Investigation of Nanoparticle-cell Interactions by Combining SERS with Laser Ablation ICP-MS and 3D X-ray Tomography

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Understanding the interaction of nanomaterials with living organisms has gained much interest, especially in the context of nanosafety and nanomedicine. Gold and silver nanoparticles represent an interesting system, as they are used, e.g., as surface-enhanced Raman scattering (SERS) substrates and drug-carriers in cells and have been characterized thoroughly regarding their cytotoxic and plasmonic properties.
To further elucidate the interactions of gold and silver nanoparticles with biomolecules and cells, a combination of SERS with laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) and 3D cryo-soft-X-ray tomography (cryo-SXT) is applied. SERS enables the spatially resolved investigation of the cellular uptake and transport mechanism of the nanoparticles and provides chemical information about their surface composition inside the cells [1, 2]. The 3D-distribution of the metal nanoparticles with respect to the cellular ultrastructure and the aggregate morphology are investigated by cryo-SXT using synchrotron radiation [2]. On our poster, SERS and nanotomography data are discussed in relation to particle number per cell. The quantification of gold and silver nanoparticles at the single-cell level is accomplished by the use of LA-ICP-MS [3]. By combination of these complimentary methods we are able to get insight into the biological reaction pathways of nanoparticles in living cells. Our findings also have implications for understanding other nanomaterials in the biological context and improve our knowledge of particle-protein and particle-cell interactions.

References:

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