ethical right which may profoundly affect human conduct in general.

For this reason the science of medicine comes to concern itself with many things besides the healing of the sick. It has been broadly interpreted as a major factor in the science of human welfare. The problems of disease and the circumstances related to it are to the science of modern medicine only the sequel of a long train of social cause and effect. Medicine has taught us how important it is to look beyond the result to the cause, not only of human sickness, but of those social disorders out of which individual difficulties necessarily arise.

Those of us who are concerned with the problems of government and of economics are under special obligation to modern medicine in two very important respects. In the first place, it has taught us that, with patience and application and skill and courage, it is possible for human beings to control and improve conditions under which they live. It has taught us how science may be made the servant of a richer, more complete common life. And it has taught us more than that, because from it we have learned lessons in the ethics of human relationship—how devotion to the public good, unselfish service, never-ending consideration of human needs are in themselves conquering forces.

Democracy looks to the day when these virtues will be required and expected of those who serve the public officially and unofficially. Modern medicine has set an exalted example. It has shown the way for us all.

You whom we honor to-day rendered the highest form of patriotic service during the battles of the World War, but, even more than that, you deserve the nation's thanks for the national service that you have rendered throughout your lives.—*The Associated Press.*

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN EASILY CONSTRUCTED ELECTRO-MICROCAUTER FOR USE IN CELLULAR BIOLOGY

THE need recently arose in our laboratory for a microcauter of simple construction by means of which any desired degree of heat could be applied to a very small area of the Drosophila egg. On looking up the electromicrocauters which have been described and used by Schouten and by Péterfi,[1] we found that these instruments not only require considerable technical skill for their construction, but in addition they possess several features on account of which they do not adapt themselves readily to our plan of experimental procedure. In both of the instruments described, the heat is carried to an operating tip, usually of platinum, by conduction from a heating element, and there is necessarily an initial latent period for this conduction. The heating element, whether it is encased in an insulating sheath or not, introduces factors which are difficult to control. If insulated, the heat retained within the sheath tends to accumulate, and rapid consecutive operations can not be carried on under identical conditions. If no insulation is used, direct radiation from the heating element exposes a wide area of the experimental material to possible injury.

To eliminate these factors, the electromicrocauter to be described was designed. We have found that it meets our purpose admirably, and we feel that it should be of real value in other types of micro-operative work in cellular biology. It offers, in addition to the ease with which it may be constructed, a new detail of refinement, in that the point is heated completely to its tip by the electric current. Thus it is possible to localize any desired degree of heat in a very small area without the additive effect of heat radiation from a heating element.

The construction of the microcauter is evident from the accompanying figure (Fig. 1). The outer rubber

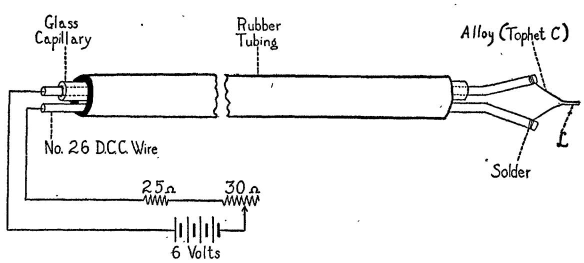

FIG. 1. Electromicrocauter with operating loop (L), made of radio filament-wire 20 μ in diameter.

tubing is about ⅛″ in diameter—the kind known to radio constructors as spaghetti tubing. Two No. 26 DCC copper wires, one of which is enclosed in a glass capillary, are run through this and fastened in place by a drop of ambroid cement at either end. The terminal point is made of an alloy known as "Tophet C," which is manufactured for radio filaments by the Gilby Wire Company, of Newark, New Jersey. A piece of this filament-wire (diam. = 20 μ) about half an inch long is soldered between the two copper wires and bent under a binocular dissecting microscope to a very narrow loop (± 30 μ). The piece used in our instrument has a resistance of 45

[1] T. Péterfi, *Abderhalden's Handbuch*, Abt. 5, Theil 2, Heft 5.

ohms and is heated by four dry cells. A series resistance of about 50 ohms is necessary to cut down the current to the desired level.

Since the microcauter tip expands on heating, the instrument is placed far enough away from the cells to be operated upon that this expansion does not unduly injure them. The loop should never be allowed to touch the cells, but merely to heat them by radiation. The duration of the heating may be limited to a fraction of a second, for the circuit is made and broken as quickly as possible, and since this fine filament-wire cools almost instantaneously, a consecutive series of identical exposures may follow each other rapidly.

Several preliminary series of experiments were made on the posterior cluster of cells in the embryo of *Drosophila melanogaster* from which the germ cells of the adults are known to be derived.[2] Eggs of *Drosophila melanogaster* were collected by allowing well-fed females to lay on strips of blotting paper saturated with yeast-water and spread with a layer of fermented banana. The freshly laid eggs were immediately dechorionated by hand and placed in sea water diluted with tap water to 33 per cent.[3] so that the stage of development could be determined.[4] For this study eggs were used which had begun to form pole cells, that is, they were approximately two hours old. The eggs (20 or more at a time) were aligned along the edge of a small block of moist agar with the posterior ends projecting slightly. Excessive desiccation was prevented by the use of the agar block, no moist chamber being necessary.

After cautery, the eggs were returned to the diluted sea water, where their development was followed through a compound microscope. No portion of any egg was seen to be coagulated. In one series of 20 eggs, 19 were found in which the pole cells were not folded into the embryo normally. Many of these embryos continued to develop but did not hatch as larvae. Four of the eggs hatched as larvae, pupated and eventually emerged as phenotypically normal imagoes. Three of these were fertile, but one female, which (on repeated testing) was sterile, was found on dissection to have no ovaries. A male which was fertile had only one testis.

Similar experiments were carried out by Hegner,[5] who burned the posterior pole of the eggs and early embryos of chrysomelid beetles with a hot needle. These burns were so drastic that the entire posterior regions of the late embryos showed structural deficiencies. Reith,[6] using the Péterfi electromicrocauter, burned large areas in the eggs of *Musca domestica*, the house fly, with similar results. It is of particular interest, therefore, that the heat radiations inflicted in our experiments were so localized and controlled as to limit the injury to the germ cells themselves. The formation of the posterior segments and of the external genitalia of the adults hatched from the operated embryos was normal. The sole effect was the production of partial or entire sterility.

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A CLOCK DEVICE FOR TEACHING SOIL TEXTURE

THE average student of soil texture fails to obtain an adequate concept of the variability of the percentage composition by weight which is permitted for a given soil texture, as defined in standard works on soils. A clock device, which is illustrated herewith,

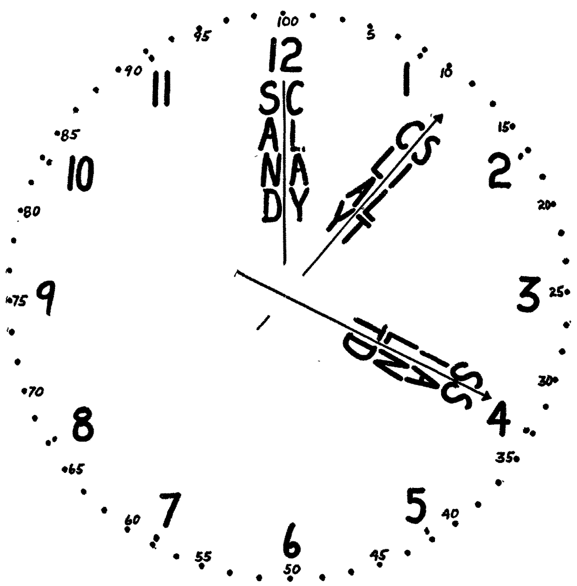

FIG. 1.

makes it possible to make a visual presentation of the limiting percentages of sand, silt and clay present in a given soil texture. The soil clock is set for sandy loam. The clay hand is at 12 minutes and the silt hand at approximately 20 minutes. This represents 12 per cent. clay, 20 per cent. silt and 68 per cent. sand. Sandy loam may contain from 20 to 50 per cent. silt and clay. The clock demonstrates this quickly and easily.

This clock device has proved so highly satisfactory

2 A. F. Huettner, *Jour. Morph.*, 37: 385, 1923.

3 We have found in our laboratory that Drosophila eggs develop normally when immersed in this concentration of sea water for the entire embryonic period.

4 R. B. Howland and G. P. Child, SCIENCE, 77: 624, 1933.

5 R. W. Hegner, *Biol. Bull.*, 16: 19, 1908.

6 F. Reith, *Z. wiss. Zool.*, Bd. 126, S. 181, 1925.