(2) It can conquer disease and help towards an increase of positive health.

(3) It can offer good counsel to help man to meet some of the perennial problems of life.

(4) It has a manifold cultural value.

(5) It affords a basis for eugenics.

(6) It is full of ethical suggestiveness.

(7) It has contributions to make toward a sound philosophy.

Therefore, he says, let us have more biology.

Although the two volumes contain over 1,500 pages, they necessarily leave very much unsaid, and if the book is widely read, as it is certain to be, it should stimulate the production of other works along similar lines. One can imagine books dealing with special groups of animals or plants, or special types of behavior, or with the natural history of particular regions. Also, Thomson's book itself is likely to appear in several editions. It did not get the final revision it might perhaps have had, if the author had lived to see it through the press, and there are naturally some errors to be corrected. It would be tiresome to try to enumerate all these in a review, but one or two may be cited as examples. The reference (p. 1369) to Pleistocene fossil tsetse flies originated in a mere blunder in a very excellent work and has been uncritically quoted. The *Hybernia* moth (p. 869) is cited as a butterfly, evidently because the facts were taken from a German work, which uses the same word for moths and butterflies. The giant cactus (*Carnegiea*) is said (p. 1180) to inhabit Texas. The accounts of fish scales are misleading, not distinguishing between the circuli and annuli. It would be worth while, for the purposes of the next edition, to submit the various chapters to specialists, and so far as possible eliminate these minor errors. They do not much affect the book as a whole, but as they are discovered, they undermine confidence. Furthermore, many of the illustrations could be much improved, and some additional ones would be valuable. The printers and publishers must be congratulated on producing so large a book with hardly any misprints.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR DEMONSTRATING THE OERSTED EFFECT

THE magnetic effect of an electric current is usually demonstrated by bringing a current-carrying wire into the neighborhood of a compass needle, after the manner of Oersted's original experiment. Convection currents, *e.g.*, those carried in electrolytes or in gases, are capable of producing the same effect, but this is not often shown explicitly.

In the belief that it might be advantageous to emphasize the fact that a conduction current in a wire, *i.e.*, one borne by charged particles of one sign moving in one direction, is essentially equivalent in its external magnetic action to electrical convection currents, in which particles of opposite sign move in contrary directions, the following simple apparatus was constructed: A straight wire (W), a long electrolytic cell (E) and a Geissler tube with a straight central capillary (G) were mounted on a wooden base, as shown in Fig. 1. A shallow cylindrical depression under the center of each unit accommodates an ordinary magnetic compass. The electrolytic cell is merely a piece of 8 mm glass tubing bent to the appropriate form, and may be filled with a solution of cupric sulfate. Ordinary copper wires whose ends are twisted into small spirals serve as electrodes. The discharge tube may be any long "I"-tube usually available in the laboratory. Single pole knife switches mounted on the base control the current through the wire and cell, while the electrodes of the Geissler tube are connected directly to the secondary of a small induction coil.

A convenient method of connecting the source of current—a six-volt storage battery—to the remainder of the apparatus is shown in Fig. 2. This arrangement

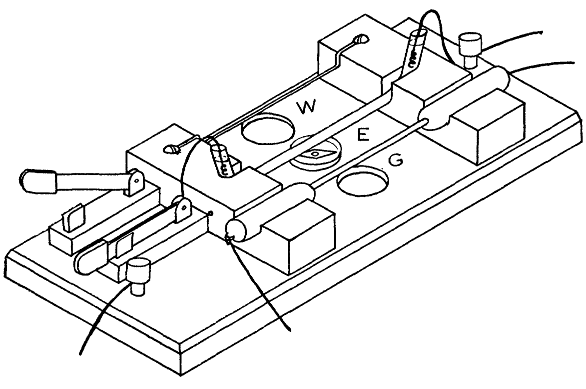

FIG. 1.

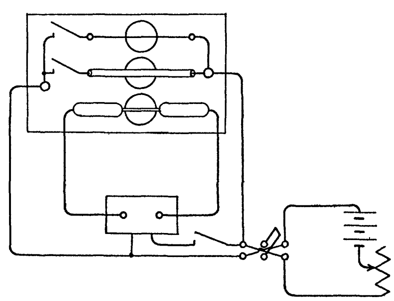

FIG. 2.

makes it possible to demonstrate the three units in rapid succession. One reversing switch serves to change the direction of the current in any unit. An inclined plane mirror clamped above the apparatus makes the effect visible to a large class.

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AN INEXPENSIVE APPARATUS FOR THE MEASUREMENT OF BODILY ACTIVITY

IT is at times important to obtain objective records of the bodily activity of animals without great expense and yet by means of a sensitive instrument. The following apparatus has been used successfully with young puppies and may be adapted to larger or smaller animals.

A small light aluminum baking pan $11'' \times 7'' \times 1\frac{1}{2}''$ (see a in Fig. 1) was suspended within a packing box

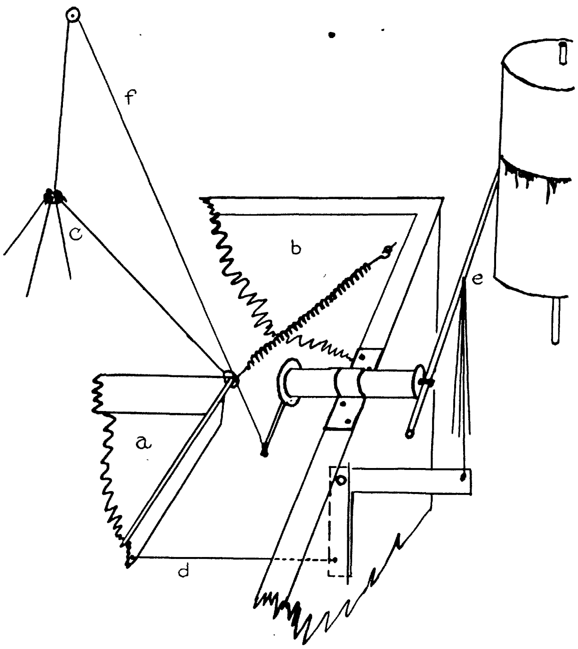

FIG. 1. Detail showing method of wiring used in apparatus for measurement of bodily activity: (a) aluminum pan; (b) packing box; (c) wire rods from corners of pan; (d) thread from side of pan to lever; (e) writing arm with threads attached; (f) thread from upright wires, leading to writing arm.

(b) (approximately 2 feet long, 16 inches wide and 1 foot deep) by means of small springs, one attached at each corner of the tray, and to eyes screwed in the corners of the box. These eyes were so arranged that they could be adjusted to various heights, depending on the weight of the animal. Four light wire rods (c) projected from each corner of the tray to meet above its center.

In order to secure a single record from all movements of the tray, heavy threads (d) were attached to it, one on each side. By means of pulleys these threads converged at a series of levers amplified 3/2, and from the levers threads were connected to a writing arm (e) bolted to a bicycle bearing.

A thread attached to the upright wires from the corners of the tray, which converged above it, was arranged by pulleys in such a way (f) as to pull downward on a lever attached to the bicycle bearing opposite to the writing arm. This lever was bolted so as to make it adjustable to the weight of the animal. Thus, with the tray under slight tension on all sides and with respect to gravity, movement in any direction resulted in a downward pull of the writing arm.

If the animal studied is very active, it may be confined within a ventilated box, which may be placed in the tray, or the box itself may be wired in the way described.

The apparatus has proved sufficiently sensitive in the case of puppies to record practically all movements of skeletal musculature.

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A SENSITIVE A-C VACUUM TUBE RELAY

A VACUUM tube relay possesses numerous advantages in the temperature control of laboratory apparatus which outweigh the slight increase in the complexity of the system. The reduction of the current which passes through the mercury regulator from ten or a hundred milliamperes to the few hundredths of a milliampere required by the vacuum tube practically eliminates all sparking at the mercury contact and makes the presence of moderate amounts of dirt or oxides in the mercury surface a matter of no consequence. This results in a twofold advantage: first, special precautions as to purity of the mercury are unnecessary, and second, the regulator will in general give trouble-free service for longer periods of time.

A vacuum tube relay circuit is described by Rosenbohm[1] requiring a storage battery for the vacuum tube filament current supply and dry batteries for plate and grid voltages. Korpiun and Geldbach[2] show a circuit for operating a similar device with batteries or 220 volt alternating current supply, using two triodes. Both of these systems have certain disadvantages, the first requires a relatively large investment in batteries

[1] E. Rosenbohm, *Proc. Acad. Sci. Amsterdam*, 35: 876, 1932.

[2] J. Korpiun and Alfred Geldbach, *Z. Electrochem.*, 39: 755, 1933.