A demonstration of the working of the system was provided by the navigation of an aeroplane from Washington to Newark during a fog between the two cities of such density that all other aircraft were kept on the ground. In cases such as this, the ordinary radio beacons are used to navigate the aeroplane during the three-hour flight, until on approaching Newark at an altitude of 3,000 ft. the signals from the 'runway' beacon give the correct orientation, with respect to the landing path and the prevailing wind, for approaching the aerodrome. A second receiver on the aeroplane is now tuned to receive the signals on a wave-length of 3·3 metres emitted nearly horizontally by the beam transmitter indicating the landing path on the aerodrome. As the aeroplane passes a line 2,000 ft. from where the landing is to be made, a special signal is received from a vertical marker beacon. A second distinctive special signal is received as the aeroplane passes over the edge of the aerodrome, and the pilot now knows that he is not only in the runway, but actually over the field. He now prepares to land by so manœuvring his aeroplane that constant output is indicated on the ultra-short wave receiver picking up the landing beam signals. If the fog is thin enough to enable him to see the ground before he reaches it, he will land in the conventional manner. If it is still so thick that he cannot see the ground, he will throttle down his engine and prepare for a three point landing as soon as he crosses the wall of signals indicating the boundary of the aerodrome.

During periods of thick fog there is usually little wind, and it may be sufficient to instal the landing beam apparatus in such a position that the runway is in the direction of the generally prevailing wind for the airport. As an alternative, however, the runway beacon transmitter may be installed underground in the centre of the field and rotated to orient the runway as the wind conditions require. Since most commercial aircraft in the United States are now equipped to receive the signals from the course-indicating beacons, the only addition required to make use of this new service is an ultra-short-wave receiver together with a suitable aerial. The cost of the extra installation on the ground is not large, and it is likely that the system may be applied to other airports in the future.

[1] H. Diamond and F. W. Dunmore: "A Radio Beacon and Receiving System for Blind Landing of Aircraft." *Bur. Stand. J. Res.*, 5, 897–931; 1930.

Growth Substance (Auxin) in Plants*

By PROF. F. A. F. C. WENT

ADVANCES in the botanical study of growth substances have recently been made in several laboratories, but the present paper is more especially concerned with the work of the Utrecht Laboratory. Brief mention is made of Heyn's investigations in Paris and in Leeds on the influence of auxin on the extensibility of the cell walls of oat seedlings, where he could distinguish between the plastic and the elastic extension. This work affords an explanation of the differences of elastic extensibility, which occur as a result of changes of the rate of elongation. These experiments are carried out at Utrecht, more especially the X-ray investigations.

Van Overbeek, working with *Raphanus*, has been able to show, first, that auxin is produced in the cotyledons under the influence of light, and secondly, that light alters the sensibility of the cells for growth substance, more especially diminishing it; this gives an explanation of Blaauw's photo-growth reaction. On the other hand, lateral illumination causes a deviation of the auxin to the shaded side; the two phenomena together give an explanation of the phototropic curvatures of these seedlings, this being a synthesis of the theories put forward by Blaauw and by Went Jr. A somewhat similar explanation can be deduced from Du Buy's experiments with oat seedlings.

Dijkman has investigated seedlings of *Lupinus*, more especially their geotropic curvatures; he has been able to prove that here, just as in the case of *Avena* studied by Dolk, the flow of the growth substance is deflected from the longitudinal direction as soon as the hypocotyls are moved out of their vertical position. When they are placed horizontally, a greater quantity of auxin flows to the lower side, which afterwards shows more powerful growth so that a negative geotropic curvature arises. Just as in Van Overbeek's case, here also the amount of curvature produced was exactly equal to that deduced from the distribution of the growth substance.

Bottelier has made a study of protoplasmic streaming in the coleoptiles of *Avena*. In young plants the influence of temperature is rather small but in older plants the Q_{10} becomes 1·8, giving a ratio of the velocity of the streaming at 16·5° C. to that at 24° of 10 to 21·3, which is the same as the ratio found by Van der Wey for the velocity of transport of the auxin. The influence of light on the velocity of protoplasmic streaming is such that its curve can be very well compared with that obtained by Van Dillewijn for the influence of light on growth. The quantity of protoplasmic streaming is not always the same and it has become evident that this quantity is small when the sensitivity of oat seedlings to the growth substance is low, whereas it is high with a greater sensitivity.

An investigation into the factors which influence the sensitivity to growth substance in a room kept at constant temperature and constant humidity is in progress under the auspices of Kögl, and is being carried out by Haagen Smit and J. J. Went. They have been able to show that a standard sensitivity can be kept constant as soon as the plants are placed in boxes made of a good electric conductor. On passing a feeble electric current through the seedlings, the plants assume their standard sensitivity. When the tip is negative with respect to the base, the standard sensitivity is lowered; and in the opposite case it is increased. The supposition is made that changes of the electric conductivity of the air play a rôle in this variability of the standard sensitivity.

Already in several instances an influence of this electric conductivity on plant life has been suggested. Oat seedlings now will enable us to obtain exact measurements of it.

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