GENETICS AND GENODERMATOSES

CHARACTERIZATION OF BARRIER MIMETIC LIPID MODEL FORMULATIONS

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Introduction: Topical formulations containing saturated di-acyl phoshadylcholine in combination with long chain fatty alcohols and acids can be effective in restoring stratum corneum barrier function in compromised or diseased skin. By deploying a range of in vitro methods, complemented with in silico molecular simulations, we have characterized combinations of these lipids, by concentration and chain length, that mimic skin barrier organization. Experimental data have been collected to describe inter and intra molecular lipid dynamics, the lamellar repeat distances, and the membrane permeability of lipid combinations in several model biomimetic formulations.

Material/methods: Fourier transform infrared spectroscopy, X-Ray diffraction, and modified dynamic vapour sorption experiments were used to characterise a range of systematically constructed model lipid formulations. These methods provided information on lipid orthorhomic and hexagonal packing, lipid chain fluidity (gel or liquid crystal), the length of the lamellar lipid bilayers (membrane thickness) and water vapour permeability, which is essentially a proxy measure of barrier function.

Results: The data from these studes indicated there were significant differences in lipid packing, lipid melting temperatures, and barrier function between model formulations containing di-C18 phosphatidylchonline when combined with either C12, C16 or C22 fatty acid and when fatty alcohol replaced the fatty acid. The presence of orthothombic packing was clear when C22 lipid chains, either acid or alcohol, were included in the formulations compared to C16 or C12.

Conclusions: These studies indicate that specific combinations of saturated di-acyl phosphatidylcholine with long chain alcohols and acids mimic key structural attributes of stratum corneum. Furthermore, these attributes can be determined using in vitro measurements thereby providing a useful screening approach for expected barrier efficacy prior to clinical studies. Separate in silico studies demonstrate that chain length mismatch and headgroup chemistry play a significant role in the overall organization and properties of these model formulations.