



SOLAR CARCINOGENESIS

An Epidemiological, Experimental and Histochemical
Study of Tumours Induced by Ultraviolet Radiation.

A Thesis submitted for the Doctorate
of Medicine of the University of
Adelaide.

by

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SYNOPSIS

A statement indicating in what respects I consider the contents of this thesis to contribute to the knowledge and practice of medicine.

The epidemiological studies of solar lesions reported in Sections 2 and 3 are the first systematic investigations undertaken in Australia, and one of the few in the world literature. The combination of the high incidence of skin cancer and the uniform centralised method of treatment is unique, and permits systematic study of the frequency of lesions over a wide geographical range. The hospital figures indicate that the incidence increases towards the Equator, but that the increase does not follow a simple relationship with latitude. Reasons for this are discussed in relation to the climatological factors. In calculating the incidence curves a method of estimating the population at risk is used, which gives a better estimate than that based simply on the total population. The significant feature of the incidence curves in relation to experimental pathology, is that their slopes are similar on straight line transformation.

The cane farmers' and graziers' survey provided a population that was documented with respect to the physical characteristics that are normally associated with predisposition to development of solar lesions, or protection against them. These populations were also analysed according to national origin, and as the occupational factor was constant, it was possible to study the prevalence of skin lesions in homogeneous groups. Significant correlations of prevalence of lesions with latitude were obtained, and so far as I am aware, this type of correlation has not been reported before.

The histochemistry of the ultraviolet tumour in the mouse has not been published by any other worker. It is shown that the spindle cell tumours are, in fact, carcinomas. Histochemical and microscopical evidence is presented that these tumours may be due to clones of cells having undergone a mutation. They lose enzymatic characteristics of normal epidermis, yet retain in an enhanced manner those of an actively metabolising tissue. This concept of enzymatic dedifferentiation has not received wide attention, but is germane to the subject of tumour biology.

In the section on the histochemistry of human skin cancer it is shown that collagen degeneration is a simple ageing process, probably accentuated by tropical conditions and infrared radiation.

In Appendix 3 an entirely new histochemical method for demonstrating lipoproteins in fresh tissue, and amino and disulphide groups in fixed tissue is reported, for the most part unpublished. This is the cobalt-MTT-hydroquinone reaction. Various experiments to demonstrate its specificity are described and discussed. In the final section of Appendix 3 the adaptation of this histochemical reaction to quantitative estimation of dehydrogenase reactions in tissue sections is proposed. This could have wide application in estimating cellular metabolic activity.