Hydrogen Peroxide and Cancer

AFTER consultation with Holman, his experiment¹ was repeated as closely as possible in all details, except the strain of rat used, which was an inbred strain of Wistar origin. Experimental animals and controls carried tumours of the 9th, 10th, 11th and 15th successive transplants into this strain of a Walker carcinoma obtained from the Chester Beatty Research Institute. On the sixth day after inoculation, the drinking water of experimental animals was replaced by 0.45 per cent hydrogen peroxide in tap water. Tumours in experimental animals then ranged from 3.5 to 5.4 cm. longest diameter (mean 4.46 cm.), and in controls from 3.0 to 5.6 cm. (mean 4.48 cm.).

Of 20 experimental animals, 6 died of tumour in 18–36 days after inoculation, in 13 the tumour regressed completely in 17–60 days, and in 1, killed after 66 days, a residual tumour 1.1 cm. long was found. Of 20 controls, 3 died of tumour in 13–26 days, and in 17 the tumour regressed completely in 14–87 days after introduction.

Blood catalase and haemoglobin values decreased as the tumours grew in size and rose again as they regressed. Blood catalase was approximately proportional to haemoglobin, as found by Miller² for human erythrocyte catalase. The catalase/haemoglobin ratio, however, tended to be higher for treated rats, with a wider scatter of values than in controls. The difference was not apparent until about a fortnight after the commencement of treatment; mean catalase/haemoglobin ratios (ml. oxygen liberated per min./gm. haemoglobin) for rats drinking peroxide for 18 days and more are $1,880 \pm 244$, and for untreated animals over the same period $1,719 \pm 46$; the mean difference is 161 ± 74 , which has a probability of less than 1 in 20 of arising by chance.

Maximum growth of tumours which afterwards regressed was found at 7–24 days after inoculation, and in 20 of the total 31 regressions at 10–12 days. This appears consistent with an immunological mechanism of regression. Maximum tumour growth was slightly, but not significantly, less for treated animals than controls, and the mean weight of tumour-bearing rats at the time of maximum tumour growth differs significantly, being 193 ± 21 gm. for treated rats and 210 ± 29 gm. for controls—a mean difference of 17 ± 5 gm., with a probability of less than 1 in 100 of arising by chance. These findings are in accord with those of Ghadially and Wiseman³, who also noted a smaller food intake by rats drinking peroxide. Choraży *et al.*⁴ report decreased liquid intake, which was found also in this experiment. Mean values of 120 observations on each group were 16 ± 4.2 ml. per day for treated rats and 24 ± 4.0 ml. per day for controls—a mean difference of 8 ± 0.3 ml., which is highly significant.

Drinking hydrogen peroxide thus appears to have two effects on the tumour-bearing rat. It slows down growth by reducing food and liquid intake, and it tends to raise the catalase/haemoglobin ratio in the blood. No effect on survival was found in this experiment.

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A White-eyed Mutant Form of the American Cockroach, *Periplaneta americana* (L.)

WHITE-EYED mutants are well known in insects, but the majority of reported cases are confined to the order Diptera. Tate¹, in a paper on a white-eyed mutation in *Calliphora erythrocephala*, gives references to five other dipterans in which it has been known to occur, and more recently Paterson² has added another. Comparable mutations in other orders of insects seem to be less frequent, although the related phenomenon of albinism is known in the desert locust³. It may be of interest, in view of this, to report the occurrence of a white-eyed mutant form of the American cockroach, *Periplaneta americana* (L.).

This was originally found among a population of these cockroaches in a deep coalmine in Glamorgan and has been kept in pure culture in this Department for more than eleven years. The mutant character behaves as a Mendelian recessive, and observations on the laboratory stock indicate that it is not sex-linked; this point, however, needs further investigation.

During the past eleven years rough sampling of the cockroaches in the pit has been carried out from time to time, and the white-eyed mutants have been found to comprise about 5 per cent of the population. There has been no noticeable tendency towards any change in this proportion throughout the period. It is perhaps surprising that a mutant form should maintain itself at a substantially constant level for such a time, but presumably under mine conditions an unpigmented eye is a neutral character with no selective significance. The conditions of the population when the mutant form was spreading to its present numerical level are, of course, quite unknown. Cockroaches are said to have been present in the pit for a long time, but it is not known when white-eyed forms first appeared, and there is no reliable information about numerical fluctuations of the population as a whole.

In the course of a survey of the fauna of a number of South Wales coalmines, *Periplaneta americana* was found quite commonly, but only in the one pit were white-eyed mutants seen.

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