Molecular interactions in human skin

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Abstract

Why (trans-)dermal drug delivery is important? Topical delivery (into the skin) is used to treat local skin conditions, whereas transdermal drug delivery involves transport of drugs through skin layers into the bloodstream. Delivering drugs through the skin is an attractive approach because it provides a convenient, effective and pain-free route of drug administration. The main challenge in dermal medication is penetrating the skin barrier.

The Stratum Corneum (SC), the outermost layer of skin, protects our body from the penetration of external pathogens and toxins and also prevents internal water loss. SC is often described as 'bricks-and-mortar' structure, where the bricks refer to corneocytes and the mortar represents extracellular lipid matrix.[1] Corneocytes are the major water-holding components of the SC. They are flat, horny and functionally dead cells filled with proteins (mainly keratins), water and specific small hygroscopic compounds, known as Natural Moisturising Factors (NMFs). Contrary to the corneocytes, water content in the SC lipid phase is extremely low. SC lipid phase consists mostly of ceramides, cholesterol and fatty acids, organized in a highly ordered gel phase and characterised by very low permeability.[2] The SC lipid phase provides the main barrier against passive permeation of therapeutic molecules through the skin

Here we present our *in-silico* research findings in the both areas: the skin lipids and skin proteins. We have used Self-Consistent Field approach to investigate the interactions between Keratin Intermediate Filaments and the role of NMFs[3] and atomistic Molecular Dynamics simulations to study skin lipids.[4] In this presentation we will address the issues of how the lipids (oils) from the topical application penetrate into the skin and how the different oils affect the structure of the skin lipid matrix. Effect of urea and glycerol, the small NMF molecules naturally present in the SC, on the skin lipids bilayers will also be discussed.

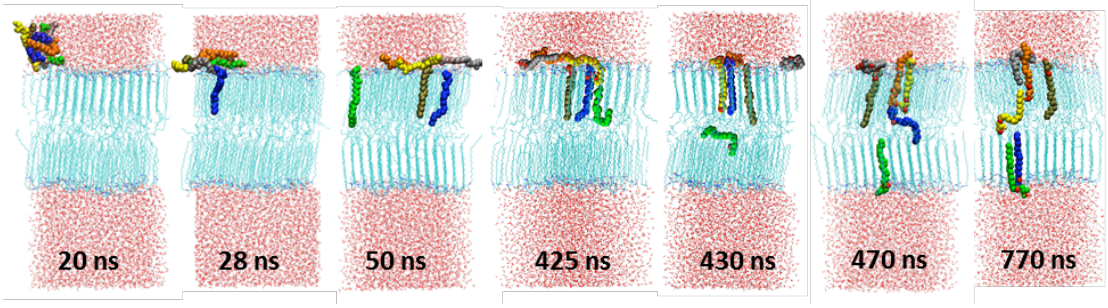

Figure 1. Spontaneous permeation of monoolein molecules into the ceramide bilayer.

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