RADIOBIOLOGY

Inability of Thiotaurine to protect Mice against Ionizing Radiation

ONE of the theories proposed for explaining the protective role of certain substances on animals submitted to a lethal dose of ionizing radiation involves the capture of free radicals by the protective compound (scavenger action). As a consequence of this process the compound is chemically modified in the biological structures where it happens to be, which then survive the irradiation. If such a theory is correct a certain degree of correlation would be expected between the protecting activity of a substance and its lability towards radiation, unless a catalytic mechanism is involved.

Cystamine, one of the best-known biological protectors against radiation¹, is relatively resistant to radiation in solution. A low percentage of degradation products has been detected only after heavy irradiation². Thiotaurine, a metabolic product of cystine and cystamine, has been recently found more sensitive than cystamine to an equal amount of X- and γ -rays³.

The validity of the presumed correlation between radiochemical degradation and biological protection has been investigated by comparing the protective effects of thiotaurine and cystamine against a lethal dose of X-rays on mice. Three groups of 15 white male mice of the Swiss strain weighing 20 gm. were placed in a wooden box with a 'Perspex' cover in mixed groups of 15 animals and exposed to a dose of 600 r. in the space of 15 min. One group was the control: another was injected intraperitoneally with half the LD₅₀ of cystamine neutralized with *N* hydrochloric acid (cystamine and cystamine have equal protective power⁴), 15 min. before irradiation. The third group received half the LD₅₀ of thiotaurine⁵ in the place of cystamine. Under our conditions the LD₅₀ for cystamine and thiotaurine were respectively 0.27 gm./kgm. and 3.52 gm./kgm., that is, thiotaurine is tolerated much more than cystamine. On the molar base, the thiotaurine injected represents an amount seven times higher than that of cystamine.

Fig. 1. Effect of cystamine and thiotaurine on the survival of mice after exposure to X-rays. X, 600 r.; O, 600 r. and half the LD₅₀ of cystamine (0.135 gm./kgm.); Δ, 600 r. and half the LD₅₀ of thiotaurine (1.760 gm./kgm.)

The results are shown in Fig. 1. It may be seen that all the thiotaurine-treated mice died within 10 days of irradiation, while little less than 50 per cent of the cystamine-injected mice are still alive. This clear-cut result excludes any possible role of thiotaurine as a protective agent despite its relative lability towards radiations, and despite the large dose injected. This finding suggests that the correlation of the radiochemical degradation of a substance with its biological protective power is untenable. Moreover, it supports the view of those who believe that the 'scavenging action' plays only a minor part in the mechanism of the chemical protection⁵.

This work has been assisted by a grant of the Comitato Nazionale Ricerche Nucleari.

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² Shapiro, B., and Eldjarn, L., *Rad. Res.*, **3**, 255 (1953).

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⁴ Cavallini, D., De Marco, C., and Mondovì, B., *Bull. Soc. Chim. Biol.*, **40**, 1711 (1958).

⁵ Cohen, J. A., Vos, O., and van Bekkum, D. W., "Advances in Radiobiology", edit. by Hevesy, G. de, Forssberg, A., and Abbatt, J. D., 134 (Oliver and Boyd, Edinburgh, 1957).

Divergence between Lethal Doses and Sterilizing Doses of X-Rays with Progressive Development in *Habrobracon* Females

IN the present work I have determined the weakest link in an insect life-cycle and related this to the quantitative differences between the sterility and lethality doses when virgin females were irradiated at various developmental stages. The wasp used is known in genetic literature as *Habrobracon juglandis* (Ashmead). The females were chosen since it was believed that a non-sterile female would normally live and copulate with a son and afterwards produce both males and females. Critical stages for exposure were selected at significant changes in somatic and/or gonadic differentiation.

The stock, derived from a mother-son mating in 1952 of wild type Whiting stock No. 33, has maintained excellent egg production and viability for more than 270 generations. The small braconid wasp parasitizes various lepidopteran larvae. *Ephesia kuehniella* (Zeller) caterpillars are the standard host employed. *Habrobracon* females usually mate once. Fertilized eggs develop into diploid females; unfertilized eggs develop parthenogenetically into haploid males. All rearing was done at 30° C., and samples of 20 wasps per stage were used.

Eggs or immature forms of known age were irradiated at the Marine Biological Laboratory, Woods Hole, Massachusetts (25 m.amp., 250 kV. peak, filtration $\approx$ 0.2 mm. copper). A constant target-tube distance of 23 cm. was maintained to produce 600 r./min.

Females were considered sterile if oviposition failed; or in the case of forms more than 6 days old, if oviposition ceased after the deposit of eggs performed at the time of irradiation. The lethal dose is considered to be that X-ray exposure which prevented eclosion; consequently, death could occur between