Impact of Stimuli-Responsive and Hierarchical RGD Nanostructured Surfaces on Integrin-mediated Cell Guidance

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In tissue engineering, biological, physical, and chemical inputs are combined to mimic cellular environments designed to fulfil different biomedical needs. Protein nanoparticles (pNPs) can simultaneously provide such physical and biochemical stimuli to cells when attached to surfaces. [1] To provide a stable anchoring, a covalent binding of pNPs will be presented featuring a robust nanoscale topography with unprecedented mechanical stability and availability to influence cell morphology and orientation. [2]
Dynamic molecular interfaces that allow temporal control of cell behavior using an external stimulus, are very relevant for applications in biology, material sciences and medicine. Here we will present a cell adhesion study with spatio temporal control using stimuli-responsive self-assembled monolayers (SAMs) of an electroactive hydroquinone-benzoquinone (HQ-BQ) molecule that are used as a dynamic interface to immobilize pegitaled RGD functionalized peptides via interfacial reactions upon the application of a low electric potential. [3]

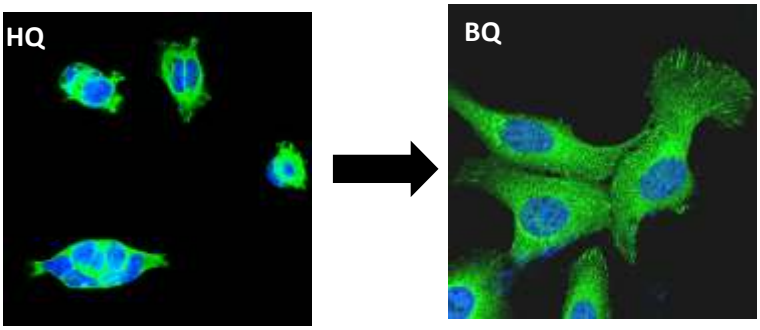

Figure 1: Confocal microscopy images of U2OS cells on the pegilated-HQ functionalized surface at t0 and after the RGD electrochemical activation (BQ) where clear focal adhesions are observed.

Density and spacing of RGD peptide at the nanoscale has already shown a significant influence on cell adhesion but its hierarchical nanostructuration influence is still rather unexplored. Here we present a versatile colloidal system based on fluid nanovesicles as a novel template for the hierarchic nanostructuration of RGD, anchoring it on the fluidic vesicle membrane. The engineered RGD-based nanovesicles are covalently anchored to surfaces. Such hierarchical substrates significantly enhance cell adhesion capabilities opening new pathways for the hierarchical immobilization of biomolecules on surfaces.

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