Detection of Micro- and Nanoparticles in Animal Cells by TOF-SIMS 3D Analysis

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Label-free characterization of cellular compartments and molecular structures in single cells has become possible by means of ToF-SIMS 3D analysis [1, 2]. Major molecular building blocks, such as amino acid fragments and phophatidylcholine fragments could be detected successfully. A correlation between the distribution of these components and the intracellular architecture (golgi, nucleus, nucleoli) was possible and the respective results were in line with the expectations derived from cell biology textbooks.

Although the development of this technology in our and other groups [3, 4] shows the general ability to access cellular compartments, the future of this approach will highly depend on the ability to locate further cell components and – in particular – xenobiotics in single cells.

Our on-going studies focused on the detection of particles in cells. Starting with microspheres in the micrometer range where the location within the cells could be controlled by optical techniques the dimension of the particles was gradually lowered to the nanometer scale. Further test series have been started in order to locate organic xenobiotics which were still ongoing at the time of this abstract. Both atomic and polyatomic primary ions were used for sputtering. Results will be discussed with respect to both voxel resolution and detection limits.

[1] Breitenstein, D., et al., *The Chemical Composition of Animal Cells and Their Intracellular Compartments Reconstructed from 3D Mass Spectrometry.* Angew Chem Int Ed Engl, 2007. 46(28): p. 5332-5.
[2] Breitenstein, D., et al., *The Chemical Composition of Animal Cells Reconstructed from 2D and 3D ToF-SIMS Analysis.* Appl. Surf. Sci., 2008. 46(28): p. 5332 - 5335.
[3] Nygren, H., et al., *Bioimaging TOF-SIMS: High resolution 3D imaging of single cells.* Microsc Res Tech, 2007. **70**(11): p. 969–974.
[4] Fletcher, J.S., et al., *TOF-SIMS 3D Biomolecular Imaging of Xenopus laevis Oocytes Using Buckminsterfullerene (C60) Primary Ions.* Analytical Chemistry, 2007. **79**: p. 2199-2206.