Using Atomic Force Microscopy to Investigate Biomaterials: From the Topography and Mechanical Properties of Living Cells and Tissues to the Dynamic Processes of Single Molecules

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Atomic force microscopy can be divided into two different worlds. On the one hand, force spectroscopy-based modes are used to characterize the nanomechanical properties of biomaterials. Innovative imaging modes like Quantitative Imaging (QI™) and PeakForce Tapping allow the fast and easy measurement of various sample properties such as topography, nanomechanics and adhesion on the nanometer scale. Revealing the nature of biological processes, such as, biofilm formation, cell differentiation, and morphogenesis etc. is the main purpose of these techniques [1-4].

On the other hand, investigating dynamic processes at high spatial resolution and fast imaging rates is demanding. Combing cutting edge electronics, with high-end scanner technology and advanced algorithms have sped up image acquisition rates to over 50 images per second. Time-resolved processes such as the dynamics of single molecule binding behavior, two-dimensional protein assemblies, motor proteins and membrane trafficking are just some examples of what can be investigated.

In this workshop, we will address both worlds and demonstrate two different systems:

- The acquisition of biomechanical data will be shown on a NanoWizard® 4XP system mounted on an inverted optical microscope.
- Highspeed imaging will be demonstrated with the newly developed NanoRacer®. We will image DNA Origami nanostructures containing protein binding sites in fluid.

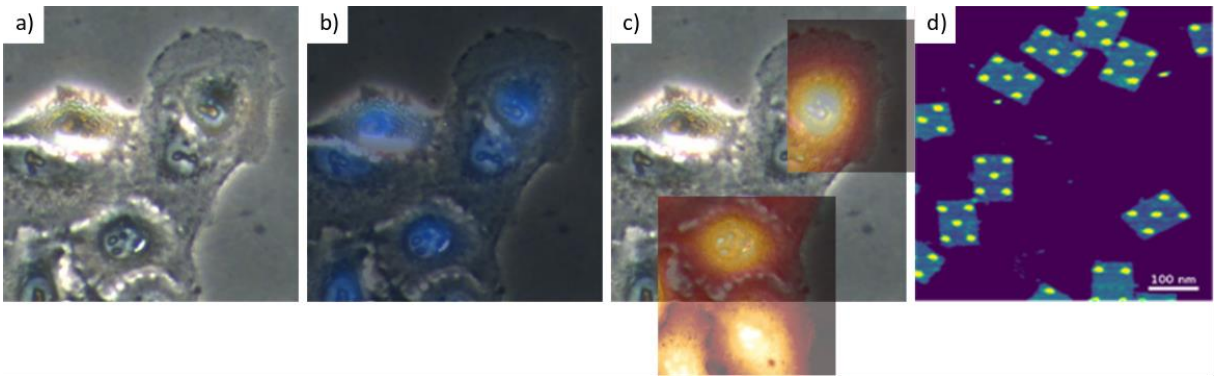

Fig. a) Optical microscopy image of a living cell b) – overlaid with fluorescence image c) – overlaid with two QI™ scans. d) HS-AFM on biotinylated DNA origamis with streptavidin proteins attached.

Literature

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[3] Cisneros, DA. et al., Small, **2007**, 3(6):956-63
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