BIOPHYSICAL MODELS OF CELL ADHESION AND MECHANICS APPLYING NANO- AND MICROSTRUCTURED MATERIALS AND TOOLS

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The aim of our studies is to understand the dynamic regulation of adhesive contacts and of the cytoskeleton architecture of cells, and its resultant influence on cellular activities on a molecular scale.

In this context, we apply in an interdisciplinary approach new optical and mechanical techniques and use novel micro- and nanostructured materials to perform experiments on living cells. We also construct biomimetic models of protein networks with tuneable complexity to untangle chemo-mechanical properties of the cytoskeleton and the adhesion protein complex.

In detail, we will discuss

(i) formation of bio-functional nanostructures by block copolymer micelle nanolithography
(ii) programming cell functions by activation and organizing single integrin of adherent cells through nanopatterned adhesive interfaces
(iii) biomimetic models of the actin cortex based on microfabricated pillar surfaces and dynamic holographic optical tweezers
(iv) regulation of metastases formation of human cancer cells by cytoskeleton architecture

These cellular observations are dictated by the cooperative interplay between hierarchically assembled protein complexes, its architecture and chemo-mechanical coupling.