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Biosensing with AFM

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Atomic force microscope (AFM) was used as a nanomechanical transducer for biosensing in different ways - this will be demonstrated on experiments with proteins, nucleic acids, their affinity complexes and cells. The cantilever tip modified with biorecognition element served for affinity sensing. The interaction of ssDNA binding protein with oligonucleotides was imaged using bare tips, the binding forces in the affinity complex were studied using the ligand-modified tip and the ForceRobot for automated recording of force-distance curves. Similar experiments characterized immunoreactions between antibody and antigen (human serum albumin, microbial cells), hybridization of nucleic acids; interactions were confirmed using surface plasmon resonance and electrochemical measurements. Properties of mast cells related to biotransformation events triggered by antigens were imaged with AFM and correlated to real-time measurements of model allergens and anti-allergic substances with piezoelectric sensors. Furthermore, periodic beating of cardiomyocytes was followed with oscillations of the contacting cantilever. Recording of contractions and electric activity of cardiomyocytes was obtained using the AFM cantilever with conductive tip functioning as transducer for cellular biosensor suitable for evaluation of physiologically active compounds in real time. Advanced tools of nanobiotechnology allow to realize biosensing experiments at the level of a single cell and few individual molecules.