Metastasis of cancer spheroids on the micropatterned surfaces

Inhibiting cancer invasion is the foremost current medical challenge. A fundamental process in cancer invasion is the spreading of tissue. For example, glioblastoma is an aggressive type of cancer that quickly spread and invades surrounding regions. Physical properties (such as surface topography and stiffness) of the extracellular matrix (ECM) influence the behavior of single cancer cells (Figure 1) and multicellular aggregates, such as tumors and spheroids (Figure 2). It has been shown that increasing the diameter of nanodot (Figure 1) activates the metastasis progression in cancer cells. However, the effects of ECM topographies (micro-pillars, micro grooves, etc.) on the metastasis of multicellular cancer spheroids have rarely been studied. The aim of this project is to explore the spreading of multicellular cancer spheroids on the micropatterned surfaces. With this regard, the following main tasks are expected to be done during an MSc project:

Step 1- Fabrication of micropatterned surfaces by electron beam lithography (EBL, one of the nanofabrication techniques used to generate different topographical features.)
Step 2- Investigating the spreading of cancer spheroids on the micropatterned surfaces.

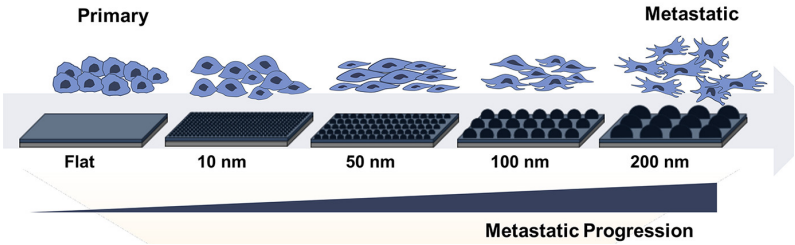

Figure 1 Increasing the diameter of nanodots developed the metastasis in primary cancer cells. The morphology of primary epithelial cancer cells (left) changed to a mesenchymal-like shape (right) [1].

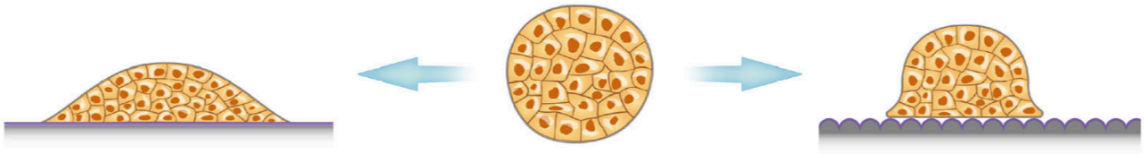

Figure 2 Arrangement of a multicellular spheroid on the non-patterned substrate (left) and patterned substrate (right). A diameter of 1500 nm inhibited the metastasis progression in cancer spheroids [2].

What's in it for you?
Working on this topic in our group allows you to

- Deepen your knowledge on metastasis of cancer cells, migration, and transport phenomena in living systems.
- Develop your technical skills in cell culture, fluorescence microscopy, Image analysis, and micropatterning

Contact:
Highly motivated MSc students interested in conducting exciting and rewarding projects are encouraged to contact Dr. Pouyan Boukany (P.Boukany@tudelft.nl) and Mahdiyeh Nouri (m.nourigoushki@tudelft.nl) at the Product and Process Engineering Research group in the Department of Chemical Engineering.

[1] Tai, C. S., Lan, K. C., Wang, E., Chan, F. E., Hsieh, M. T., Huang, C. W., ... & Chen, W. L. (2021). Nanotopography as Artificial Microenvironment for Accurate Visualization of Metastasis Development via Simulation of ECM Dynamics. *Nano letters*, *21*(3), 1400-1411.
[2] Wang, L., Cai, P., Luo, J., Zhang, F., Liu, J., Chen, Y., ... & Wang, S. (2018). Engineering subcellular-patterned biointerfaces to regulate the surface wetting of multicellular spheroids. *Nano Research*, *11*(10), 5704-5715.