

High Resolution TOF-SIMS Imaging of the Multi-Layered Barrier Structure of Mouse Skin

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The stratum corneum (SC) is the outermost layer of epidermis that acts as a barrier to keep foreign objects out of the body and to keep water in. It is composed of multi-layered sheets of dead cells containing keratin that continuously fall off and are regenerated from live cells in the underlying layers. The total thickness of the SC layer is less than 40 μm . In order to study the barrier properties of the SC and how this function fails in certain skin disorders, it is necessary to visualize the distribution of different biomolecules within the multi-layered SC structure. It is also valuable to compare the penetration of various foreign chemicals into the SC layer in mice with and without the skin disorder. In this initial study, we applied TOF-SIMS imaging using a bismuth cluster ion beam to characterize the multi-layer structure of mouse skin. Samples were prepared by quick freezing of mouse tails followed by cross-sectioning by cryostat. TOF-SIMS imaging provided the spatial resolution and molecular specificity to clearly visualize dead cell layers and living layers of the epidermis. By using peaks characteristic of specific molecules, it was possible to image the distribution of amino acids, cholesterol, and lipids within the SC. The results suggest that SC might contain several chemically distinct layers. Skin samples were also depth profiled using GCIB sputtering. Imaging of cross-sections and depth profiling from the skin surface will be compared for obtaining molecular profiles within the SC structure.