was significantly higher than that from the control plain drug solution in 0.9% NaCl ($p < 0.001$). Untreated group of animals showed invasive moderately differentiated keratinizing squamous cell carcinoma (malignant stage). However, with cisplatin loaded protransfersome gel system simple epithelial hyperplasia (precancerous stage) with no cancerous growth was observed. Also, a significant induction in micronucleus formation was found in the group that was treated with injectable intraperitoneal cisplatin preparation in 0.9 % saline as compared to the group treated with topical protransfersome gel formulation. The findings of this research work appear to support improved, site-specific and localized drug action in the skin, thus providing a better option for dealing with skin related problems like squamous cell carcinoma.

Han, S. M. et al. (2017). "Emulsion-based intradermal delivery of melittin in rats." *Molecules* 22(5):836.

Bee venom (BV) has long been used as a traditional medicine. The aim of the present study was to formulate a BV emulsion with good rheological properties for dermal application and investigate the effect of formulation on the permeation of melittin through dermatomed rat skin. A formulated emulsion containing 1% (w/v) BV was prepared. The emulsion was compared with distilled water (DW) and 25% (w/v) N-methyl-2-pyrrolidone (NMP) in DW. Permeation of melittin from aqueous solution through the dermatomed murine skin was evaluated using the Franz diffusion cells. Samples of receptor cells withdrawn at predetermined time intervals were measured for melittin amount. After the permeation study, the same skin was used for melittin extraction. In addition, a known amount of melittin (5 μg/mL) was added to stratum corneum, epidermis, and dermis of the rat skin, and the amount of melittin was measured at predetermined time points. The measurement of melittin from all samples was done with HPLC-MS/MS. No melittin was detected in the receptor phase at all time points in emulsion, DW, or NMP groups. When the amount of melittin was further analyzed in stratum corneum, epidermis, and dermis from the permeation study, melittin was still not detected. In an additional experiment, the amount of melittin added to all skin matrices was corrected against the amount of melittin recovered. While the total amount of melittin was retained in the stratum corneum, less than 10% of melittin remained in epidermis and dermis within 15 and 30 minutes, respectively. Skin microporation with BV emulsion facilitates the penetration of melittin across the stratum corneum into epidermis and dermis, where emulsified melittin could have been metabolized by locally occurring enzymes.

Hoeller, S. et al. (2009). "Lecithin based nanoemulsions: A comparative study of the influence of non-ionic surfactants and the cationic phytosphingosine on physicochemical behaviour and skin permeation." *Int J Pharm* 370(1–2):181–186.

Charged drug delivery systems are interesting candidates for the delivery of drugs through skin. In the present study, it was possible to create negatively and positively charged oil/water nanoemulsions by using sucrose laureate and polysorbate 80 as nonionic surfactants. The positively charged nanoemulsions were generated by adding cationic phytosphingosine (PS). The relationship between the physicochemical properties of the nanoemulsions was shown by particle size and zeta potential measurements. These properties were dependent on the type of nonionic surfactant and the concentration of PS. Furthermore the cationic PS had a positive impact on the skin permeation rates (flux) of the incorporated model drugs fludrocortisone acetate