

Micro- and Nanostructured Biointerfaces

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High-resolution 3D printing of biomimetic microenvironments to study T-cell activation

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T-cell activation plays a crucial role in adaptive immunity. Antigen presenting cells present peptide bound major histocompatibility complexes (pMHC) to which T-cells can bind to via their specific T-cell antigen receptors (TCRs), which in turn it recruits other molecules to initiate a signaling cascade. T-cell activation processes, including immunological synapse formation, cellular polarization, receptor sequestration and signaling are regulated by the cytoskeleton motility. [1] However, most of the studies concerning T-cell antigen recognition and kinetics were mainly performed on 2D systems. Additive manufacturing technology (AMT) allow the reproducible production of complex 3D constructs in accordance to computer-aided design (CAD) models.[2] However, conventional AMTs such as stereolithography and extrusion based bioprinting technologies require a layer-by-layer deposition of the resin, which is often results in low resolution. Two photon-polymerization (2PP) is a state-of the-art 3D printing technique, where nonlinear absorption of a femtosecond-pulsed infrared laser leads to the crosslinking of a very small voxel within the volume of the photosensitive material or photoresist. High resolution 3D structures with feature sizes down to 100 nm can be produced directly within the bulk of the sample.[3] With the help of 2PP it is possible to generate complex high resolution 3D architectures which make it possible to perform in situ experiments to study single cell response.

References

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