Practicals

N°66: High-resolution 3D printing for the investigation of cell sensitivity to multiscale geometrical cues

Teachers:
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Cell culture is an important tool for the study of physiological and pathological cell activity in vitro. In traditional cell culture, cells are grown on rigid two-dimensional (2D) surfaces, usually made of polystyrene or glass. However, these kinds of templates can be non-predictive for in vivo behavior.

To address this limitation, a promising approach involves the creation of 3D scaffolds with defined geometry and mechanical properties at the microscale. This is achieved using high-resolution techniques such as direct laser writing via two-photon polymerization (TPP), allowing the generation of microenvironments that better replicate in vitro aspects of the in vivo setting.

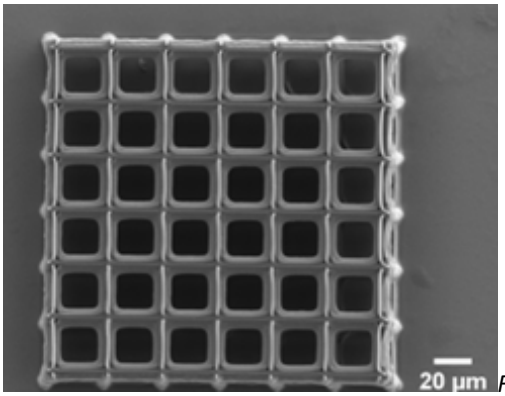

Fig. 1: SEM image of 3D structure with cavity size of 20 µm created by two-photon polymerization.

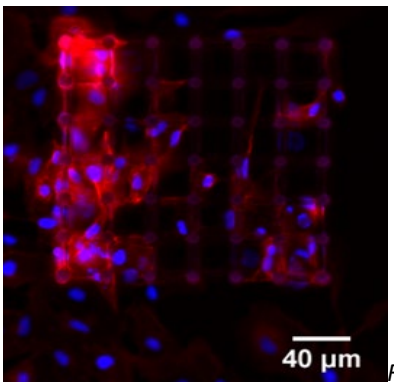

Fig. 2: Fluorescence image of fixed and stained A549 cells with labeled nucleus (blue) and actin (red) on 3D structure.

In this context, the goal of this practical is to explore the full process of cell culture on 3D scaffolds. This involves first the design of the structure using a computer-aided design tool (CAD), fabrication using two-photon polymerization and characterization using Scanning Electron Microscopy. We will then observe cell infiltration on the structure using video-microscopy and, using fluorescence microscopy, evaluate cell distribution and morphology changes with respect to cells grown on a traditional 2D surface.

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