followed by the cutting out of this section and the extraction of the vitamin from this rich portion.

Our pentane fractions were analyzed by the "Official Pharmacopoeia Method" reported by the Cod Liver Oil Color Sub-Committee, using the usual Lovibond tintometer. One worker had used such methods for a year and the other was approved after frequent comparisons.

Needless to state, there are many precautions and many difficulties in working with a substance so extraordinarily sensitive to oxidation (and to light), but these will be discussed in a later paper. It was thought best to make this preliminary announcement before taking time to analyze the concentrate, to determine its molecular weight, its spectral absorption bands, its extinction coefficients and its biological value.

Like the other workers mentioned, we secured a pale yellow, viscous oil. We shall continue our attempts to crystallize it.

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THE EFFECT OF X-RAYS ON GROWTH SUBSTANCE AND PLANT GROWTH

IT has long been known that the growth of plant and animal tissues is inhibited by x-radiation. The amount of inhibition has generally been found to be a function of the amount of irradiation up to a certain lethal dosage which varies greatly with different types of cells and under different experimental conditions.

In this preliminary report of work done during the last year on the effect of x-rays on growth substance, the "growth hormone" of plants, it is possible to explain the immediate effects of irradiation in terms of its action on a specific chemical substance. The high voltage x-ray tube of the W. K. Kellogg Radiation Laboratories of the California Institute of Technology, which produces a well-defined beam of hard γ-rays of uniform intensity (soft rays being eliminated by successive steel, lead and aluminum filters) was used. The dosages given varied from 20 to 5,000 Röntgen units applied at different rates between 15 and 50 Röntgen units per minute at 750,000 to 925,000 volts and 3 to 4 milliamperes. The growth substance was irradiated in different media and solvents, such as agar blocks of standard size and concentration, water and other solutions of known activity. A few species of plants were directly irradiated. The amount of growth substance remaining after irradiation was determined by the usual *Avena* technique.

Growth substance was inactivated by irradiation both in solution and in the intact plant and by comparable dosages. Under certain conditions the inactivation was complete. When a water solution of growth substance was irradiated in an atmosphere of nitrogen there was no immediate inactivation, indicating that the reaction is an oxidation.

Tips from irradiated plants, placed on agar blocks, showed a large decrease in growth substance diffusing out from them as compared with tips from control plants. This was true even when relatively small dosages were administered, so that the growth rate of the intact plant would be only temporarily decreased. This difference in amount of growth substance diffusing out from the tip is not due to an effect produced by irradiation on the rate of growth substance transport through the plant, because the transport is not decreased by previous irradiation of the plant.

Irradiated seedlings showed a decrease in growth rate. But similar seedlings, given a continuous supply of growth substance immediately after irradiation, were able to maintain their normal growth rate compared with similarly treated nonirradiated controls. No stimulation of growth by irradiation was observed for the intensities used in these experiments.

Many workers have found that regeneration in plants through the development of buds and shoots is greatly increased by moderate dosages of x-rays. Since it is known that growth substance inhibits the outgrowth of buds, this regeneration may now be explained by the inactivation of growth substance by x-rays, rather than interpreted as a stimulative effect on the cells irradiated.

These experiments show that the primary action of x-rays on the growth of plants is through the inactivation of growth substance. They offer a simple technique whereby the immediate effects of irradiation on the living cell may be quantitatively studied.

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