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DEPARTMENT OF THE ARMY
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Testing of the mutagenity of nucleic acids exposed to ultraviolet rays.

by R. W. Kaplan (Max Planck Institute for Culture Research, Voldagsen)

Die Naturwissenschaften, Vol. 40, 1953, p. 25.

The genesis of substances capable of causing mutations in organic media exposed to UV irradiation suggested that during direct irradiation of cells the induced mutations might also develop indirectly, i.e. owing to the production of analogous "ray-toxins" within the cell. It is true that analysis of the dependency on wave lengths of this mutagenization of nutrient media showed that only wave lengths below 2170 A are noticeably effective (1), while the effective spectrum upon direct irradiation with its maximum at about 2600 A corresponds to absorption in nucleic acid (2). If such an indirectness of the UV effect during direct irradiation is nevertheless assumed, nucleic acid deserved primary consideration as the substance which is made mutagenic within the cell by UV (e.g. by oxidation or other destruction). It seemed interesting, therefore, to find out whether or not nucleic acid, similarly to (chemically not more closely defined) materials capable of mutagenization, is able to cause mutations in organic nutrient broth subsequently to UV irradiation.

The color sector mutations (S-mut.) of Bacterium prodigiosum (Serratia marcescens) were utilized as easily tested mutations. Irradiated were ribonucleic acid, purest, "Bayer," 1% dissolved in saline, also desoxyribonucleic acid "Bayer," 0.3% in saline. These solutions were exposed to an HNS 12 lamp, which predominantly yields the wave 2537 A. Immediately after irradiation of the doses for 1 min and 5 min at about 8,000 erg cm^{-2} min^{-}, resting bacteria were introduced and held at 3.5°C for 20 minutes, then smoothed onto agar plates with a spatula and incubated for 48 hours. The dosis of 1 min would have produced an S-mutation rate of 15% upon direct irradiation of the cells, as evidenced by previous investigations (3). The non-irradiated control suspensions revealed 138/5077 equals 2.72%, which corresponds to the spontaneous rate ordinarily observed. Irradiated solutions showed the following S-mutation rates:

Table 1

	1 min UV	5 min UV
desoxyribonucleic acid	38/1957 equals 1.94%	50/2150 equals 2.33%
ribonucleic acid	42/1864 equals 2.25%	33/1820 equals 1.81%
pure saline	64/2545 equals 2.52%	56/2690 equals 2.08%

The experiments show that ~~As table 1 reveals,~~ there is no evidence of a mutation-causing effect of nucleic acids irradiated with UV. The results therefore do not support the hypothesis of an indirect cause of mutation by means of mutagenized nucleic acid or its UV degradation products upon direct irradiation of cells, even though they should not be regarded as a positive refutation, but only as circumstantial evidence.

Literature

(1) Haas, I., B. Clark, O. Wyss and W.S. Stone: Amer. Naturalist 84,261 (1950). — (2) Kaplan, R.W.: Z. Naturforsch. 7b, 291 (1952). — (3) Kaplan, R.W.: Arch. Mikrobiol. 1952.