Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

ROY MAGRUDER

U. S. HORTICULTURAL FIELD STA.
BELTSVILLE, MARYLAND

MAGNESIUM SULFATE—A NEW INSECTICIDE

DR. V. R. HABER discovered the insecticidal properties of magnesium sulfate (Epsom salts) several years ago. His tests showed that $MgSO_4$ used as a spray, in the proper concentration, constitutes an effective control for the Mexican bean beetle (*Epilachna corrupta* Muls.). This spray has many advantages over arsenical sprays, in that it is easily applied, easily removed in preparing beans for cooking, and is harmless to humans if ingested.[1]

Hawkins, in a paper on the wheat wireworm (*Agriotes mancus* Say), finds magnesium sulfate and magnesium chloride toxic to this form.[2]

The following work on grasshopper control by $MgSO_4$ is the outgrowth of Dr. Haber's suggestion. Since there were neither time nor facilities to make complete tests, the results are only preliminary.

Grasshoppers, confined in small insect cages, four per cage, were fed with bran baits made of bran, molasses and water, with $MgSO_4$ added for test groups. The control groups received the bait with no poison, while others received a 5 per cent. arsenic bran bait. The test groups received the standard bait with 5 per cent., 10 per cent., 15 per cent., 20 per cent., 25 per cent. and 30 per cent. $MgSO_4$ added.

From comparisons of the mortality rates among the different groups, the following formula for a grasshopper bait is proposed:

Bran	60 per cent. to 65 per cent.
Molasses	15 " "
$MgSO_4$	20 " " to 25 " "
Water	Enough to moisten.

This formula seems to be just as effective as the 5 per cent. arsenic bait, it is cheaper, and it is absolutely harmless to humans, cattle, swine and poultry or other birds.

These results indicate that $MgSO_4$ may be an insecticide of value for the control of mandibulate insects. As a spray, it could be used safely on many vegetables and fruits, with little danger to humans and domesticated animals eating such foods. It is cheap, easily dissolved and should be compatible with other insecticides. Entomologists with facilities for testing $MgSO_4$ as an insecticide against mandibulate insects should attempt to determine its value in the control of such forms.

HUBERT W. FRINGS
MABLE S. FRINGS

UNIVERSITY OF OKLAHOMA

ANATOMICAL NOMENCLATURE

AT the annual meeting of the American Association of Anatomists, held at the University of Toronto on March 26, 1937, Professor C. M. Jackson, chairman of the Committee on Anatomical Nomenclature, made the following statement.

An account of the establishment of a permanent International Commission on Anatomical Nomenclature was published in the Anatomical Record, 1936, vol. 67, No. 1, pp. 1–6. This Commission adopted the NA system of nomenclature as the basis for revision, and requested that any desired changes be submitted before September, 1937. (The NA list was printed in the Anatomischer Anzeiger, Ergänzungsheft zum Band 81, 1936.)

Accordingly during the present year our American Committee has studied the question as to what changes should be proposed. Many difficult problems are involved. While the committee has not yet reached a final decision, it has agreed upon some questions of general policy. One is that in order to reconcile conflicting views it will be desirable for the present to use synonyms for some of the terms, as (for example) many of those of position and direction.

Any member of the Association may propose desired changes in the terms listed by the NA, and our committee would be glad to have these proposals for consideration. As the time is short, any such proposals should be submitted promptly, with reasons therefor. It is hoped that the final report of nomenclature with the recommended changes can be formulated in time to submit it to the Executive Committee of the Association for review and criticism before it goes to the International Commission.

GEORGE W. CORNER,
Secretary

SPECIAL ARTICLES

PHOSPHORESCENCE OF CELLS AND CELL PRODUCTS

A BODY which continues to give off light for a visually observable period of time after exposure to radiation is generally said to be *phosphorescent*.[1,2] Phosphorescence of inanimate systems has been studied rather extensively;[3] little attention, however, seems to have been paid to the phenomenon in cells and cell products. Thus while phosphorescence of tissues was

[1] Personal letter from Dr. V. R. Haber.
[2] J. H. Hawkins, Maine Agr. Exp. Sta., Bull. 381, 1936, p. 120.

[1] R. A. Morton, "Radiation in Chemistry," 1928.
[2] S. E. Sheppard, "Photo-chemistry," 1914.
[3] P. Pringsheim, "Fluorescenz und Phosphorescenz," 1928.

noticed as early as the eighteenth century by Becchari, who found that " . . . if a person shut up in a dark room puts one of his hands out into the sun's light for a short time and then retracts it, he will be able to see the hand distinctly and not the other"[4] no further study seems to have been made until 1933. In that year Hoshijima[5] found that human bones, teeth, cartilage, nails and dried tendons as well as certain abnormal calcifications would phosphoresce following irradiation with a Hanovia quartz mercury lamp, while a number of tissues did not.

To determine whether the property of phosphorescence is wide-spread, various materials of biological origin were irradiated, at one centimeter distance from the edge of the tube, for ten-second intervals, with a mercury-argon discharge tube (emitting radiations, of which some 85 per cent. are of 2537A),[6] and the life of visible phosphorescence was observed with the 20–30 minute dark-adapted eye and recorded. Three to nine trials were made with each object and three subjects took part in the studies. In all cases the afterglow can readily be observed, even if the period of irradiation is reduced to one second or less, but it is more difficult to compare the life of visible phosphorescence in many of the materials; therefore the longer period was used throughout.

It was found that while frog cornea, lens, stomach, kidney, muscle, blood and skin of the back showed no observable phosphorescence, the skin of the belly of the frog and the skin of the back as well as the palm of the human hand emitted light for two to four seconds after irradiation. All the tissue products studied showed phosphorescence. Chitinous material (Limulus exoskeleton), silicious material (glass sponge) and cellulose materials (wood, leaves and flowers of several kinds) showed short-lived phosphorescence. Horny materials, such as human finger nails, bird bills and feathers (pelican) and a spongin sponge phosphoresced for as long as ten seconds or more. Calcareous materials, such as bones, shells (of mollusks) and teeth showed very long-lived phosphorescence (20 to 25 seconds), and strangely enough bean seeds phosphoresced for almost as long a time. In general, it may be concluded that tissues show little or no phosphorescence, but compact tissue products may be highly phosphorescent.

Live human teeth showed about the same life of phosphorescence as did dead teeth from the same individual; apparently the living constituents of the teeth have little to do with the after-glow in this case.

To determine which wave-lengths of light were effective in producing phosphorescence, several objects were irradiated with monochromatic light obtained by passing the radiations of a quartz mercury arc through a natural quartz monochromator. The intensity of the light was measured with a thermopile and galvanometer. The apparatus has been described in detail elsewhere.[7] The materials were irradiated and observed in the same manner as in the first set of experiments. It was found that very intense yellow light (5844A) excited no phosphorescence of teeth, bones and cotton, while blue (4350A) and violet (4050A) light of fair intensity induced just perceptible phosphorescence. All the ultra-violet wave-lengths tried excited phosphorescence, the shorter being most effective despite their low intensity; for while the intensities at λ's 3660, 3130, 3025, 2804, 2654 and 2537A were, respectively, 11.1, 8.5, 6.0, 1.0, 2.1 and 1.9 times the intensity at 2804A (12.54 ergs/sec./mm^2), the afterglow for the wave-lengths 3130 and shorter was 2 to 3 times that at 3660A for teeth and generally somewhat longer, when not markedly so, for cotton and bone. Thus the short ultra-violet is most effective, the long much less so and the visible region least effective in exciting phosphorescence in the objects tried.

There are two main groups of phosphorescent materials: (1) *organic materials,* such as dyes, of which Sheppard[8] says: " . . . all organic bodies possessing marked absorption bands in the ultra-violet seem capable of fluorescence in the dispersed medium or phosphorescence in a condensed condition, when excited by radiant energy of sufficient frequency"; (2) *inorganic salts,* such as the classic Lenard phosphors consisting of ZnS and CaS containing various metals as impurities. Some organic materials of biological origin such as starch and glucose, tested here, and gelatin, tested by Hoshijima,[9] even when chemically pure, show considerable phosphorescence. On the other hand, bone washed free of salts with HNO_3 is no longer phosphorescent.[10] In this case the inorganic salts are probably the phosphorescent agents. It is probable that both types of materials are responsible for biological phosphorescence, the constituent of greatest activity in any given case depending upon the composition of the material.

A. C. GIESE
P. A. LEIGHTON
STANFORD UNIVERSITY

[4] E. Darwin, "The Botanic Garden," p. 181, 1801.
[5] S. Hoshijima, *Sci. Pap. Inst. Phys. and Chem. Res. Tokyo* (*a*) 20: 109; (*b*) 21: 15 (1933).
[6] W. G. Leighton and P. A. Leighton, *Jour. Chem. Ed.*, 12: 139, 1935.
[7] A. C. Giese and P. A. Leighton, *Jour. Gen. Phys.*, 18: 557, 1935.
[8] S. E. Sheppard, "Photo-chemistry," p. 413, 1914.
[9] S. Hoshijima, *Sci. Pap. Inst. Phys. and Chem. Res. Tokyo,* 20: 109, 1933.
[10] *Ibid.*