2. No evidence of cell division in these large mid-gut cells was obtained at any time. Their number is supplemented during larval life by the growth of very small regenerative cells which are apparently present from the time of hatching. From the second day of larval life to the time of pupation individual large cells are found being shed into the lumen of the gut where they disintegrate without division. They are replaced by regenerative cells. At pupation the remains of the larval mid-gut is shed and hundreds of cells in all stages of disintegration are found, but again with no evidence of cell division. The new mid-gut is formed by the rapid multiplication of the small regenerative or imaginal cells which show 6 metaphase and 12 anaphase chromosomes in their division figures.

3. In the most anterior part of the intestine, the ileum, numerous multiple chromosome complexes (24–48 chromosomes) were found in dividing epithelial cells between the 12th and 18th hours of pupal life. Throughout the larval period and the first hours of pupal life the nuclei of these epithelial cells of the ileum are typical resting nuclei, very finely granular in appearance and in no way resembling the salivary gland type of nucleus.

In brief the evidence indicates that cells having the salivary gland type of chromosomes do not divide, while the cells giving rise to multiple complexes do not have nuclei and chromosomes of the salivary gland type.

[1] *Jour. Morph.*, **29**, 607–627 (1917).

[2] *Zeits. Zellf. Mik. Anat.*, **22**, 47–53 (1934).

[3] *Ibid.*, **23**, 280–313 (1935).

[4] In *Sciara* the large epithelial cells of the larval mid-gut have chromosomes possessing the salivary gland chromosome characteristics.

DIFFERENT ACTION OF AUXIN-A AND OF HETERO-AUXIN (PRELIMINARY NOTE)

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1. *Light Growth Response.*—It is well known that unilateral growth hormone application to young coleoptiles and hypocotyls causes negative curvatures (growth substance curvatures) in these organs. Light affects these curvatures as has been shown in an earlier paper (Van Overbeek 1933) for the hypocotyls of Raphanus. Light also has an effect on the growth substance curvatures of Avena coleoptiles, as will be shown below.

Etiolated *Avena* seedlings were decapitated twice with an interval of

TABLE 1

INACTIVATION OF HETERO-AUXIN AND AUXIN EXTRACTED FROM CORN MEAL BY SECTIONS OF AVENA COLEOPTILES. MEAN VALUES OF 12 PLANTS. TWO HOURS

HETERO-AUXIN STARTED WITH	HETERO-AUXIN LEFT OVER	% INACTIVATED	AUXIN-A AND B STARTED WITH	AUXIN-A AND B LEFT OVER	% INACTIVATED
12.1	8.8	18	10.7	4.5	48
11.3	10.3		10.3	6.3	

$1^1/_2$ hours between both decapitations. Immediately after the second decapitation agar blocks containing pure auxin-a[1] were applied unilaterally, and the plants were exposed uniformly *on all sides* to light of water-cooled, incandescent lamps. The exposure was continued for 110 minutes after the blocks had been put on; at this moment the experiment was stopped

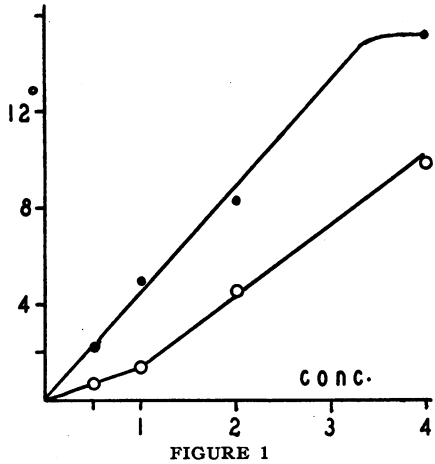

FIGURE 1

Growth substance curvatures of twice decapitated Avena coleoptiles; in dark (black dots) and uniformly exposed on all sides (open circles). PURE AUXIN-A. Abcissa: concentration of the auxin-a. Ordinate: curvature in degrees. Light intensity about 3000 M.C. Mean values of 36 plants. Time: 110 minutes. Temperature: 21°C.

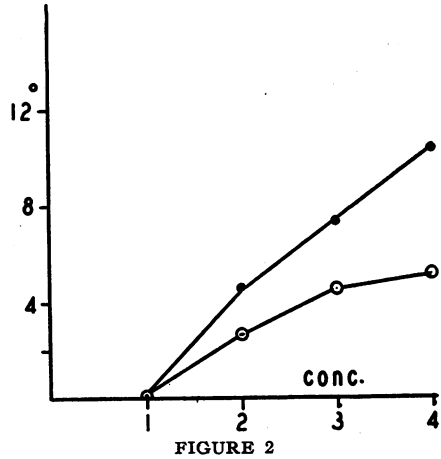

FIGURE 2

Growth substance curvatures of twice decapitated Avena coleoptiles; in light and dark. AUXIN EXTRACTED FROM CORN MEAL. Light intensity: about 500 M.C. Mean values of 24 plants. Time 90 minutes. Temperature: 23.5°C.

and the curvatures photographed. The results are shown in figure 1. *The growth substance curvatures of the coleoptiles that had been exposed are smaller than those of the non-exposed controls.* Figure 2 shows a similar experiment, but instead of pure auxin-a an active product extracted from ground corn was used. This active product probably is auxin-a and b, as expected from results obtained by Kögl, Erxleben and Haagen Smit (1934).

The time between the moment of g.s. application and photographing of the curvatures was 90 minutes in this experiment. This result was the same as obtained in the experiment with pure auxin-a, viz., the curvatures of the exposed plants are smaller than those of the non-exposed ones.

TABLE 2

INACTIVATION OF HETERO-AUXIN AND AUXIN EXTRACTED FROM CORN MEAL BY SECTIONS OF RAPHANUS HYPOCOTYLS. MEAN VALUES OF 12 PLANTS. TWO HOURS

HETERO-AUXIN STARTED WITH	HETERO-AUXIN LEFT OVER	% INACTIVATED	AUXIN-A AND B STARTED WITH	AUXIN-A AND B LEFT OVER	% INACTIVATED
10.5	6.5	30	8.0	4.2	50
10.5	8.1		8.0	4.0	
8.7	5.6	20	8.9	3.6	64
7.4	7.4		9.3	3.0	

However, if in the above experiment the auxin-a was replaced by hetero-auxin[2] no difference between the growth substance curvatures obtained in light and darkness was found. Hence *the growth inhibition of Avena coleoptiles due to exposure to light does not seem to occur when the actual growth hormone is hetero-auxin instead of auxin-a.*

2. *Destruction.*—If sections of coleoptiles, etc., from which the growth substance has been removed, are put with their basal cut surface on agar blocks containing a certain amount of g.s., enzymes from these sections inactivate some of the g.s. in the blocks (Van Overbeek 1935). Table 1 shows the results of a destruction experiment in which the inactivation of auxin-a and hetero-auxin by sections of Avena coleoptiles is compared. Table 2 shows the same for sections of Raphanus hypocotyls. The experiments were performed in a dark room. In either case *the auxin-a is considerably more inactivated than the hetero-auxin.*

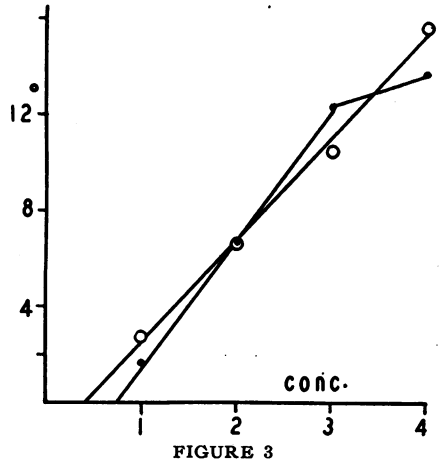

FIGURE 3

Growth substance curvatures of twice decapitated Avena coleoptiles; in light and in dark. PURE HETERO-AUXIN. Light intensity, time and temperature the same as in figure 2. Mean values of 12 plants.

A more detailed description and a possible explanation of the above phenomena will be given in a more extensive paper.

[1] The pure auxin-a was supplied by Prof. F. Kögl and Dr. A. J. Haagen Smit; the experiments with it were performed in Utrecht (Holland) at the botanical laboratory of the university during the beginning of 1934.

[2] The pure hetero-auxin was supplied by Drs. K. V. Thimann and J. B. Koepfli.

Kögl, F., Erxleben, H., and Haagen Smit, A. J., *Hoppe-Seyler*, **225**, 215 (1934).
Van Overbeek, J., *Rec. trav. bot. neérlandais*, **30**, 537 (1933).
Van Overbeek, J., *Proc. Nat. Acad. Sci.*, **21**, 292 (1935).

THE DOUBLE MOTOR INNERVATION OF A CRAYFISH MUSCLE

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Several investigators have noted that the muscles of the claws of crustaceans can react in two different ways, to which Lucas[1] assigned the names of twitch and slow contraction. Each of these would have, according to to him, a different nerve muscle system. Other investigators[2,3,4] have shown that his experiments were not conclusive on this point. The present paper is an investigation of this matter.

We used the adductor muscle of the claw of Cambarus clarkii. Single motor axons were prepared as follows. The nerve is exposed in the meropodite and then just submerged in an adequate physiological solution. Under a binocular microscope the nerve is then divided with sharp pointed needles into bundles. Each bundle is in turn lifted out of the fluid on micromanipulated electrodes and stimulated faradically in order to find out in which bundle the motor axons run. The ineffective bundles are discarded and the effective one is again divided and tested. This process goes on until the motor axons alone are left.

In a large number of preparations it was found that two and not more than two motor axons could be demonstrated for the adductor muscle. Both axons belong to the largest fibres of the nerve bundle in the meropodite; one is always a little thinner than the other. The mean value for the thicker fibre was 55 μ, for the thinner one 38 μ. It was possible to separate these two axons, which in most of the preparations run close to each other, and to stimulate them separately. It was then shown that each has a different function; the larger of the two evokes the twitch, and can be stimulated with a single induction shock; the thinner one elicits the slow contraction. No effect either mechanical or electrical was found in the muscle upon stimulation of the thinner fibre with a single induction shock. After the first few stimuli each stimulus is followed by a muscle action cur-