Application of ferrofluids to develop biocompatible micro-structured surfaces and characterization of cell-surface interactions by scanning probe microscopy

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Inducing cell differentiation or reprogramming of stem cells by using certain structured and functionalized substrates is the general intention of this work.
By using thin films of magnetic material like PtFe or CoCr on a carrier substrate, a magnetically structured surface can be obtained by optical, e-beam or contact lithography. Substrates with particular domain structures can be applied as well. Magnetic nanoparticles (Fe_2O_3/Fe_3O_4) of 20 nm – 1 µm diameter, which are functionalized by growth or differentiation factors, are deposited onto the magnetically structured substrate. Thus, a highly variable set up for investigating influences of substrate roughness, structural geometry, and immobilized growth factors on biological systems is resulting. One of its mayor advantages is that biologically functional surfaces can be octained without difficult and complex chemical approaches. Additionally, it is straightforward to vary the concentration of the allocated biomolecules by using different amounts of particles and by changing the beads´ configuration by externally applied magnetic fields.
For characterizing the interactions between living cells and the above mentioned surfaces, scanning probe and electron microscopy are applied. Information about cell topography is obtained by atomic force microscopy in contact or tapping mode or by electron microscopy. Additionally it is important to have access to information about the cell morphology. Thus is for example given by elasticity measurements in terms of force-distance curves. Magnetic structures and bead properties are examined by magnetic force microscopy.