SKIN AND RELATED PHOTOREACTIONS

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Introduction.

Skin reactions to sunlight may be broadly classified as normal, the varying degrees of inflammation known as sunburn, suntan and over a long period, the more serious changes culminating in skin cancer, and abnormal, the Photodermatoses (Table 1). Normal sunburn and suntan are well characterised in terms of morphology and wavelength and exposure dose dependence. The majority of the Photodermatoses remain idiopathic, the mechanisms and especially the chromophores involved being unknown. However, we are able to differentiate quite clearly those reactions which are brought about by photosensitizers from those of the idiopathic group or those where some other recognised factor is involved as in the DNA repair deficient Xeroderma Pigmentosum.

Table 1: Skin reactions to sunlight.

Normal: Acute; Sunburn, suntan.
Chronic; Accelerated ageing, solar keratoses, cancer.
Xeroderma Pigmentosum.
Photosensitization.

Cutaneous photosensitization (1,2,3,4) may in turn be classified as, Phototoxicity, in which the skin reactions derive directly from photosensitized damage to the cellular components of the skin and Photoallergy in which the mechanisms of the immune system are activated (5).

The Skin.

The structure of human skin is complex and varies with anatomical site.
Nonetheless, it consists essentially of two layers, an outer, stratified squamous epithelium, the epidermis, supported by a connective tissue dermis. The major cell components of the epidermis are keratinocytes, derived from embryonic ectoderm, cell division occurring in the basal layer to provide a well ordered process of differentiation called keratinization in which the cells progress through spinous and granular cell layers to form the tough, impermeable but flexible horny layer of dead cells at the skin surface. Melanocytes, dendritic cells derived from the neural crest, are distributed among the basal layer keratinocytes. Melanin pigment, formed as melanosomes, is transferred through the dendrites to the neighbouring basal and suprabasal layer cells to provide the varying shades of "colour" seen in human skin. Higher level dendritic cells, one population well defined as Langerhans cells and a second group less well known as yet, form the most peripheral component of the immune system. The epidermis is by definition, avascular but certain nerve endings do extend into the basal layer. The dermis consists of a connective tissue made up of collagen and elastic fibres embedded in a ground substance of glycosaminoglycans. Fibroblasts, responsible for the synthesis of these structures, are the major cell type found but mast cells, containing histamine and other vaso-active compounds, are also present. The vascular supply, a rich network of venules, arterioles and capillaries, ensures that the full complement of inflammatory processes, both humoral and cell mediated, may be activated. In the context of photosensitization, the major variations in human skin structure would appear to be the much thickened, and therefore more optically dense horny layer of the palms and soles and the distribution of hair, in particular on the scalp which again results in natural filtering of incident radiation. The skin of experimental animals is basically similar to that of humans in that it is two layered. However, apart from the genetically hairless strains, hair growth is a major feature to be controlled, the epidermis is much thinner than in humans and the vascular supply, particularly in the lower rodents is very much less complex than in human skin. These differences have to be taken into account if animals are used for studies of cutaneous photosensitization.

It is clear that if there are numerous target sites available for photosensitization at the cellular level and it is still not established which of these may be responsible for lethal effects, then the elucidation of the events leading to cutaneous photosensitization is even more difficult. These difficulties are further compounded by the differential penetration