MSc Project

Date: Feb/2022

(Living Soft Matter group)

Cancer cell migration through a complex microenvironment: from microfluidics to computational modeling

Relevance and motivation

The fight against cancer is long-standing, with the focus of intense research aimed at suppressing cell invasion and migration into surrounding soft tissues (based on a molecular basis). Cancer cell migration into the surrounding extracellular matrices (ECM) and tumor-microenvironment (TME) is a critical step at the early stages of cancer metastasis (responsible for over 90% of cancer-related deaths). Crucially, the biomechanics of the ECM fibers and the chemical gradients in the ECM dictate how well cells can penetrate the ECM. There are overwhelming complexities associated with the effect of biophysical cues and cellular cues on cancer cell invasion. While much is known about the molecular basis of cancer cell invasion, the biophysical and transport mechanisms behind cancer invasion and cell-ECM interactions, and migration dynamics of the invasive cells through the complex TME remain elusive.

Multidisciplinary project: To fill this gap, we will combine our expertise on microfluidics modeling of metastasis (Boukany) and computational modeling (Rens) in collective cell migration to address how ECM mechanics, cell-cell/ECM interactions, and cell heterogeneity influence cancer invasion (**see Fig.1**). A better understanding of the underlying biophysical mechanisms of cancer invasion will lead to better treatment of metastatic cancer.

Objective of MSc-research project

The central aim of the envisaged MSc project will be to apply advanced microfluidics, visualization tools, and computational modeling to **unravel the biophysical mechanisms of cell migration through a complex microenvironment (similar to the tumor conditions in patients)**.

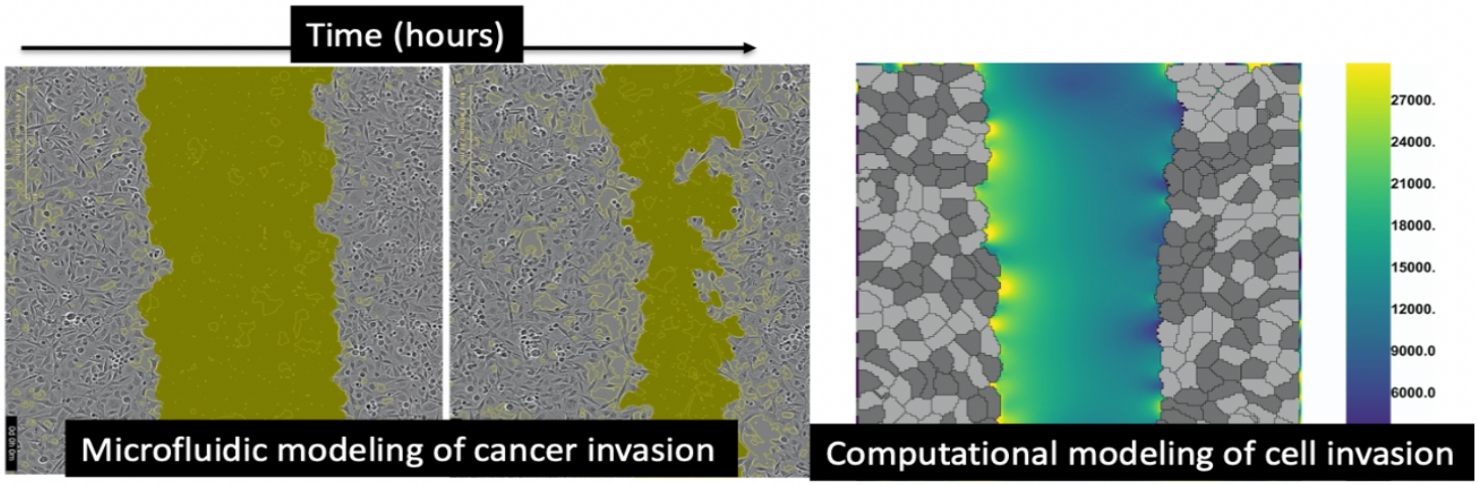

Fig.1. Left: microfluidics assays integrated with advanced microscopy for cell migration dynamics (developed by the **Boukany lab**). Right: computational modeling of cell invasion (available in the **Rens group**).

What's in it for you? Working on this topic in our group allows you to
- deepen your knowledge on transport phenomena in the field of biology, transport phenomena, and biology
- develop your skills at the interface between biophysics and soft matter science
- maneuver at the Biology-Chemical Engineering Interface

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