Cell interactions with nanostructured surfaces

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Biomaterial surfaces structured with topographical features in the nano- and micrometre range have been predicted to play an important role in the future of biomedical implants. Naturally occurring geometrical cues in this size range presented to cells by the extracellular matrix are known to influence cellular behaviour like migration, adhesion or proliferation [1]. Therefore, it is important to gain fundamental knowledge about the interaction of mammalian cells with different topographies.

In the present study, a cheap and fast particle-based structuring technology is implemented to study cells interacting with convex and concave features between 100 and 1000 nm and transferring the achieved knowledge to medical applications with structured surfaces (Fig. 1). Polystyrene colloids were used as a template to create two different highly ordered and close-packed topographies in various sizes [2-4]. Results show the high impact of surface feature size on bone marrow derived murine stromal cells (ST2), whereas geometric details play an insignificant role. Feature sizes below 200 nm show higher cell adhesion compared to flat surfaces. The study identifies colloidal templating as a simple method to produce large areas of highly defined topographies as model systems to investigate complex cell functions such as contact guidance, adhesion and migration and provides a research tool for the choice of particulate coatings on commercial implant materials.

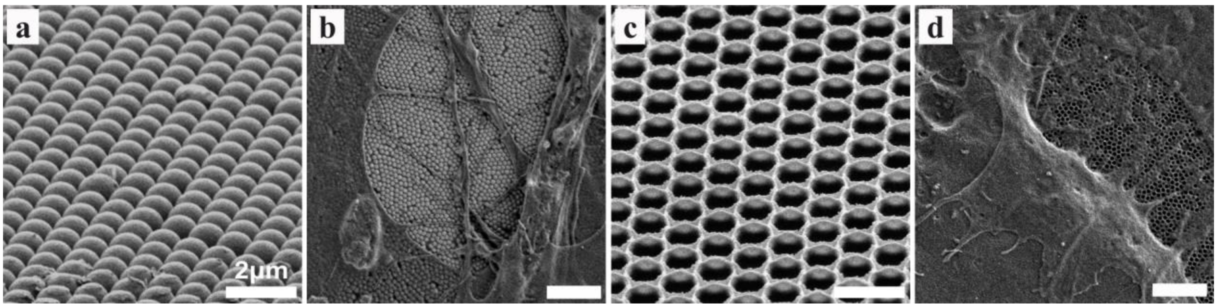

Figure 1. Scanning electron microscopy images of the interaction of cells with convex (a,b) and concave (c,d) topographies created by colloidal templating. a) Exemplary image of convex features, b) ST2 cells on convex topography with 190 nm features, c) exemplary image of concave features, d) ST2 cells on concave topography with 190 nm features. All scale bars correspond to 2 µm.

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[4]Vogel et al., *Nature Communications* (2013), 1

Acknowledgement: The authors acknowledge financial support by the Deutsche Forschungsgemeinschaft (DFG) within the Cluster of Excellence "Engineering of Advanced Materials" (project EXC315) (Bridge Funding). N.V. acknowledges support from the Interdisciplinary Center for Functional Particle System (FPS) at FAU Erlangen-Nürnberg.