KREEZER AND DARGE ON AUDITORY ACTION CURRENTS

G. KREEZER and H. DARGE, in the January 22 issue of this journal, have reported their inability to reproduce the results of our auditory nerve experiments. And they suggest the "possibility" that we have neglected one of the more elementary precautions required in an experiment of the kind.

It should be unnecessary to state that this precaution was taken, or to inform Kreezer and Darge that our experiments have been repeated and our results reproduced by Adrian (*J. Physiol.*, 1931, *71,* pp. 28–9 *P*), Adrian, Bronk and Phillips (*ibid.*, 1931, *73,* pp. 2–3 *P*), Davis and Saul (SCIENCE, 1931, *74,* 205–6), Rademaker and Bergansius (*Arch. néerl. de physiol.*, 1931, *16,* 346–9), and Crowe and Hughson (*Zsch. f. Hals-, Nasen- u. Ohrenheilk.*, 1931, *30,* 65–76; *J. Amer. Med. Assoc.*, 1931, *96,* 2027–8).

E. G. WEVER
C. W. BRAY
PRINCETON UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE CENTRIFUGE-MICROSCOPE FOR SUPER-CENTRIFUGAL FORCES

IN 1930, Harvey and Loomis[1] described a form of centrifuge-microscope for observing living material while being centrifuged. It consists of a special centrifuge head containing a microscope objective mounted at the circumference under the special slide of living cells. Right angle prisms bring the image to the axis and then vertically upward, where it is observed by an ocular which does not rotate. A high voltage discharge in mercury vapor illuminates the material synchronously with each revolution of the microscope. Although the image is perfect, even at highest powers, the size of the head (2⅝ inches thick, resisting air) offers so much air resistance that speeds over 4,000 r.p.m. (about 2,000 times g at 11 cm radius) can not easily be attained. In recent models the air resistance has been greatly diminished by using objective lenses only and small right angle prisms mounted either between objective and object or between the lenses of the objective system. In this way the thickness of the head has been reduced to ½ inch, and by stream-lining the contours, it is possible to run up to 10,000 r.p.m., giving forces of 12,000 times gravity. This type of head is most suitable for general biological work.[2]

However, it is possible to adapt the microscope-centrifuge principles to the Beams[3] ultra-centrifuge, by which forces approaching one million times gravity can be attained. This scheme is the simplest possible arrangement and has worked out remarkably well, in fact far beyond expectation. No lenses but only mirrors revolve. As shown in Fig. 1 two stellite mirrors

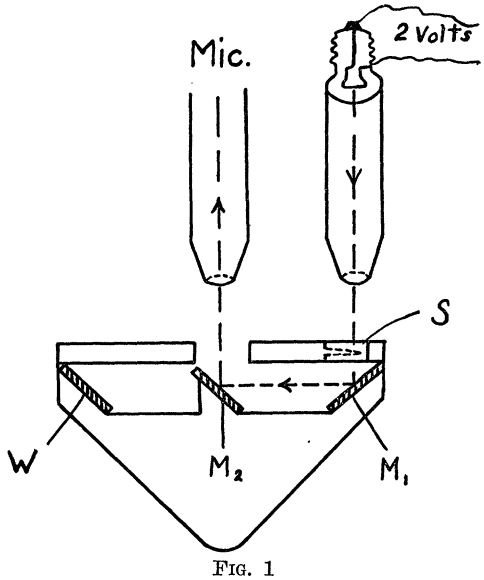

FIG. 1

(M_1 and M_2) are mounted on the Beams' rotor in such a position that the image of the object on a special slide (S) is brought to the axis and reflected into a microscope (Mic) mounted above and on the axis of the rotor. W. is a counter weight for balancing the rotor. The illumination is a narrow image of the filament of a straight filament tungsten lamp thrown on the material to be observed parallel to a radius of rotation. A relatively large movement at the circumference becomes a very small movement when the image is brought to and observed on the axis of rotation. While the whole field of view is not perfect, the center is good enough for all practical purposes. The magnification of this scheme is limited by the working distance of the objectives; ×5 to ×7 objectives can be used giving with ×20 oculars, 100 to 140 diameters. By mounting lenses on the rotor higher

[1] E. N. Harvey and A. L. Loomis, SCIENCE, 72, 42, 1930.

[2] The high speed heads were made at the Alfred L. Loomis Laboratory at Tuxedo Park, N. Y. I express my sincere thanks to Mr. Loomis for his generous hospitality and advice during the progress of the work. I am indebted to the Bausch and Lomb Optical Company for lenses and prisms used in developing the new form of head. This company expects to place the microscope-centrifuge on the market in the near future.

[3] J. W. Beams, *Rev. Sci. Inst.*, 1, 667, 1930: SCIENCE, 74, 44, 1931. Dr. Beams and Mr. Weed, of the University of Virginia, have constructed one of the rotors with stellite mirrors which works perfectly.

magnification can, of course, be used. The centrifugal force attainable by means of the Beams' rotor is limited only by strength of materials, and for microscopic observations by this method, is determined by the strength of the glass container of the living cells. This might be put at 200,000 times gravity. Such an arrangement should be particularly useful for determining molecular weights of substances by the method of sedimentation, for observing movement of materials in highly viscous cells and for observing the change in shape of living cells due to the stretching forces of light and heavier material. From such observations one is frequently able to gain an idea of the surface and other forces which counteract distortion.[4] In order that a cell may not be completely crushed by forces thousands of times gravity, it is necessary to adopt the expedient of suspending the material in a medium of graded density, so that the cell comes to lie in a stratum of equal density, and is thereby perfectly cushioned against crushing. Magnified observation of centrifuged material during centrifuging is so easily carried out that the microscope-centrifuge should be a most useful tool in every laboratory.

E. NEWTON HARVEY

PRINCETON UNIVERSITY

A SIMPLE METHOD FOR SEPARATING CERTAIN INSECTS FROM FOOD PRODUCTS

IN connection with the enforcement of the Federal food and drugs act, the writer had occasion, during the raspberry canning season of 1929, to assist in making a survey of the extent of infestation of raspberry fruit by the larvae of *Byturus unicolor* Say. A simple rapid method for the detection of larvae is very desirable for this purpose as well as for determining the fitness of the fruit for food purposes prior to canning. A description of the method as devised is given at this time in the thought that it may be of general use in entomological studies.

Methods of decantation with water were found to be inadequate because the large number of seeds in the raspberries interfered with the rapid detection of the larvae. After considerable experimentation it was found that the incorporation of some oily substance, such as kerosene or gasoline, with the cooked and pulped raspberries caused the larvae to rise to the surface of the subsequently diluted liquid. It was originally thought that the larvae must first be saturated with the oil, and for that reason a method of shaking the oil with a partially diluted pulp in a large Mason jar was devised. While this method gave good results, it was soon found that prolonged shaking was unnecessary, it being essential merely to bring the larvae into contact with the oil-water interface.

The method as recommended for factory testing of raspberries is given below. For other purposes changes will no doubt be advisable. The esssential points in detecting the larvae by the use of gasoline or kerosene are: (1) Maceration of the fruit, (2) formation of oil globules throughout the liquid, and (3) careful agitation at end of test to permit all the larvae to come to the top.

The materials required are: (1) Gasoline or kerosene, (2) two No. 10 cans (approximately 3,100 cc each), (3) one No. 2 can (approximately 580 cc), (4) a large spoon or paddle, (5) source of heat, (6) small graduate, (7) forceps and (8) a shallow pan.

PROCEDURE

(1) Fill the No. 2 can with the raspberries to be tested.

(2) Pour berries into a No. 10 can, crush with spoon and cook until soft. If steam heat is used see to it that it is as dry as possible so as not to allow the can to become more than one fourth full of pulp and steam condensate. With dry heat, add enough water to facilitate cooking.

(3) Add 1 to 2 ounces of gasoline or kerosene to the can and stir vigorously.

(Caution: The need of guarding against fire and explosion should not be overlooked.)

(4) Fill the can nearly full with water.

(5) Allow water and pulp to come to rest and examine the surface for larvae. All insects should be picked off with the forceps as soon as located.

(6) Since some of the larvae may be entangled in the pulp, it should be stirred several times, and the surface examined after each stirring. In stirring, the water should be given a rotary movement, then, by placing the spoon in a slanting position along the side of the can, an upward current can be established which helps to bring the larvae to the surface.

Some prefer to pour the contents of the No. 10 can directly into a shallow pan, rinsing out the No. 10 can into the pan and adding enough water to fill the pan to the depth of about 2 inches with liquid and pulp.

(7) As a final precaution, pour the mixture from one No. 10 can to the other, or from pan to can, once or twice, and examine the surface each time for insects.

Insects commonly found in infested foods, in general, respond to the gasoline treatment. This method, or some modification of it, has been found useful in the examination of cereal products, fig paste, spinach and turnip greens, as well as raspberries. Unfortunately the maggot of the cherry fly and of the blueberry fly, and possibly other maggots, do not rise to the surface on such treatment.

[4] E. N. Harvey, *Biol. Bull.*, 60: 67, 1931; 61: 273, 1931.