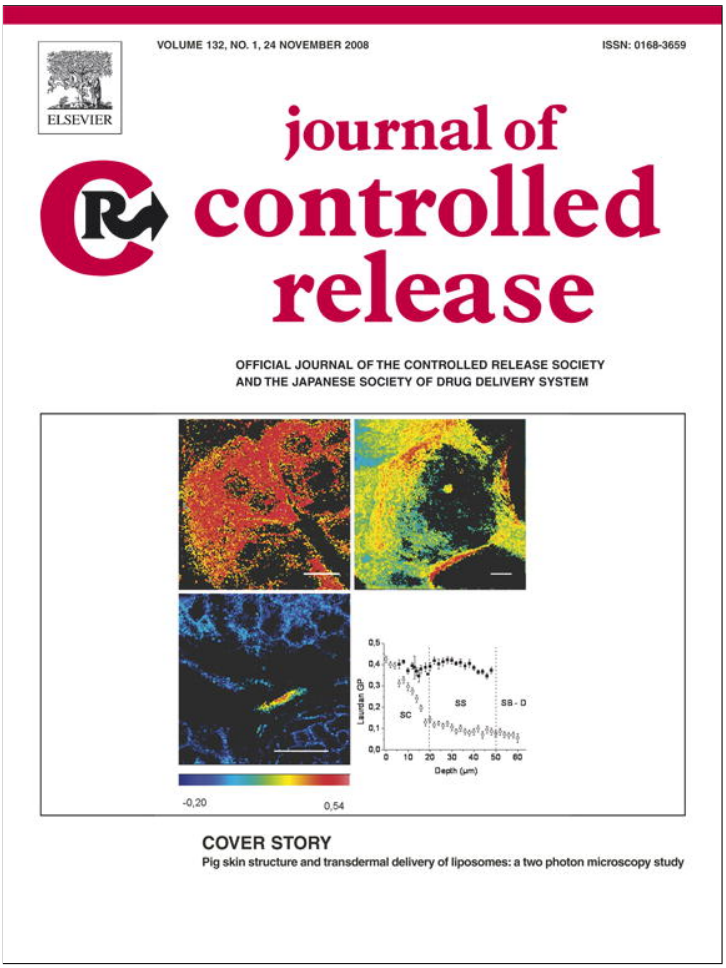

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Cover Story

Understanding skin architecture: A two photon microscopy study

In the transdermal drug delivery field, only a few things could match the excitement if one develops an efficient transdermal system for delivering clinically relevant drugs. Despite many transdermal drug delivery systems already in clinical applications, further development of clinically useful transdermal systems has been rather slow. Expediting such development requires a precise understanding of the architecture and physical properties of the skin. The main barrier for skin penetration is the stratum corneum, which allows for the diffusion of only small, hydrophobic molecules and very flexible lipid vesicles [1]. Diffusion of high molecular weight drugs, such as insulin, through the stratum corneum has met with strong resistance by the skin.

In the article by Professor Luis Bagatolli and his group in this issue, two-photon fluorescence microscopy was used as a novel non-invasive tool to ascertain skin structure at different depths (up to the one of the epidermis–dermis plane) [2]. This technique allows obtaining information about intrinsic fluorescence resulting from skin autofluorescence (generally UV excited molecules) and Laurdan generalized polarization images (a parameter that is sensitive to local polarity) at different depths of pig skin. The study showed that cells in the epidermis, from the basal layer to the stratum corneum, are organized in clusters that are in turn separated by intercluster regions the authors named “canyons”. These structures share physical and structural characteristics with the stratum corneum supporting the idea that these canyons are invaginations/extensions of this particular part of epidermis. These canyons provide for a hydrophobic pathway of penetration 60–100 μm deep, that reaches the epidermis–dermis junction. It has been shown that very flexible liposomes penetrate through these structures to the depths that correspond to the epidermis–dermis plane. Professor Luis Bagatolli and his research team speculate that these structures may act as a reservoir for hydrophobic drugs allowing a slow transversal diffusion from canyons to the deeper regions of the epidermis.

It is still premature to expect delivery of clinically relevant drugs using the very flexible liposomes through the skin, but more clear understanding on the skin architecture and physical properties will undoubtedly increase our chances of developing efficient transdermal delivery systems in the near future.

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