If u.v. erythema is induced by the action of radiation on the superficial layers of the skin, the melanin, present only in the basal layers of the epidermis in untanned white skin, can offer no protection. The decrease in sunburn response after repeated exposures is due to the thickening of the stratum corneum. Eight weeks after a sunburn exposure the corneum has reverted to its normal thickness, and the hyperpigmentation remaining offers no protection against u.v. irradiation. However, the depigmented skin of vitiligo patients is more sensitive to sunburn than normal areas. In countries with strong sunlight, poorly pigmented people are more easily sunburnt than others, and the increase in redness with increase in dose of erythema producing u.v., is less steep in more pigmented skin.

Theoretical considerations suggest two distinct erythema producing actions of u.v. in the skin. One has a smooth action spectrum with a flat peak at 250 nm, extends above 360 nm, and acts directly in the dermis. The other has an action spectrum confined to the 300 nm region, produces a stronger erythema, and acts on the epidermis. Pigment in the basal cells would, therefore, give protection against all wavelengths except those of the 300 nm region.

Depigmented and closely adjacent normal skin of vitiligo patients was irradiated with monochromatic 250 nm, 300 nm and 360 nm radiation. Slight protection was provided by the pigment against 250 nm and 360 nm, but none against 300 nm. The same phenomenon obtains if the reaction of 8-week-old sunburn skin is compared with that of closely adjacent unexposed skin. The protection against 250 nm radiation is slightly more than 20 per cent in this case. Pigmentation was also found to give some protection against the radiation from a low sun (38° C) but not from a high sun (61° C).

The results indicate that two processes are involved in erythema production, and ‘erythemal effective energy’ should be calculated in two fractions. Low pressure mercury arcs, producing monochromatic
250 nm will act on the dermis, as will super-high pressure mercury arcs with predominantly long wave u.v. emission. The high pressure mercury arcs used as 'artificial sunlight' emit strongly near 300 nm and will produce primarily an epidermal effect.

Erythematous effective energy of the sun can be calculated from spectral energy curves. For a high sun, the epidermal effective fraction is predominant. A decrease in altitude results in a slight shift of spectral energy distribution, and a change in the proportions of the two fractions so that the dermal effect may predominate. These considerations explain the results obtained using natural sunlight.

Threshold erythema determinations were used in all cases. If more severe effects are studied, the increased erythema with increasing dose relationship shifts the bias to the dermal effect.

The protection afforded by a thickened stratum corneum may amount to some factors of ten, whereas the protection observed in these experiments was at the most 20 per cent. The pigment in white skin, however, is distributed as small caps over the nuclei of the basal cells. A discontinuous pigment layer cannot be expected to have such a protective effect as may be observed with the closed layers of melanin found in more developed pigmentation.

Vitiligo patients suffer from sunburn in the depigmented areas because here, the more severe dermal effects are predominant. Because the depigmented areas have reacted more severely to previous exposure to sunlight than the surrounding skin, they may be less sensitive to 300 nm irradiation from artificial sources.

The just perceptible erythema may be due to epidermal action and is not affected by pigmentation. The more severe effects are mainly dermal and are prevented by the presence of pigment. Increasing the dose would produce less effect in a more pigmented skin.

The results stress the possible difference between the sunburn observed by the dermatologist and the lesions produced by the investigator using artificial sources and threshold doses of u.v. radiation.