SUPROMOLECULAR PROTEIN STRUCTURE FORMATION IN ANIMAL AND HUMAN SKIN INVESTIGATED BY SANS

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The etiology of many diseases of the skin, the respiratory system and the digestive tract is associated with functional disorders of ordered systems in their surface layers. Psoriasis [1], ichthyosis [2], asthma, bronchitis, chronic obstructive pulmonary disease, cystic fibrosis [3], many dysfunctions of the digestive tract and reproductive system - all these pathologies are associated with disturbances in the structural organization of the ordered systems of integumentary tissues. Although the first structural information from skin was obtained by electron microscopy and X-ray diffraction more than half a century ago, at this time the structural organization can be considered well described only for the lipid component of the stratum corneum [4], whereas the structural and functional properties of the protein component of the surface layer of skin formed by keratins and proteins of the epidermal differentiation complex, its formation and interaction with the components of the lipid matrix and cell membrane as well as the role in the barrier function of the epidermis are much less understood. Existing models suggest self-organization of intermediate protein filaments in interaction with lipid membranes [5] into a dense highly ordered package. We used contrast variation SANS that revealed a series of diffraction maxima in the skin preparations of adult mice that can be attributed to the presence of a hierarchy of ordered protein structures with the characteristic sizes of 10 – 60 nm. The diffraction pattern was significantly less pronounced in the skin and the epidermis samples from newborn mice, and was completely absent in undifferentiated keratinocyte cultures. Treatment of preparations with collagenases led to a significant decrease in the amplitude of the observed diffraction pattern with the protein structures with the characteristic size of ca. 10 nm being the least affected. In the human skin bioprobes the intensity of the maxima varied depending on the age of the donor and the site of the biopsy but were always observed in the region 0.01 - 0.03 Å-1 while in isolated human epidermis these maxima were completely absent with a pronounced maximum observed near 0.07 Å-1. These data have implications in understanding of the process of would healing as well as the protein structural organization involved in dynamics of formation of skin corneal envelope.
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