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Drug delivery across skin barrier: Investigation on different biocompatible thermoresponsive soft nanocarriers

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Despite skin accessibility, delivery of drugs across skin barrier and the maintenance of a constant drug concentration in the target region is still a challenge. Nanocarrier-based approaches have been shown to improve both dermal and transdermal drug delivery. Depending on the type of nanocarrier, different drug release properties as well as different interactions with skin barriers and cell components can be achieved. A systematic correlation between nanocarrier physicochemical characteristics and their skin penetration and drug delivery properties is necessary to foster the use of nanotechnology in dermatology. Nanocarriers' physicochemical properties and their performance after application on human skin explants have been investigated by methods like atomic force microscopy and stimulated Raman spectroscopy, whereas fluorescence and electron microscopy as well as flow cytometry of single skin cells served to elucidate nanocarrier penetration pathway and cellular uptake. Results show that size, surface charge, type of cargo, softness, and stability mostly influence nanocarrier penetration and drug delivery to skin. In particular, thermoresponsive nano-gels which can release loaded drugs preferentially above a distinct temperature represented an attractive approach to improve the selectivity of anti-inflammatory therapies. In addition, soft, thermoresponsive nano-gels were found to penetrate deeply within the stratum corneum, the outermost skin barrier, changing its permeability and improving drug penetration. Penetrated nano-gels were internalized by skin cells in both epidermis and dermis. Interestingly, also significant percentages of antigen presenting cells were found to be associated with nanocarriers depending on the degree of skin barrier disruption. These observations could further be developed for specific targeting approaches in order to increase drug delivery to key cell populations.

Biography

Fiorenza Rancan has expertise in "The use of human skin explants and skin organ culture as model for skin penetration and drug delivery studies". She extensively investigated nanocarrier skin interactions with focus on both biological properties and toxicological effects of particle-based systems. Her main research topics are "The use of biodegradable particles (e.g. PLA and virus-like particles) for the delivery of adjuvants and antigens to skin (transcutaneous vaccination), the exploration of new generation nanocarriers for the treatment of skin inflammatory conditions giving special attention to antigen presenting cells, and the development of new antimicrobial treatments using skin models for infected chronic wounds".

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