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Topical drug delivery into skin by polymer nanocarriers

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Novel concepts of topical drug delivery into skin by polymer nanocarriers are presented. This work results from an interdisciplinary approach, which involves the large multidisciplinary research consortium of the collaborative research center 1112 (SFB 1112). The research program includes: (1) Nanocarrier synthesis, (2) optimization of drug uptake into the polymers, (3) evaluation of the physical and toxicological properties of polymer nanocarriers, (4) exposure of these nanoscopic drug delivery systems to healthy and inflamed skin samples and (5) probing the nanocarriers and drugs in the skin as a function of depth and penetration time. This allows us to evaluate the concept of polymer nanocarriers for efficient dermal drug delivery compared to standard formulations. Specific emphasis will be put on the detection of drugs and nanocarriers in skin samples with high spatial resolution far below the diffraction limit of optical microscopy along with selective and quantitative detection of drug penetration profiles. This is accomplished most advantageously by label-free approaches, in which the intrinsic spectroscopic properties of the drugs and nanocarriers are exploited for sensitive detection. Selected examples using X-ray microscopy and Raman-based approaches as well as results from numerical modeling, yielding the crucial parameters of drug penetration, will be discussed. Furthermore, recent results from atomic force microscopy-based techniques, such as optical near-field microscopy and photo-thermal expansion will be shown, which can reach at chemical selectivity a spatial resolution below 10 nm. Such developments will contribute to develop a molecular understanding of dermal drug penetration processes.

Biography

Eckart Ruehl is a Professor of the Department of Physical and Theoretical Chemistry, Free University of Berlin, Germany. He is dedicated to the fields of structure, dynamics, environment and life sciences with a focus on nanoparticles and spectroscopy, which are processed experimentally, theoretically as well as application-oriented and interdisciplinary He is involved in numerous international collaborations, for example within the framework of the German-Russian Laboratory at the synchrotron radiation source BESSY II.

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