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JULY 1953

PART II

(Including Sections A, B, and C)
Top Secret Appendix Under Separate Cover

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BUDGET AND REPORTS DIVISION
Reports Branch
August 12, 1953

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BIOLOGY AND MEDICINE

RESEARCH

Biology

Cytogenetics--It has been previously demonstrated that hydrogen peroxide does not induce mutations in Paramecium even when the catalase in the cell is partially poisoned by cyanide. It has been shown that neither peroxide nor cyanide present during X-irradiation modifies the induced mutation rate. Calculations show that the average concentration of peroxide inside a cell the size of a paramecium is a large fraction of that outside. The concentration of peroxide used in these experiments was more than thirty times that produced in pure water by the doses of X-rays normally used in mutation experiments. At these doses, more than half of the mutagenic effect is eliminated when irradiation occurs in the absence of oxygen. It may be concluded that oxygen does not exert its influence on the mutagenic action of X-rays by its influence on peroxide formation.

The ratio of chromatid aberrations induced by X rays in Tradescantia in the presence of air and in pure nitrogen indicates a pronounced wave-length effect. For chromatid deletions the ratio increases from longer (50 kvp) to shorter wave lengths (gamma rays); with isochromatid deletions the ratio changes in the reverse direction.

Biochemistry--The cell-free bacterial luminescence recently produced at ORNL was examined from the standpoint of emission spectrum, ultraviolet effect, and of its dependence upon temperature, pH, inhibitors, substrates, and cofactors. In addition to reduced coenzyme-I and riboflavin

RESEARCH--CONTD.

phosphate, it was found that a lipid-like substance, extractable from hog kidney cortex, stimulates the luminescence. This substance was isolated and purified to the extent that one microgram per milliliter will produce a tenfold stimulation of luminescence. Its chemical structure is under investigation.

Pathology and Physiology--Mice, guinea pigs, and rats were exposed to cyclotron-produced neutrons and to 250-kvp X-rays in order to determine their relative biological effectiveness. The parameters studied thus far include LD_{50}/30 days, cataract induction, and bone-marrow activity, as indicated by Fe^{59} uptake in red blood cells and white cell counts. The preliminary LD_{50} studies are nearly completed and the others are in progress. The tentative neutron/X-ray ratios for acute lethality are as follows: in mice 1 rep neutrons equals about 3.4 rep X-rays; in rats 1 rep neutrons equals $\sim$3.0 rep X-rays; and in guinea pigs 1 rep neutrons $\sim$2.8 rep X-rays.

Enzyme Chemistry--The investigation of the relationship between molybdenum and xanthine oxidase, undertaken in collaboration with the UT-AEC group, was completed. It was not found possible to remove the Mo^{99} activity from the labeled enzyme either by means of exchange or by prolonged dialysis. Spectrophotometric measurements on the enzyme and chemical, spectrographic and radio-assay methods for determination of the associated molybdenum indicate that one atom of molybdenum is combined in a molecule containing two riboflavin residues. The minimum molecular weight of the xanthine oxidase is in the neighborhood of 200,000, a value which is in agreement with the results of ultracentrifuge measurements made in other laboratories.

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