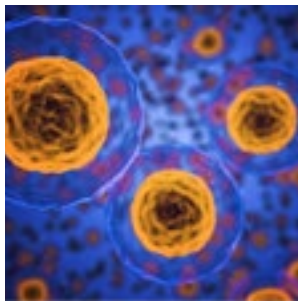
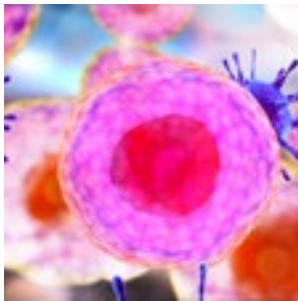

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Non-contact cell and tissue analysis using Raman-Trapping microscopy

Statement of the problem: There is an increasing need to analyze cells and tissue in a fast, gentle, and non-destructive way. The method should be highly sensitive and measure cells in a native surrounding without inducing stress. Current analytical technologies do not meet those requirements as antibodies, fluorescent stains, or the exposure to fluorescence excitation light induce phototoxicity causing stress and degradation.

Methodology: Raman spectroscopy solely records the interaction of focused laser light with the biomolecules of the cell. This non-destructive, yet highly sensitive method provides specific information about the features and status of the cell. Raman trapping microscopy (RTM) - a digital microscope with combined Raman and integrated optical trapping - allows label-free and gentle cell analyses.

For example, RTM discriminates diseased from healthy cells, identifies the percentage of cell groups within a culture, follows differentiation of stem cells or depicts the effect of drugs and compounds on individual cells and even complex tissue. RTM also allows to calculate the amount of activated vs non-activated T-cells or to follow the effect of T-cells acting on tumor cells. The change of Raman spectra of blood cells reflects change of functionality, e.g., of stem cells, cell therapeutics or blood products due to storage time or caused by bacterial contamination. Quality check of skin cells and skin grafts using Raman trapping microscopy saves time and money and supports patients' safety.

Conclusion and significance: In summary, RTM provides an entire new perspective of cell information. The

collected Raman spectra show differences due to different compositions of biomolecules, i.e. changes in cellular expressions of glycogens, DNA/RNA, proteins and/or lipids as depicted in figure 1. whilst keeping cell features and vitality completely untouched. Therefore, RTM will be a valuable tool for fast vitality check of cells involved in wound repair, their interaction with compounds as well as for quality control of cell-derived medicinal product.

Recent Publications

1. Yosef and Schütze (2021) Book chapter: Non-destructive and label-free monitoring of 3D cell constructs in: Basic Concepts on 3D Cell Culture Springer; editors: Cornelia Kasper, Dominik Egger, Antonia Lavrentieva; Springer-Verlag ISBN 978-3-030-66748-1.
2. Yosef and Schütze (2020) Book chapter: Raman Trapping Microscopy for Non-invasive Analysis of Biological Samples In: Animal Cell Biotechnology: Methods and Protocols, Springer Protocols Editor: Ralf Pörtner; 2020,4: 2095: 303-317

Biography

Karin Schütze is a biologist. She focused on bio-photonics and became expert in non-contact cell handling, cell characterization and cell enrichment based on innovative photonic technologies. Together with her husband Raimund Schütze they founded and headed the former PALM company focusing on laser microdissection and catapulting. In 2008 they both founded CellTool GmbH that develops and markets innovative Raman trapping microscope systems for label-free and sample sparing cell analysis. Their expertise is developing complex photonic systems into user friendly easy to handle tools for biomedical applications. She has more than 80 publications and about 30 patents. They received several awards - such as the Phillip Morris Research Prize, the Berthold Leibinger Innovation prize, nomination for the German Presidents 'Zukunftspreis' and First prize "Health Technology Innovation award" in Nanjing, China.

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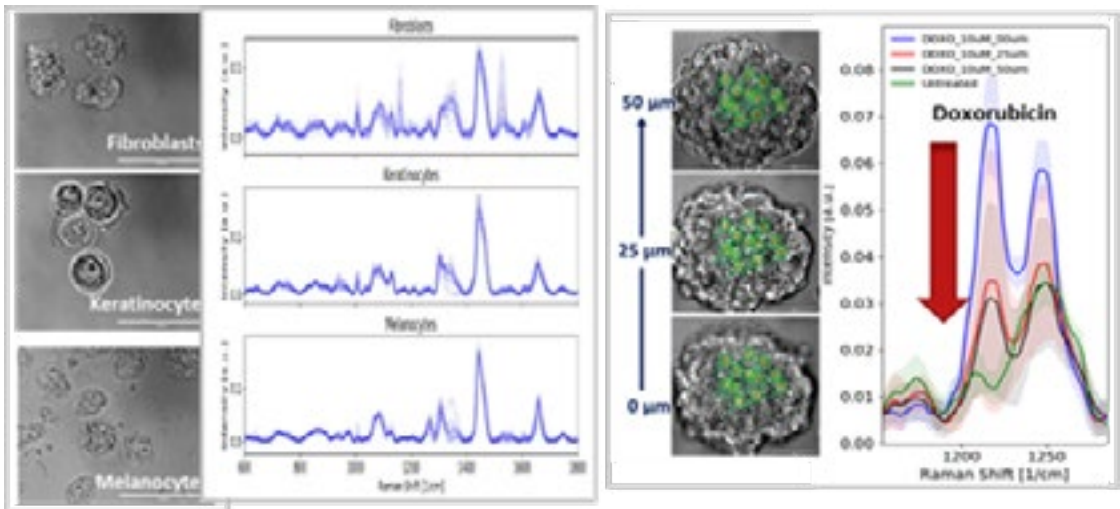


Figure 1a: Typical Raman spectra of skin cells in culture. 1b: Doxorubicin-Peak within different depths of a spheroid, as example how Raman could localize compound reaction and interaction within 3d tissue.