LETTERS TO THE EDITORS

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Absorption of Ultra-violet Light by Living Cells

NUCLEIC acids, because of the presence of purines and pyrimidines in the molecule, absorb ultra-violet light with a maximum absorption at 2600 Å. Recently, Larionow and Brumberg¹ suggested, on the basis of ultra-violet light photomicrographic studies, that desoxyribonucleic acid, as it exists in the nuclei of living cells, does not absorb ultra-violet light of wave-lengths near 2600 Å. These investigators contended that absorption develops as a result of injury or death of the cell.

Ultra-violet light photomicrographs of living cells made in this laboratory show absorption of light of wave-length 2654 Å. Cells of the Walker Carcinoma No. 256 of the rat were used. Cell suspensions were prepared immediately after removal of tumours from the host by mincing tissue finely with scissors in Ringer's solution and straining through a thin layer of cotton to remove coarse aggregates. Cells prepared in this manner and kept for much longer periods of time than was required in these experiments produced tumours when implanted into rats. The cells, in Ringer's solution, were placed on a quartz slide and covered with a quartz coverglass and sealed with paraffin.

Ultra-violet light photomicrographs were made with a quartz optical system microscope by the method previously described², with a 2.5-mm. objective, N.A. 0.85 and a 10 × ocular, magnification 240 ×. Condenser diaphragms were closed to small aperture.

Ultra-violet light (2654 Å.) photomicrograph of Walker Carcinoma No. 256 of the rat, magnification × 900

Focusing was performed by means of a fluorescent screen and a magnifier with 2654 Å. light. The focus was obtained on one area of the field; all light was then barred from the microscope, and the slide was moved to a distant field. In this procedure the cells were exposed to only the amount of ultra-violet light necessary to produce the image on the film. Panatomic X (Eastman Kodak Co.) was used. Photomicrographs made in this manner (see illustration) show the same absorption pattern as those made after the cells have been exposed to several times the amount of ultra-violet light necessary for photomicrographs.

Nuclear and cytoplasmic absorption varied considerably from cell to cell, depending on the metabolic state. Chromosomes, where present, absorbed intensely. In the resting cells the nucleolus usually absorbed much more intensely than did the remainder of the nucleus.

Visual observations of fluorescent images of cells illuminated by ultra-violet light made by rapidly moving the slide across the microscopic field revealed absorption by cells as they came into view; under these conditions exposure to ultra-violet light was less than one second. Chicken erythrocytes in whole blood when observed in this manner within three to five minutes after drawing the blood showed intense nuclear absorption. These observations, which have been repeated many times, indicate that the nucleic acids as they exist in the living cells absorb ultra-violet light. This contention is supported by the work of Wyckoff³, who made successive ultra-violet (2750 Å.) photographs of a living grasshopper spermatocyte and showed absorption by the chromosomes throughout division.

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¹ Larionow, L. T., and Brumberg, E. M., *Nature*, **158**, 663 (1946).

² Ely, J. O., and Ross, M. H., *J. Franklin Inst.*, **246**, 87 (1948).

³ Wyckoff, R. W. G., "Symposia on Quantitative Biology", **2**, 39 (1934).

Plant Injury from Phosphorus-32

It has been generally considered, on the basis of the work reported by Hendricks and Dean¹, that a sufficient margin of safety exists in the tolerance of the plant to radioactivity to permit the use of phosphorus-32 as a tracer in phosphate experiments without fear of any effects on plant growth from the radioactive isotope. The recent communication by Scott Russell and Martin², indicating an injurious effect, suggests that a danger exists which requires further study.

In the course of field experiments with wheat in Saskatchewan in 1948, phosphorus-32 was used to follow the uptake of phosphate from seven different fertilizer treatments. Only one row (9 ft. long) in each treatment plot was treated with radioactive fertilizer; but the two immediately adjacent rows were treated with exactly the same amount of the same inactive fertilizer. While this was done to avoid handling large amounts of tracer, and also to check the amount of fertilizer applied with the seed in one row taken up by adjacent rows, the arrangement was ideal for an estimation of effects due to phosphorus-32.

Fertilizer was applied to give P₂O₅ applications of 12, 24 and 48 lb. of P₂O₅ per acre. Two dilutions of phosphorus-32 were used, one at 26 microcuries and the other at 260 microcuries per gram of phosphorus (both measured at time of planting), in connexion with harvests at four different stages of growth. We therefore have information on identical fertilizer treatments, with and without phosphorus-32, at various stages of growth, and at two levels of phosphorus-32 activity. The application of P₂O₅ at 48 lb./acre is the treatment most likely to show injury, since the absolute uptake of phosphorus-32 was highest for this treatment.

Measurements of yield, total phosphorus and phosphorus-32 were made as in previous work³. The data are presented below.

Some of the data indicate a small but statistically significant increase as a result of the presence of phosphorus-32. This requires a word of explanation.