were synthesized and tested for the biological effects indicated by the present hypothesis. Results of the tests on mice and on the seeds of oat (*Avena sativa* L.), a monocotyledonous plant, and those of yellow charlock (*Brassica sinapis*), a dicotyledonous plant, are shown in Table 1.

In germination experiments the compounds were applied on a filter paper enclosed between two watch glasses and kept moist by a solution of a concentration of 1 g mol/million ml distilled water. The insolubility of compounds 5 to 8 called for treatment as follows: The weighed quantity was dissolved in ½ ml ethanol and 99½ ml distilled water quickly added to the flask, which was shaken vigorously.

Results of this investigation show a broad agreement with the postulated hypothesis in regard to the anticonvulsant effect and less strikingly the selective growth-inhibitory effect. However, neither phenylurethane nor its analogs compare well in their anticonvulsant effect with phenobarbital sodium, a well-known anticonvulsant structurally unrelated to the present series. Compounds 3 and 5 are the most potent of the series, both in inhibiting germination and in anticonvulsant activity; it would be of interest to find out if they mimic the third biological effect, namely, the retardation of experimental tumors, reported to be shown by phenylurethane and isopropyl phenylcarbamate (*6*).

This investigation is being continued.

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The Recording of Flight Movements in Insects[1]

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In studies of insect flight, wing rates have been widely used to gauge physiological activity. As these may reach frequencies of 1000/sec (*1*), an inexpensive, accurate, and objective recording method is not easy to find. Of the methods discussed by Chadwick (*2*), the stroboscopic has been the choice in several recent studies (*3, 4*). Where continuous records of frequency are required, a crystal pickup may be used to convert thoracic movement into electrical current (*5*). The discoveries of Pringle (*6*) and Roeder (*5*) have stimulated interest in the neuromuscular mechanisms of insect flight and have made necessary the development of superior methods of recording flight movement.

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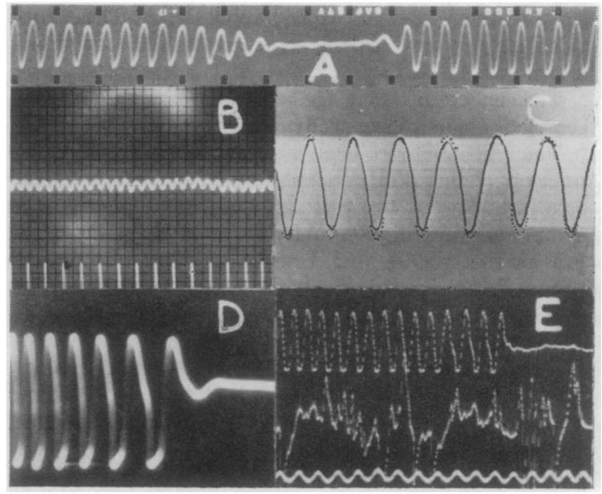

Fig. 1. *A*: Record of the movements of the scutellum of a fly during a stop and start; time calibration by film perforations, .014 sec. *B*: Electrostatic record of wing movement in a chironomid midge; time calibration, 1/300 sec. *C*: Superimposed simultaneous records of wing movements obtained by electrostatic method and of scutellum movements recorded by reflected light; solid line traced over cathode beam record; dotted, over light beam record. *D*: Record of movements of scutellum during a fast stop. *E*: Simultaneous records of wing movements by electrostatic method (upper trace) and of thoracic electrical activity (middle trace) during a fast stop; time calibration, 1/60 sec.

With insects of reasonable size, flight movements may be recorded photokymographically with a slit camera, using a beam of light reflected from a fragment of silvered cover slip sealed to the scutellum. In flies, the movements of the scutellum reflect closely the changes in length of the indirect muscles and the movements of the wings (*7*). Where continuous records are required, an Army surplus GASP 16 mm gun camera can be used, provided the framing mechanism is removed and additional film guides are installed in the magazine. This gives a constant maximum film speed of 520 mm/sec, attained in 1/10 sec. Fig. 1, *A* is a record of movements of the scutellum in normal flight; Fig. 1, *D*, in a fast stop.

A more convenient method that records wing movement and may be used with the smallest insects has been developed. This depends on the fact that moving electrostatistically charged bodies may act as variable condensers. The capacity charges induced by the rapidly moving, charged wings of an insect may be amplified and photographed from the screen of an oscillograph. The necessary charge is induced on the wings by the presence of a charged nonconductor. Voltages as high as 10 mv may be obtained. Even the frequency of flight movements in wingless insects has been recorded by this method. The wing frequency of untethered insects flying about in a jar may also be obtained. Fig. 1, *B* shows wing movements of 500/sec in a chironomid midge.

The position of the electrodes determines to some extent the nature of the record. The most accurate record of wing position is obtained if the leads are placed so that the wings move either toward or away from them. Experiments were performed to determine how closely the record gives the instantaneous wing position during a cycle. For this a simple camera was constructed in which a piece of film could be pulled past two small slits opposite each other. The antihalation back was removed from the film with hypo so that, through the slits, two simultaneous records could be made. The cathode ray and the light beam from the scutellum were superimposed through the slits, and the film was pulled past when the insect began to fly. The record (Fig. 1, *C*) shows almost perfect correspondence; the solid line is traced over the wing movement record and the dotted line over the scuttellar movement record.

No methods of recording flight movements previously used could demonstrate the gradual development of a fast stop as shown in *D,* a record of scutellar movements, and *E,* a record obtained by the electrostatic method. The fast stop is reflected in changes in the thoracic potentials (*E,* middle trace). The electrostatic method, because it converts movement into electrical voltage, permits comparison with other parameters that can likewise be made to produce electrical change.

There may be some question as to whether this method records position at all movement frequencies. This can be determined directly in a specific case—at least in flies—by comparison with scutellar movements as demonstrated in this report. A simpler method of obtaining the approximate phase relation between wing position and electrical voltage is to set one input lead so that a wing just touches it when the wing is at its extreme excursion. This puts a small pip on the record at the instant the wings reverse direction. If the pip occurs at a negative or positive voltage peak, the record shows wing position. Adjustment of the polarity of the leads should be made to make a positive peak correspondence to the extreme up position and a negative peak to the extreme down position. If only wing frequency is desired these precautions are not necessary.

This method has wide application in studies of insect flight and, by comparison with the direct recording of scutellar movements, will give instantaneous position, direction of movement, and velocity during rapid flight with an accuracy sufficient for many purposes.

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Paleobotanical Investigations in Naval Petroleum Reserve No. 4, Alaska[1]

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During the summer of 1951 a party from the University of Michigan spent several weeks looking for fossil plants in Naval Petroleum Reserve No. 4 in northern Alaska. The project was sponsored by the Office of Naval Research, and the Arctic Research Laboratory at Point Barrow furnished field equipment and transportation within the reserve. The party, consisting of the writer, with Richard A. Scott and J. Stewart Lowther as assistants, arrived at Point Barrow on July 3. Most of the work was done along the Colville River at the southern edge of the reserve, but a short visit was made to the coal mine at Atkasuk, about 80 miles south of Point Barrow on the Meade River. In addition to collections made by our party, one was made by W. V. Mayer at East Oumalik, which is on the northern edge of the Arctic Plateau between Point Barrow and the Colville River.

Along the Colville River, two stretches totaling about 120 miles were explored for fossil plants, using an 18-ft canvas boat for transportation. The longest of these stretches was that between the mouths of the Etivluk and Killik rivers. The rocks along this part of the Colville River belong mostly to the Nanushuk group, and the plants were found in the Chandler formation, the nonmarine part of the group which intertongues with the marine Umiat formation. Then along a shorter stretch of the river, beginning at Umiat, which is about 50 miles downstream from the mouth of the Killik River, extensive exposures within the Colville group were examined. Formerly regarded as Upper Cretaceous, the Nanushuk group is now believed by geologists who have recently worked in the reserve to be Lower Cretaceous. The Colville group has been retained in the Upper Cretaceous, where it was originally placed (*1*).

Fossil plants were collected at 13 localities in the Chandler formation between the places where the Etivluk and Killik rivers join the Colville. The flora of the Chandler formation is a typical late middle Mesozoic one, consisting of conifers, cycadophytes, ginkgoes, ferns, and a few fragmentary dicotyledonous leaves. The latter are always a minor element, so minor, in fact, that at the best locality none were found, although they were diligently looked for. The most abundant conifers are *Sequoia*-like forms represented by cones and foliage, and foliage of ancient members of the Taxaceae. Well-preserved silicified coniferous wood was found at several places. *Podozamites* is very abundant, and the Ginkgoales are represented by the extinct genus *Baiera* and deeply dissected leaf-forms of *Ginkgo*. The most prevalent

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