ADVANCES OF ATOMIC FORCE MICROSCOPY IN BIO-NANOTECHNOLOGY

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AFM/SPM (Atomic Force Microscopy/Scanning Probe Microscopy) is widely used to image active protein molecules, DNA or living cells in a non-destructive manner. In addition, a variety of molecules can be attached to AFM cantilevers, making them chemically selective sensors for studying individual molecular interactions.
Agilent Technologies has developed a variety of different techniques to investigate and manipulate biological matter - from single molecules to live cells. The following topics will be discussed in more detail:

1. High Resolution Imaging of biological species: Several examples of both controlled imaging forces and controlled environment, together with modified cantilevers will be demonstrated. Applications include imaging and probing live cells and viruses, isolated proteins, protein crystals and DNA/RNA. Finally, the great potential of higher harmonics imaging for enhanced resolution will be shown.

2. Topography and Recognition (TREC): We will present recent advances in a new AFM technology called TREC, a unique technique that enables measuring real-time, simultaneous topography and specific recognition information.
Examples for recognition imaging will be presented on receptor/protein identification on live cells and DNA/protein complexes, as well as applications in medical diagnostics.

3. AFM in combination with inverted optical microscopy: Simultaneous gathering of light, fluorescence, topography and probe data of living cells and/or their components will be introduced. We apply this technique on finding and probing cell membrane proteins where fluorescence microscopy helps us to locate receptors, and AFM imaging and force spectroscopy enables us to study interactions with biologically relevant ligands.

4. Advanced Force spectroscopy: from intermolecular forces of ligand-receptor pairs to intramolecular forces involved in protein unfolding. New data analysis enables the correlation between kinetic and thermodynamic (affinity) data.