tities of the active ingredient; if this administration is continued for a considerable period of time the fly becomes sterile. Up to a certain point, however, the fly retains its inherent ability to produce eggs, provided it is supplied with suitable food.

Some interesting speculations arise from these results. The fact that these arsenates suppressed egg production in all four species of Diptera selected for laboratory testing because they were readily available, suggests to us that arsenates may influence the fecundity of many species, or other orders of insects, or even other classes of animals.

The question may then be raised whether arsenicals have influenced the establishment and development of parasites and predators in orchards during the many years that these chemicals were used in very large quantities. Because we have found that four species of Diptera, the only ones tested, are influenced in this way, it seems possible that parasitic and predaceous Diptera may be similarly affected.

H. T. Stultz of this laboratory studied the parasites of the eye-spotted bud moth, *Spilonota ocellana* (D. and S.), for many years and observed on numerous occasions that the braconid *Agathis laticintus* (Cresson), although almost absent from orchards sprayed regularly with arsenicals, would frequently appear in substantial numbers on trees so treated if there were unsprayed apple trees nearby. The parasite developed to the adult stage in the sprayed trees but never increased in numbers until the use of arsenicals was discontinued. Unfortunately no examination of the ovaries of these braconids was made and there is no proof that they were not killed directly by the arsenates; however, Stultz has suggested that the tissues of the larvae of *S. ocellana* may have contained sufficient arsenic to affect reproduction in *A. laticintus*.

These tests emphasize the necessity for determining more exactly the effects of pesticides on the pests against which they are directed; a mere counting of living or dead, or of survivors, is not enough. They suggest also the desirability of considering more precisely the effects of the applied pesticides on the faunal complex as well as on the higher animals which may come in contact with the chemical (*4*).

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Gibberellin: Effect on Diffusible Auxin in Fruit Development

Abstract. *Diffusible auxin is not present in tomato flowers at anthesis, but significant amounts can be obtained after the plants are treated with gibberellin. The early growth of the ovary in plants treated with gibberellin corresponds closely with growth after pollination and fertilization; the amounts of diffusible auxin are not significantly different over a period of 22 days.*

One of the more remarkable effects of gibberellin in plant growth is the induction of parthenocarpy by smaller quantities than those required for the hormone, indole-3-acetic acid (IAA) to produce the same effect. In tomatoes, parthenocarpy is induced by as little as $10^{-5}M$ gibberellic acid (GA) in lanolin, while $10^{-2}M$ IAA is the minimum effective application. Treatments with 10 μl of $3 \times 10^{-4}M$ solutions of nine gibberellins cause a significant increase in the diameter of tomato fruits (*1*). Several investigators have suggested that gibberellin may be a principal factor along with IAA in the control of fruit development (*2*).

Although there are reports of an increase in extractable auxin in plant tissues after treatment with gibberellin (*3*), one investigation showed no change in diffusible auxin after treatment (*4*). Treatment with GA causes a doubling or tripling of diffusible auxin in stem apices of peas and a tenfold increase in stem apices of sunflowers corresponding with the increased growth of the plants (*5*). Since the stimulus of pollination and fertilization also causes an increase in diffusible auxin in the ovary (*6*), we have examined the effect of treatment with GA on diffusible auxin in ovary tissue of the tomato.

Flowers of the Waltham Forcing variety of tomato (*Lycopersicon esculentum* L.) were emasculated at anthesis and 1 day later were treated with GA (85 percent, in lanolin at concentrations of $3 \times 10^{-4}M$ and $3 \times 10^{-3}M$. At intervals of 28 and 51 hours the flowers were cut at the base of the calyx and placed on blocks of 1.5 percent agar, 2 by 2 by 2 mm, in a moist chamber under 100 lu/ft^2 of cool white fluorescent light. Diffusion of auxin into the agar blocks took place during a period of 2 hours. The auxin content of the agar blocks was then measured by the standard Avena curvature test (*7*). The IAA concentration equivalent to the curvature was determined from curvatures induced by $2 \times 10^{-7}M$, $6 \times 10^{-7}M$ and $2 \times 10^{-6}M$ concentra- of IAA.

Four experiments gave essentially the same results. Although diffusible auxin is present during early stages of flower development, at anthesis there is none; without pollination and fertilization the flower abscisses. Within 28 hours after treatment with $3 \times 10^{-4}M$ and $3 \times 10^{-3}M$ GA there is an equivalent IAA concentration of $2.7 \times 10^{-7}M$ and $3.2 \times 10^{-7}M$ respectively. Fifty-one hours after treatment with GA the equivalent IAA concentration is $4.6 \times 10^{-7}M$ for both treatments. No diffusible auxin was obtained from ovaries 28 and 51 hours after treatment at anthesis with plain lanolin. The amount of diffusible auxin in the ovary apparently does not depend on the concentration of GA applied.

The effect of GA treatment was also compared with the effect of pollination and fertilization by measuring the diffusible auxin in ovaries during several

Table 1. Diffusible auxin obtained from normally developing tomato fruits and ovaries treated with gibberellic acid. The values at 22 days were obtained by using an agar block 4 by 2 by 2 mm for diffusion and cutting it into 4 blocks 2 by 2 by 2 mm for assay.

Treatment	Diameter of ovary (mm)	Curvature (degrees)	Equivalent IAA concentration ($10^{-7}M$)
3 days after treatment			
Pollinated	4.1±0.4	6.2±1.4	3.4
$3 \times 10^{-4}M$	3.8±0.1	8.6±1.1	4.9
$3 \times 10^{-3}M$	4.1±0.3	8.7±1.2	5
6 days after treatment			
Pollinated	9.2±0.6	13.±0.7	7
$3 \times 10^{-4}M$	8.0±0.5	9.9±0.7	4.6
$3 \times 10^{-3}M$	9.7±0.4	11.9±0.9	6.2
15 days after treatment			
Pollinated	29.0±1.1	16.0±1.6	14
$3 \times 10^{-4}M$	26.7±1.9	16.6±1.5	15
$3 \times 10^{-3}M$	28.1±1.1	17.3±1.6	16
22 days after treatment			
Pollinated	28.3±2.0	14.0±1.2	41
$3 \times 10^{-3}M$	32.3±3.8	11.2±1.7	26

weeks after treatment and in normally developing fruit. All ovaries developing as a result of GA treatment were examined for parthenocarpy. The data in Table 1 are the average curvatures with standard errors for groups of 8 to 10 flowers. They show that the growth of the ovary treated with GA corresponds closely with the growth after pollination and fertilization and the levels of diffusible auxin are not significantly different. Again there is no significant difference in the amount of diffusible auxin after treatment with the two concentrations of GA.

Thus, the stimulus of pollination in fruit growth arises from a gibberellin in the pollen which results in the production of diffusible auxin in the ovary tissue. An extract of 8 grams of fresh stamens of tomato was made by the procedure of MacMillan *et al.* (*8*) as modified by Lang and Reinhard. Initial extraction was made with methanol at 5° to 7°C. The methanol was then evaporated and the residue was acidified (*p*H 3) with 5*N* HCl, saturated with NaCl, and extracted with ethyl acetate. The ethyl acetate fraction was extracted with a buffer of *p*H 8. The water phase was acidified and extracted repeatedly with ethyl acetate. The ethyl acetate was then evaporated and the residue was dissolved in 4 ml of water. Maize seedlings, dwarf-5 (from seed kindly supplied by Dr. B. O. Phinney), were treated with 0.2 ml of the crude extract and its dilutions to determine the presence of gibberellin-like substances (*9*). Treatment with the extract induced an elongation of 13.0 mm in the first leaf sheath of the seedlings corresponding to an equivalent GA concentration of $1.3 \times 10^{-5} M$. The elongation after treatment with the extract diluted 10 times was 5.4 mm corresponding to $5 \times 10^{-7} M$ GA and after treatment with the extract diluted 100 times the elongation was 2.9 mm corresponding to $9 \times 10^{-8} M$ GA. The amount of gibberellin-like substance in the stamens is 11 μg per gram, fresh weight.

The gibberellin-like substance of young developing seeds (*10*) similarly may have an effect on the production of auxin by such seeds during fruit growth (*11*). The effect of GA on the mechanism for auxin production in the ovary (*12*) is still under investigation.

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Olfactory Epithelium: Unitary Responses in the Tortoise

Abstract. *In the tortoise,* Gopherus polyphemus, *single unit spikes in the olfactory epithelium in response to amyl acetate were positive relative to the slow potential. The number of spikes in a response train was 4 to 15, the duration 3 to 4 msec, the height 0.5 to 2 mv. The height of successive spikes in a train decreased. The decrement in height, the number, and the frequency of spikes changed with the strength of the odor.*

Recently a few workers began to study the activity of single receptor units in the olfactory epithelium with microelectrodes (*1–3*). Gesteland (*3*) stated that specially designed metal microelectrodes were necessary for recording spikes from the olfactory epithelium.

In our experiments on single unit responses of the olfactory epithelium, we found spike discharges in response to odor clearly by microelectrodes filled with 3*M* KCl. The tortoise, *Gopherus polyphemus,* was used to compare the results with those of Tucker (*4, 5*), who studied responses of olfactory nerve twigs. The tortoise was anesthetized with ethyl urethane, and its head was stabilized by a holder. After parts of the skin, bone, and cartilage over the olfactory cavity had been removed, a small hole 5 mm in diameter was made in the dorsal olfactory mucosa. The olfactory epithelium was about 0.4 to 1.0 mm thick and its color ranged from yellow to brown. The microelectrode, less than 1 μ in tip diameter and filled with 3*M* KCl, was inserted with a micromanipulator through the hole into the olfactory epithelium on the septal wall. Odors of various strengths were applied to the epithelium through 1 mm Teflon tubing from a syringe or through glass tubing from a continuous flow olfactometer.

The slow potential produced by olfactory stimulation was always negative, as was that of frog and toad (*2, 6*). Its height decreased gradually as the tip of the microelectrode was lowered from the surface of the mucus to the basal membrane. In one experiment the height of the slow potential was reduced by half at a depth of 200 to 250 μ (1/10 amyl acetate). Spike discharges of a single receptor unit in response to odor were positive relative to the slow potential (Fig. 1*A*) and were monophasic or diphasic in shape. The height of spikes was 0.5 to 2 mv, and the duration was 3 to 4 msec. The number of spikes discharged by one odorous puff was usually 4 to 15, and the spike heights decreased in succession (Fig. 1*A* and *B*). Spikes were recorded stably for about 1 hour. The decrement of spike height, the number of spikes per stimulus, and the average frequency all increase with the increasing strength of the odor (Fig. 2).

For example at amyl acetate concentrations of 1/100, 1/50, 1/10 (fraction of saturation), which gave odors of different strengths, the average frequency of spikes per second was 7.8, 8.3, and 14.0, respectively.

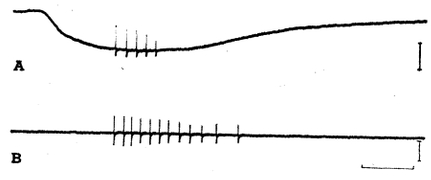

Fig. 1. Single receptor unit response of the olfactory epithelium. *A*, Response recorded through d-c amplifier; 0.5 ml puff of 1/50 amyl acetate. *B*, Response recorded through a-c amplifier; 0.5 ml puff of 1/10 amyl acetate. Calibrated voltage, 1 mv; time trace, 0.5 second.