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The interplay of spontaneous and stimulated Raman spectroscopy, high-resolution microscopies and the use of machine learning methods in the assessment of the impact of micro- & nanoplastics on human / animal health

Abstract
The driving force behind this research stems from the growing occurrence of harmful health effects like various sorts of cancer and kidney diseases in both humans and animal models and the potential role of micro- and nanoplastics particles. These effects are now affecting younger individuals more frequently. Additionally, the increasing environmental concerns related to microplastic particles and endocrine-disrupting chemicals (EDCs) add to the urgency of investigating their potential role in the development and advancement of the aforementioned diseases.
To delve into this subject, we align spontaneous and stimulated Raman spectroscopy with high resolution microscopies (with light, electrons, ions) and their analytics with the help of the nanoGPS^{R} technology [1,2]. Together with the use of machine learning algorithms for a quantitative assessment of plastic particles and their cell uptake, existing knowledge gaps will be bridged.
The specific use of mouse models provides a nuanced approach to understanding the intricate dynamics between disease progression and plastics particle presence and the details of the particle size, shape, chemical composition, etc.
The use of the aforementioned innovative analytical technologies in their interplay is crucial to ultimately promote a translation of novel findings into clinically relevant procedures / therapies.

References

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[2] G. Sarau, M. Yarbakht, B.E. Oßmann, L. Kling, J. Ast, F. Vollnhals, et al. “Context Microscopy and Fingerprinting Spectroscopy of Micro- and Nanoplastics and Their Effects on Human Kidney Cells Using NanoGPS and Particle Finder”. Horiba Readout. 2020. 54: 23–32.

Figures

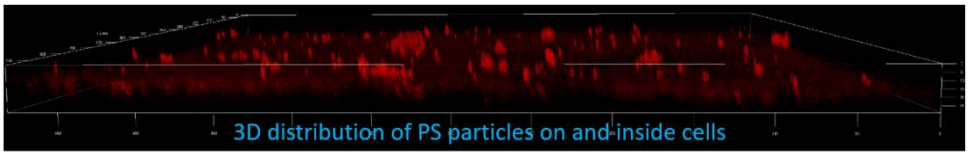

Figure 1: Particle localization (polystyrene particles) in and on biological material (individual cultured cell). The 3D Z-Scan was carried out with a Stellaris 8 (Leica) in an area of 581 µm (X) x 581 µm (Y) x 28 µm (Z) with a resolution of X, Y: 1.13 µm, Z: 0.91 µm within a scan time of ~2 min.