MSc Project – Mechanics of heterogeneous spheroids on a microfluidic chip

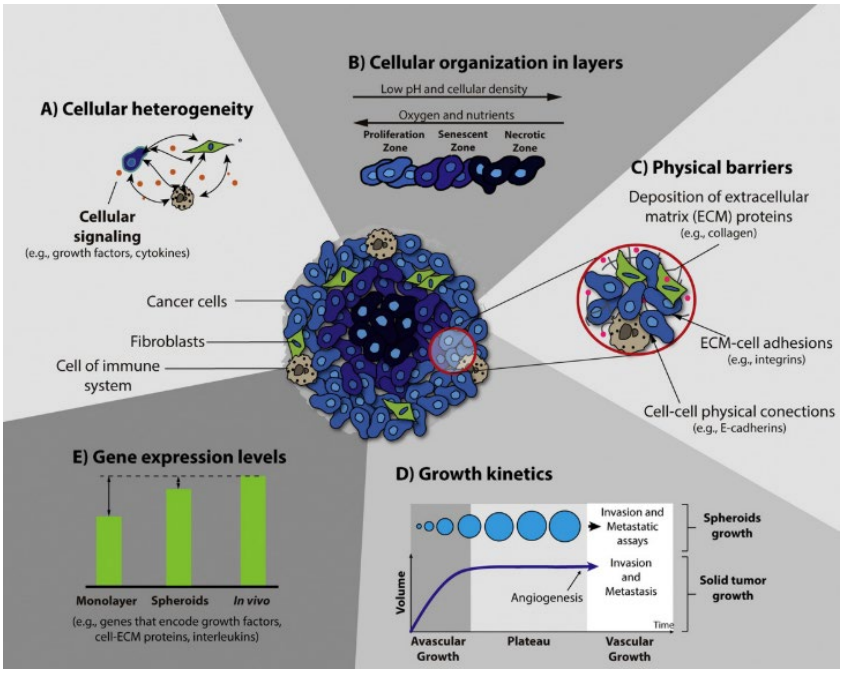
R.C. Boot, Pouyan E. Boukany – PPE

Contact

If you would like to find out more about the project, please feel free to contact Ruben (r.c.boot@tudelft.nl) or Pouyan (p.boukany@tudelft.nl).

Background

Metastasis is the single most significant challenge to the treatment of cancer, as it contributes to more than 90% of cancer-related deaths. During this process, cancer cells detach from a primary tumour, migrate into blood vessels and spread through the body to nearby places to form secondary tumours. *In vivo*, tumour cells are situated in a 3D environment with the major physical contacts being cell-cell interactions with surrounding cells, and cell-matrix interactions with the extracellular matrix (ECM). This 3D environment shows a complexity that is not observed in monolayer cell culture. *In vitro*, multicellular tumour spheroids (MTS) are thought to be the most suitable model to reproduce the main features in solid tumours such as cellular heterogeneity, cell-cell signalling, internal structure, ECM deposition, etc. Therefore spheroids are a suitable model to investigate the mechanics behind metastasis. Cancerous *in vivo* tumours have a heterogeneous cellular composition, containing cancer cell, fibroblasts, immune system cells and other components. The exact influence of this cellular heterogeneity on the pathways of metastasis in tumours remains to be further investigated.



(Image taken from Correia *et al.*, 2016)

Goal of the project

The goal of the project is to study the mechanics of heterogeneous spheroids using different cell lines and compositions. Using micropipette aspiration on a microfluidic chip, microscopy and immunostaining techniques, the student will investigate how mechanical parameters such as the surface tension or Young's modulus of the spheroid depend on their heterogeneous composition. By doing so, this project will try to improve the knowledge on mechanics of heterogeneous spheroids. Eventually, this project can be followed up on by an investigation of the migrational behaviour of the cells from these spheroids in ECM, thereby linking spheroid mechanics to their migration in tissues. As such, it would increase our understanding of metastasis in *in vivo* cancerous heterogeneous spheroids.

Your profile

We are looking for a MSc student with experience and interest in the field of soft matter and biophysics. The nature of the project is experimental, as the student will spend a lot of time in the lab learning on how to culture his/her own cells, grow spheroids and measure their mechanics on a microfluidic chip. In this project, you will deepen your understanding of cell properties by studying a **clinically relevant problem** and develop skills in the area of **cell culture, microfluidics, bioengineering, microscopy** and **immunostaining**.