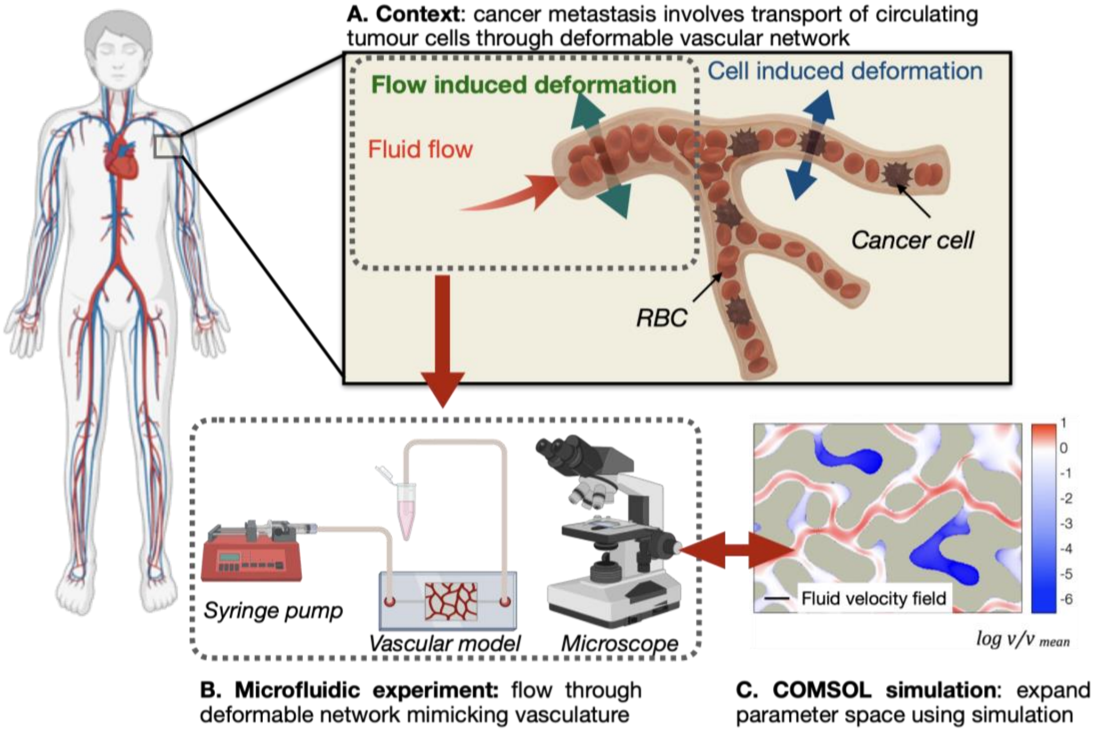

Fig. 1: A. Schematic describing the deformability of blood vessels linked to cell transport, B. A schematic of experimental setup involving microfluidics, C. Velocity field obtained via COMSOL simulation in a relevant network

In this context, the internship will explore how local feedback between fluid flow and deformable structures influences macroscopic transport processes. The project will focus on designing **microfluidic models of deformable vascular networks** to characterize these fluid–structure interactions (**Fig. 1B**). Working closely with a PhD student or postdoc, the intern will contribute to innovative experiments that measure both channel deformation and local flow fields using **fluorescence microscopy, image analysis, and particle tracking velocimetry**. These experimental studies will be complemented by **COMSOL simulations** to broaden the accessible parameter space (**Fig. 1C**). Time permitting, the work will be extended to connect local coupling effects with global transport of particles or cells. Importantly, **this internship may be continued as a PhD project grant financed by CNRS**.

Duration: 5-6 months
Grant: 600 euros per month
Degree: M2, Starting from February 2026.
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References:

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- Scheidweiler, D., Bordoloi, A.D., et al. Nature Communications 15, 191, 2024
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