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Topical drug delivery and nanotoxicity as revealed by advanced fluorescence microscopy

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Fluorescence Lifetime Imaging Microscopy (FLIM) provides new possibilities in the investigation of nanocarrier penetration and drug delivery, as the fluorescence lifetime is highly sensitive to the microenvironment. Using Cluster-FLIM, image contrast is enhanced and a clear-cut discrimination between different fluorescent species is feasible. This allows visualization of nanoparticles with an unprecedented precision and sensitivity in skin sections, skin biopsy, living cells and in living tissue. The latter is realized in a multiphoton FLIM setup. To further increase resolution and to resolve nanocarrier fine-structure we employed single molecule TIRF microscopy. Using this method, we were also able to show the penetration of individual nanoparticles into the viable epidermis, thereby adding new information to the debate of whether nanoparticles can cross the skin barrier. Since nanotoxicity is a major concern in the application of nanoparticles, we recently developed a novel FLIM-based imaging assay (FLIM-ROX) for reactive oxygen species detection. Using FLIM-ROX, we demonstrate the nanotoxicity of subcytotoxic amounts of nanoparticles by linking cellular adverse effects to low-level oxidative stress.

Biography

Ulrike Alexiev fields of expertise are molecular and cellular biophysics and analytical nanomedicine, in particular in the area of experimental dermatology and topical drug delivery.

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