Penetration and Translocation of Nanoparticles through Skin

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In 2008, Professor Lisa DeLouise reported that exposing mice to a clinically relevant dose of ultraviolet radiation (UVR) increases the skin permeation of quantum dot nanoparticles (Mortensen et al. 2008). This is the first in vivo study to investigate the effect of skin barrier on nanoparticle skin penetration. Transmission electron microscopy studies discovered the penetration pathway to be through the intercellular lipid lamallae. Figure provides an example of quantum dot penetration through the stratum corneum and epidermis into the dermis 24 hours after UVR skin exposure using fluorescence microscopy.

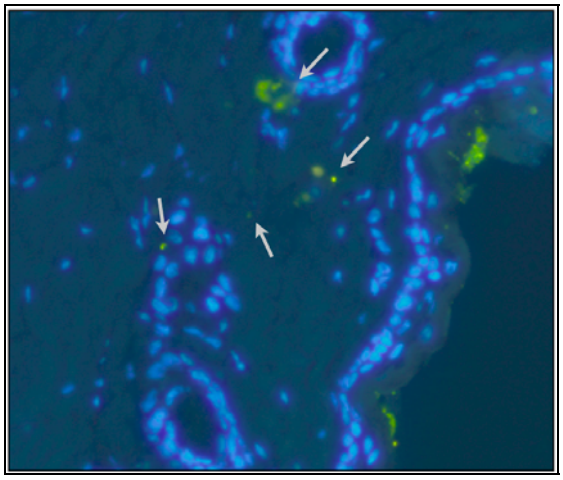

Figure. *Caption*.

Additional research has been published on determining the impact of time following UVR exposure on NP permeation (Mortensen et al. 2000) and a review of factors effecting epithelial tissue penetration was published (DeLouise, Mortensen, and Elder 2009). Furthermore, preliminary research has been done to quantify ex vivo skin barrier disruption and surface chemistry dependent nanoparticle permeation as well as *in vitro* skin cell uptake and toxicity. These results will impact the design of nanoparticles to limit bioavailability and decrease risk of systemic exposure following skin contact which is a practical concern given the increasing occupational exposure risk and presence of nanoparticle in consumer products.

References/Publications

Mortensen, L.J., G Oberdorster, AP Pentland, and LA DeLouise. 2008. *In vivo* skin penetration of quantum dot nanoparticles in the murine model: The effect of UVR, *Nano Letters* 8, 2779.

Mortensen, L.J., H Zheng, R Faulknor, A De Benedetto, L Beck, and LA DeLouise. 2009. Increased *in vivo* skin penetration of quantum dots with UVR and *in vitro* quantum dot cytotoxicity, *Proc. SPIE* 7189, in press.

DeLouise, L.A., Mortensen, L.; Elder, A. 2009 Breeching epithelial narriers – Physiochemical factors impacting nanoparticle translocation and toxicity. In T. Webster, ed., *Safety of nanoparticles: From manufacturing to clinical applications.* Springer,.