agricultural science in bringing about more efficient exchange of research publications.

J. G. LEACH
H. MACY
C. H. BAILEY
MINNESOTA AGRICULTURAL EXPERIMENT STATION,
ST. PAUL, MINNESOTA

AUDITORY ACTION CURRENTS

IN a recent issue of SCIENCE and in subsequent publications[1], Wever and Bray have reported that action currents which were led off from the acoustic nerve and amplified were heard in a telephone as tones of the same pitch as the stimuli, a result obviously of great importance for auditory theory. Since then Adrian, and Davis and Saul have in brief notes reported the repetition of the results, although Adrian has not agreed in attributing the currents to the auditory nerve. We, too, have repeated these experiments under conditions which Wever and Bray specify as adequate, but when certain sources of error are excluded we have obtained only negative results.

In most of our experiments we have used a 5 stage amplifier, 3 stages resistance-capacity coupled and 2 power stages, transformer coupled. Tests showed that changes 20 μ V in the input circuit could be distinctly heard in the telephone. (One should like to know whether the amplification figures given by Wever and Bray for their apparatus refer to voltage or power amplification, and whether they represent the theoretical or measured amplification.) In our experiments we have used both metal hooks and cotton thread electrodes; have led off from auditory nerve, brain stem, inner auditory meatus and round window; have connected electrodes to amplifier over transformer and at other times directly to grid and filament; have used both decerebrated and undecerebrated cats—but always with negative results.

Our experiments demonstrated, however, the possibility of certain purely physical causes for Wever and Bray's results which seem not to have been excluded by their checks. They report having set up a telephone line between operating room and observation room and that, for purposes of comparison, the sound stimuli were introduced alternately into the transmitter and into the cat's ear. If this is done, unless the transmitter circuit is definitely broken when sounds are introduced into the cat's ear, it is obvious that the currents in the transmitter circuit can induce upon the input circuit of the amplifying system, as in the familiar cross talk between telephone lines. Wever and Bray's steps to exclude induction as a source of error refer only to the induction possible between the sources of sound stimuli and the electrodes, but not to the type just mentioned. The mere provision of screening does not assure the exclusion of all electric and magnetic induction effects. Screening might in some cases favor a coupling of the telephone and amplifying systems instead of hindering it.

Nor is the possibility of such sources of error necessarily excluded by the physiological checks performed by Wever and Bray. The primary, input circuit of their amplifier consists in part of the animal tissues between the electrodes. Changes in the electrical properties of the tissues as a result of various physiological changes, such as the restriction of the blood supply, death of the animal and destructions of various sorts, would also change the receptivity of the circuit for induced currents. So, for example, if the induced currents in the input circuit fall beneath a certain minimum as a result of increased impedance of the animal tissues, then these currents can not be transmitted over the transformer for amplification, and the sound signals would no longer be heard in the telephone.

Induction effects of the sort mentioned are not dependent upon the presence of a transmitter system as used by Wever and Bray. Other electrical instruments in which the sound stimuli can occasion currents or modifications of current which can in turn induce upon the amplifying system may also cause such errors. In many commercial and house telephone systems, the receiver circuit is closed, even when the transmitter is hung up. The telephone receiver, because of the magnetic field always present, can of course act as a transmitter and produce variations of current that may induce corresponding variations in the amplifier. Similar effects might be produced even by a loud-speaker or mirror galvanometer that happened to be standing nearby.

We believe that the possibility of such sources of error must be definitely excluded before the Wever and Bray effect can be conclusively attributed to action currents of the acoustic nerve.

GEORGE KREEZER
HANS DARGE
BERLIN, GERMANY,
OCTOBER 13, 1931

[1] E. G. Wever and C. W. Bray, "The Nature of Acoustic Response," *J. Exper. Psychol.*, 13, 373–387, 1930; E. G. Wever, "Impulses from the Acoustic Nerve of the Guinea Pig, Rabbit and Rat," *Amer. J. Psychol.*, 43, 457–462, 1931; SCIENCE, 71, 215, 1930.

THALLIUM POISONING AND SOIL FERTILITY

THALLIUM sulfate has potential destructive effects on vegetation which have not received adequate attention from those advocating its use in vermin control. It probably is not the intention of the Bureau of Biological Survey and other agencies practicing vermin control to bring about the enduring sterility of the soil upon which thallium sulfate baits have been used. But there is real danger that the practice will lead to such an end, as will be evident from the observation here noted.

Thallium sulfate baits were suspended on stakes at a height of a few inches above the earth on a grassy slope in the arboretum of the Hawaiian Sugar Planters Association Experiment Station.[1] This lies in the head of the Manoa Valley near Honolulu, a region of heavy rainfall. The baits, each containing about 0.5 gm of Tl_2SO_4[2] were set out in July, 1929. At the time of my inspection, July, 1931, there was below each stake a patch of bare earth, from one to three feet long and perhaps a third as wide, upon which all vegetation was killed soon after the baits were set out. *Not a single trace of plant life was or had been apparent on these areas during the intervening two years.* While no exact records have been made, there appeared to have been no diminution in the size of these denuded areas.

Thallium sulfate scattered or placed as bait ultimately reaches the soil, whether the bait is taken or not. Under our continental conditions, where rainfall is much less than at the locality here cited, thallium sulfate would presumably be even less rapidly removed from the soil by leaching. Continued scattering of thallium sulfate baits will presumably lead to:

(a) Complete denudation of numerous small areas of pasture or range land, leading to reduction of plant yield and also perhaps to erosion or blow-hole formation.

(b) General toxicity or complete sterility of cultivated land, which may be expected to destroy its agricultural value completely for an unknown period.

Any group or organization which allows or urges the extensive use of measures entailing the possibility, even, of such results incurs grave responsibility; and any owner of agriculturally valuable land should look well to his own future before allowing thallium compounds to be spread upon his soil.

S. C. BROOKS

DEPARTMENT OF ZOOLOGY,
UNIVERSITY OF CALIFORNIA,
BERKELEY

[1] The writer is indebted to Mr. E. L. Caum, of the Hawaiian Sugar Planters Association Experiment Station, for the invitation to visit the arboretum.

[2] This corresponds very closely to the amount of Tl_2SO_4 in "a handful" of barley treated with 1 lb. of Tl_2SO_4 per 100 lbs. of grain. Dilling has reported (*Ann. Appl. Biol.*, 13: 160–167, 1926) that N/600 Tl_2SO_4 completely and irrevocably prevents the germination of seeds of *Lepidium sativum*. More dilute solutions were not studied. On this bases it might be guessed that one bait, containing 0.5 gm of Tl_2SO_4, would under average conditions sterilize not less than half a cubic foot of soil. The observations here recorded seem to suggest a slightly greater effectiveness.

ESSENTIAL FATTY ACIDS AND GOITER PRODUCING SUBSTANCES[1]

Two recent papers indicate that the writers have not yet come to a realization of the importance of the question of *iodin-fat* balance which was raised by R. McCarrison[2] and the Mellanbys,[3] but has apparently been forgotten by those authorities as well.

G. O. Burr, M. M. Burr, and W. R. Brown,[4] studying the nutritive value of cod liver oil, find that the feeding of cod liver oil does not prevent scaliness of the feet and tail in rats given their fat-free diet. They state that of the more unsaturated oils, cod liver oil is distinct in that it leaves the skin of the animals scaly, while lard, olive oil, corn oil, linseed oil, methyl linolate and methyl linolenate all produce skin free from scales and dandruff. They emphasize the fact that cod liver oil is highly unsaturated without linoleic and linolenic acids being present in appreciable quantities. Burr and Burr for some time contended that linoleic and linolenic acids must be furnished as a part of the diet in their fat deficiency experiments.

The findings of the writer and associates[5] indicate clearly that the reason why cod liver oil is ineffective in Burr's fat disease is on account of the iodin carried with it. Burr's animals, long depleted of fats and at the same time receiving KI, must be given fats lacking iodin, or the iodin-fat balance will not be restored. The significance of Burr's essential fatty acids[6] depends on their *degree* of *unsaturation* and not upon any specificity.

E. J. Bauman, Anna Cipra, and David Marine,[7] in a paper just published, have shown that goiter-producing substance in cabbage was extractive with ether from "cabbage fat." They failed to refer to the important pioneer work of McCarrison and the Mellanbys, to our own recent work and to the suggestion that we advanced[8] to the effect that their "goiter producing substance" was quite probably the *unsaturated fat* of cabbage from which they had permitted a loss of iodin.

F. E. CHIDESTER

[1] From the Laboratories of West Virginia University, Morgantown, West Virginia. Aided by a grant from the National Research Council.

[2] *Ind. Jour. Med. Res.*, 7, 633, 1919–1920.

[3] E. and M. Mellanby, *J. Physiol.*, 55, vii–viii, 1921.

[4] *Proc. Soc. Exp. Biol. and Med.*, 28, 905, 1931.

[5] SCIENCE, 68, 42, 1928; Collecting Net, 5, Nos. 32 and 33, 1930; *Proc. Soc. Exp. Biol. and Med.*, 28, 187–189, 1930; *Anat. Rec.*, 47, 3, 304, 1930; *Med. Times and L. I. Med. Jour.*, 59, 138–9, 1931.

[6] G. O. Burr and M. M. Burr, *J. Biol. Chem.*, 82, 345, 1929; G. O. Burr and M. M. Burr, *J. Biol. Chem.*, 86, 587, 1930.

[7] *Proc. Soc. Exp. Biol. and Med.*, 28, 9, 1017–18, 1931.

[8] Chidester and Wesson, *Med. Times*, 58, 11, 319–321, 1930.