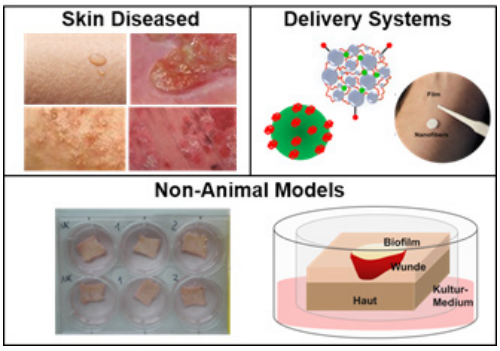
Investigation of drug delivery and efficacy using skin disease models based on *ex vivo* skin organ-culture

Fiorenza Rancan
Universitätsmedizin, Germany

Skin is a very sophisticated barrier and to deliver adequate amounts of drug to healthy as well as diseased tissue is still a challenge. Nanotechnology has the potential to improve the treatment of several skin diseases. To test these new formulations, it is necessary to have models reproducing not only the physical skin barrier but also the environmental and biological feature of skin diseases. Three-dimensional systems like reconstructed skin offer the possibility to reproduce partially the skin barrier and to test biological effects on both keratinocytes and fibroblasts. However, these models do not consider skin immune active cells like dendritic and mast cells. Skin appendages like the pilosebaceous unit are also missing. Animal studies offer the possibility to include all physical and biological parameters of skin. However, beside ethical reasons, they are expensive and results are not always reproducible in humans. *Ex vivo* skin has been used since years to test skin penetration of drugs. Thus, in order to test innovative nanoparticle-based drug delivery systems our group has developed *ex vivo* skin models reproducing skin inflammatory diseases and wound infections. These models were used to test drug delivery kinetics, toxicity, anti-inflammatory activity as well as antibacterial efficacy of different types of nanocarrier formulations. The results show that *ex-vivo* human skin models are realistic animal-free systems useful to investigate drug efficacy as well as the interactions between applied material and skin immune system.



Recent Publications

1. Wanjiku B (2019) Qualifying X-ray and Stimulated Raman Spectromicroscopy for Mapping Cutaneous Drug. Anal Chem. 91(11):7208-7214.
2. Schaudinn C et al. (2017) Development, standardization and testing of a bacterial wound infection model based on ex vivo human skin. PLoS One. 12(11):e0186946.
3. Rancan F. et al. (2017) Drug delivery across intact and disrupted skin barrier: Identification of cell populations interacting with penetrated thermo-responsive nanogels. Eur. J. Pharm. Biopharm. 116, 4-11.
4. Schulz R. et al. (2017) Data-based modeling of drug penetration relates human skin barrier function to the

interplay of diffusivity and free-energy profiles. Proc. Natl. Acad. Sci. USA. 114(14):3631-3636.

5. Rancan F., Afraz Z., et al. (2017) Topically applied virus-like particles containing HIV-1 Pr55(gag) protein reach skin antigen-presenting cells after mild skin barrier disruption. J Control. Release. 268, 296-304.

Biography

Fiorenza Rancan has a degree in Pharmaceutical Chemistry and Technology at the University of Padua (Italy) and gained her PhD at the Humboldt University of Berlin (Germany). Since 2012 she is associated scientist and laboratory manager at the Clinical Research Center for Hair and Skin Science at the Charité Medical University of Berlin (Germany). Her expertise lays in drug delivery systems, dermal and transdermal drug delivery as well as *ex vivo* skin models and organ culture as alternatives to animal studies. Her main research fields are inflammatory skin diseases, transcutaneous vaccination, as well as skin and chronic wound infections. She has published several research articles in international journals as well as reviews and book chapters.

Notes: