SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PHOTO-ELECTRIC COLORIMETER

THE principle of this simple apparatus is the following: In a blackened, covered wooden box a small rectangular glass jar (Fig. 1: 3), containing the fluid to be tested, is placed between an electric bulb (15 watts) (Fig. 1: 1) and a photoelectric exposure-meter

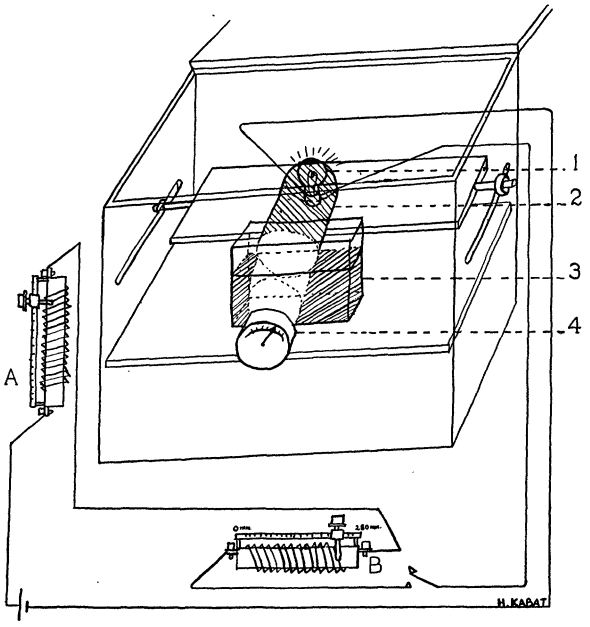

FIG. 1.

(metrophot or other devices) (Fig. 1: 4). A blackened metal tube (Fig. 1: 2) is mounted together with the bulb on a wooden board, which can be moved forward and backward in order to be adapted to the thickness of different jars. The electric bulb is lightened by the house-current (110 volts d. c.), which is led through two rheostats, the one, A, of 50 ohms and 5 amperes, the second, B, of 345 ohms and 1.1 amp. The current is interrupted by a switch. The slider-rod of rheostat B is subdivided into millimeters. If the current is closed, the light will operate the exposure-meter and the pointer will move to the right, the more, the darker the solution to be tested. Next, the slider of rheostat B is moved until the pointer of the exposure-meter reaches a given point (*e.g.*, 3). The distance in millimeters between the right edge of the slider and the zero point of the slider-rod scale corresponds to a given concentration of the color to be tested and which is found on a prepared table.

To give an example for the calibration of such a table, the determination of phosphorus with the help of the Fiske and Subarrow's method will be described for concentrations of 0.80 mg to 0.40 mg phosphorus per 100 cc. After removal of the glass jar, the slider B is moved to zero, and the slider of rheostat A is adjusted until the pointer of the meter reaches a middle position (*e.g.*, 15). Before each use the apparatus is adjusted to this fixed point, thus compensating the variations of the house-current. Next the glass jar is filled with a solution of mono-potassium phosphate to which the reagents of the test had been added and which contains 0.80 mg P per 100 cc. The cover of the box is closed. Five minutes after the mixture of the different reagents the electric current is shut, the slider of rheostat B is moved to the right outer end (280 mm), and the position of the meter pointer is noticed (*e.g.*, 3). Next, the solution is replaced by one containing 0.75 mg P per 100 cc, and the slider of rheostat B is moved until the meter-pointer again reaches the position of the first test (3). Then the millimeter distance between the right edge of the slider and the zero-point of the slider-rod is noticed (*e.g.*, 253 mm). The experiment is repeated at intervals of 0.05 mg P per 100 cc until a concentration of 0.40 mg P has been tested. Next the millimeter distance between each experiment is divided by 5 and thus a table is obtained which gives the comparative values for solutions differing in 0.01 mg P per 100 cc.

In order to test an unknown solution, the phosphorus content of which is between 0.8 and 0.4 mg per 100 cc, it is filled into the glass jar, after rheostat A has been adjusted. The cover is closed and the slider of rheostat B is moved until the meter-pointer reaches 3. The distance of the slider from the zero point of the rod is noticed and compared with the most closely corresponding figure on the prepared table. Immediately the phosphorus content of the solution in mg per 100 cc will be obtained. Tables for other ranges of concentrations may be obtained in a similar way. The measurements of the different parts are: Wooden box, 20 × 23 × 40 cm; glass jar, 27 × 50 × 53 mm (outer measurements); metal tube diameter, 40 mm, length, 45 mm. The price is approximately between $25 and $50, according to the type of exposure-meter which is used.

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A SIMPLE ERGOGRAPH

WE have had occasion to construct and use a simple hand ergograph which may be of interest to others because of the several advantages it offers. It is readily adjustable both as to size of grip and resisting force. Its construction is such as to promote a steady even pull throughout the operating stroke. It has been found more satisfactory for our research than other ergographs. At the same time it is sufficiently

inexpensive and easy to construct to make it suitable for classroom work.

The apparatus consists chiefly of an air pump (A)

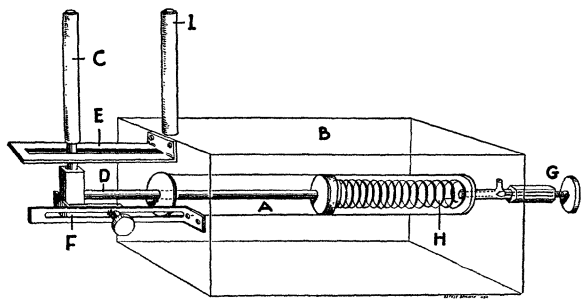

FIG. 1.

of the type used for inflating football bladders. This pump is mounted horizontally in a wooden box (B), each end of the pump being flush with the outside surface of each end of the box. A vertical metal rod (C) runs in a slotted guide (E), its excursion being limited by the adjustable stop (F). To the outlet nozzle of the pump is attached a needle valve (G). A coil spring (H) of suitable strength and an upright rod (I), attached to the box, complete the apparatus.

To operate the apparatus the forearm rests on the top of the box and the rubber (tubing) covered rods are grasped in the hand, the size of the grip being adjusted with the stop (F). When the grip is exerted, air is forced out of the pump through the needle valve (G) the adjustment of which controls the resistance to be overcome and therefore the required force. The outlet of the needle valve may be connected by rubber tubing to a suitable recording device for graphic registration. When the grip is relaxed, the coil spring (H) returns the piston to its resting position.

The work done may be calculated from the product of the number of strokes, the distance moved per stroke and the force required. The number of strokes may be recorded or counted; the distance moved per stroke is measured. The force required to bring the rod (C) into apposition with the rod (I) can be measured by performing that operation with a simple spring balance.

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SPECIAL ARTICLES

ACTIVE IMMUNIZATION IN MONKEYS AGAINST POLIOMYELITIS WITH GERMICIDALLY INACTIVATED VIRUS[1]

IN my previous work it was shown that sub-infective doses of active virus or virus-serum[2] combinations[3] may produce immunity against the virus of poliomyelitis. The former method, however, is attended by the danger of giving the disease during the course of immunization, whereas the latter method entails considerable difficulty in reaching the proper virus-serum combination. An excess of virus in the mixture may produce the disease, while an excess of serum reduces the immunity considerably.

Although the use of germicidally inactivated virus for the production of active immunity has been reported successful in the virus conditions, such as Borna disease, cattle plague, dog distemper, foot-and-mouth disease, fowl plague, herpes, psittacosis, rabies and yellow fever, the experimental results in the case of poliomyelitis, up to the present, have been both contradictory and indefinite.

Therefore, an attempt was made to produce active immunity against poliomyelitis in *Macacus rhesus* monkeys, using as antigen virus inactivated by either formalin or phenol.

It was shown that active poliomyelitis virus inactivated with formalin is antigenic. Virus treated with phenol did not prove as effective as formalized virus; besides, the concentration necessary to render the virus non-infective made it too irritating for convenient use. The monkeys were injected intracutaneously with a 10 per cent. virus suspension. Either one or two inoculations were given. In the latter case, the interval between the two doses was from 10 to 20 days.

The optimum antigenic dose was determined as being approximately ½ gram of cord tissue. This was based upon the results of the following experiments.

Tissue immunity was shown by only one of three monkeys which had received 2.5 cc of a 10 per cent suspension. One of these three had had one inoculation and the others, each two injections. Poliomyelitis antibodies were found in all three serums. Some tissue immunity was demonstrable in ten monkeys of a series of twelve animals, 3 of which were given one inoculation consisting of 5 cc of a 10 per cent. suspension and 9, two such inoculations. In seven of the ten, which showed tissue immunity, the degree of immunity was comparable with that of animals given similar treatment with active virus. Virus neutralizing substances were found in all their serums.

[1] This research was aided by grants from the New York Foundation and the Rockefeller Foundation.

[2] M. Brodie, *Proc. Soc. Exp. Biol. and Med.*, 30: 1238, 1933; *Jour. of Immun.*, in press.

[3] M. Brodie and A. Goldbloom, *Jour. of Exp. Med.*, 53: 885, 1931; M. Brodie, *idem.*, 56: 493, 1932.