Since heteroauxones produced by non-gall-forming organisms incite tumors in plants not parasitized by these organisms and since wounding alone leads to tumor production, it appears that gall production by a particular parasite in a particular host is initially conditioned by factors determining specificities of parasitism.

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SALT ACCUMULATION AND POLAR TRANSPORT OF PLANT HORMONES[1]

IT is a well-established fact that a number of ions may be taken up by plant cells against a concentration gradient, or in other words that many cells are able to perform concentration work. The physico-chemical processes responsible for this concentration work are not generally understood, but the experiments have shown that the energy is ultimately furnished by oxygen respiration, in the absence of which no ion accumulation is possible. If the internal concentration of a given ion is plotted against its concentration in the surrounding medium, a more or less logarithmic relationship is obtained. In order to compare the accumulation process with polar hormone transport, it is advantageous to formulate the former as follows: Accumulation consists in the uptake of ions by the cell to such an extent that upon reaching the steady state the internal concentration is increased above that of the surrounding medium by a definite *amount*. At very low external ion concentrations the equilibrium concentration inside (steady state) may not be reached within the experimental period, which would then account for the initial parabolic rise in the accumulation curve. But from the data of Hoagland and Davis, and Collander for Nitella, and of Steward for potato tuber cells it is evident that for each set of conditions (temperature, rate of respiration, sugar content of cells) there is a constant increment independent of outside concentration. This means that for one given set of conditions the internal ion concentration may be calculated from the external concentration plus a certain amount. Thus the accumulation mechanism is able to raise the internal concentration to a given height above its surroundings. This makes it clear why no constant "accumulation ratio" is found.

The polar transport of auxin in the living plant behaves in a similar way. It may be defined as the concentration of auxin (an organic acid) from apex towards base of each cell. It does not seem that there are theoretical objections against suggesting a homology between concentration from outside towards inside and concentration from apex to base of a cell. In addition, the facts are in accordance with this view. The accompanying graph shows the amount of indole-3-acetic acid transported in two hours through Avena coleoptile sections (4.2 mm long), as a function of the original concentration applied to one end of the sections. It will be seen that the amount transported from apex to base (normal transport) increases almost linearly with the logarithm of the applied indole acetic acid concentration. Beyond 1 mg/cc the amount transported decreases, probably due to toxicity, proving that the observed values are not caused by "leakage" through vessels or along the surfaces of the sections. The curve for transport from base to apex (inverse transport) is exactly like the normal transport, except that the applied concentrations must be 100 times as high to give numerically the same transport. This means that at each given concentration a certain amount *more* of indole acetic acid is transported in the normal direction than is transported in the inverse direction or, in other words, that the polar auxin transport mechanism handles a constant amount of indole acetic acid independent of the existing gradient. This is in direct parallelism with ion accumulation, in which also a given amount more of ions are moved from outside towards inside of cell than are moved in the reverse direction, independent of the external concentration.

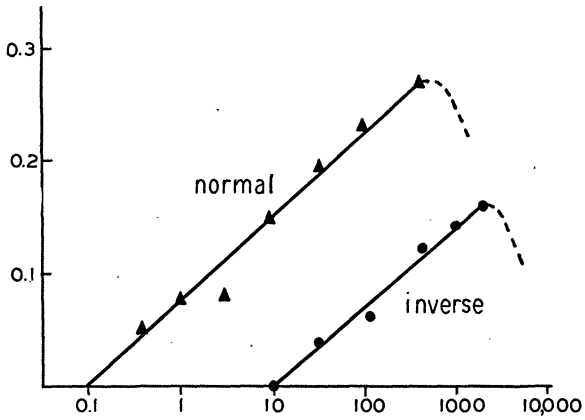

FIG. 1. Amount of indole-3-acetic acid (ordinate) transported in 2 hours through 6 Avena coleoptile sections, from apex towards base (normal) and from base towards apex (inverse), as a function of the applied concentration in mg per l (abscissa).

In addition it might be mentioned that the fact that the auxin concentration must be 100 times higher at the base than at the apex to get equal amounts trans-

chloride, amyl alcohol test. The color reaction characteristic of β-indoleacetic acid (heteroauxin) was obtained, indicating that this substance or a closely related indole compound is the heteroauxone produced by *P. tumefaciens*. We are indebted to our colleague, Professor F. C. Koch, of the department of biochemistry, for advising us and checking these tests.

[1] Published as a report on Work Project No. 6062, Official Project No. 65-3-5380, conducted under the auspices of the Works Progress Administration.

ported agrees very well with what is known about the effect of auxin on root formation. The induction of roots on cuttings by basal application of indole acetic acid requires at least 100 times higher concentration than does apical application.

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THE GREEN MUSCARDINE FUNGUS ON THE PERIODICAL CICADA

IN connection with special work by the senior writer in the Department of Entomology, University of Maryland, on the periodical cicada, *Magicicada septendecim* (L.), it is of especial interest to note that the green muscardine fungus (*Metarrhizium anisopliae* (Metsch.) Sorokin) was found on this insect in the spring of 1936.

On May 22, 1936, Mrs. P. W. Wetmore, Takoma Park, Md., brought to the senior writer two live nymphs of the periodical cicada, both of which proved to be attacked by a fungus. The nymphs were sluggish and had failed to molt. Otherwise they appeared normal with no evidence of infection. When examined microscopically, however, abundant mycelium of a fungus with septate mycelium was found in them. Later, other similar specimens were collected on the ground from the same location. Four dead nymphs also were found in the tunnels. These latter were covered with fairly abundant creamy-white mycelium. This mycelium was transferred to potato-dextrose agar and to nutrient beef agar on which the fungus grew readily and subsequently sporulated abundantly. It also sporulated readily on rice kernels. The fungus on diseased nymphs placed in Petri dish moistchambers also sporulated abundantly in 5 to 19 days. The sporulating fungus was olive-green in color. From the microscopical characters of the spores and sporophores from these various sources, it was evident that the fungus was *Metarrhizium anisopliae* (Metsch.) Sorokin. The spores measured 1.8–4.5 × 7.8–12.8 μ, chiefly 3–3.8 × 9.7–11.3 μ. On the basis of these measurements, apparently the fungus is the long-spored form referred to by Delacroix,[1] Friederichs[2] and Johnston,[3] and named *f. major* by Johnston.

Apparently the short-spored form of *M. anisopliae* was found in Java on large singing cicadas by v. Höhnel,[4] who described the fungus as a distinct species, *Penicillium cicadinum*. Petch[5] transferred this species to the genus *Metarrhizium*, making the combination *M. cicadinum* (v. Höhnel) Petch. However, Petch, who also gives a literature summary, prefers to consider *M. cicadinum* as a synonym of *M. anisopliae*. This view seems tenable. The Java fungus, however, apparently represents the short-spored form of *M. anisopliae*, as its spores are described as 1.5–2 × 5–6 μ, rarely 7 μ.

Healthy nymphs and healthy adults were artificially inoculated with spores from the pure cultures of *M. anisopliae* kept in moist Erlenmeyer flasks, and both nymphs and adults became diseased, the nymphs being more susceptible than the adults. The fungus was readily reisolated. However, the fungus did not sporulate on the adults. Later, newly hatched nymphs also were inoculated in Petri dishes and these young nymphs proved to be unusually susceptible.

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THE EFFECT OF REPEATED CORTIN INJECTIONS UPON RENAL EXCRETION IN THE NORMAL ORGANISM[1]

IT has been reported[2] that large amounts of cortin produce a differential effect upon the excretion of electrolytes in normal human beings. A further study of these effects has been made in normal dogs.

Normal adult female dogs were fed a constant diet consisting of a mixture of beef heart, Purina chow and 2 g of NaCl daily. The dogs were fed at the same time every day, which was nine hours before the beginning of the test period. They were allowed as much water as they desired, except on the test days. During the tests the dogs were kept in metabolism cages and at three-hour intervals were catheterized and given 100

TABLE I

RENAL EXCRETION IN A DOG DURING THE FIRST SIX HOURS FOLLOWING THE INTRAVENOUS INJECTION OF CORTIN*

Date	Injection	*Vol.* cc	*Na* m.Eq.	*Cl* m.Eq.	*K* m.Eq.
1–21–37	Control	194	10.17	12.57	4.34
1–23–37	Control	184	6.18	9.39	3.95
1–25–37	Cortin	**130**	**1.24**	**4.83**	**6.25**
1–27–37	Cortin	**90**	**3.84**	**6.45**	**6.82**
1–29–37	Control	256	10.18	15.28	4.92
2– 3–37	Cortin	**132**	**5.67**	**9.87**	**7.22**
2– 5–37	Control	172	7.72	11.59	5.05
2–15–37	Cortin	**222**	**7.15**	**13.42**	**6.22**
2–26–37	Control	206	9.66	9.38	6.04
3– 4–37	Control	147	8.37	12.40	6.35
3– 9–37	Cortin	**243**	**13.46**	**18.52**	**6.07**

* Heavy-faced type, after cortin; light faced type, control. (20 cat units in 0.5 cc.)

[1] From the department of physiology, the Ohio State University, Columbus. Aided by a grant from the Rockefeller Foundation.

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