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SCIENCE AND TECHNOLOGY[1]

By Professor ERNEST O. LAWRENCE
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IT is appropriate on this occasion to draw your attention again to the great partnership of modern times —science and technology; for the mutual dependence of the pure and applied sciences in the development of our material welfare is nothing short of an absorbing romance.

The applied sciences are devoted to perfecting instruments and means already available, a procedure which in some quarters has been regarded as the best attack on practical problems. On the other hand, the pure scientist is guided by curiosity to learn more about the facts of nature—and it frequently has turned out that new knowledge thus gained has furnished the basis for doing something in a way incomparably better than any perfection of the methods that were already in use.

The following is an illustration: A hundred years ago if one had wanted to improve artificial illumination the direct practical procedure would have been to improve the candle or the oil lamp, and worthwhile progress could certainly have been made in this direction; but researchers in electricity, who studied the subject at that time entirely without regard to its practical application, furnished the basis for new means of lighting which turned out to be vastly superior to anything that could have been obtained by the further perfection of the old sources. It was then that Michael Faraday discovered that a current can be generated in a wire by a changing magnetic field. You all know how, from the tiny galvanometer deflection which first showed Faraday the principle of electromagnetic induction, there developed for the use and comfort of mankind the electric generator, the electric light and the hosts of modern inventions which have followed in their wake.

It is remarkable that Faraday, the man of science so

[1] Commencement address at the Stevens Institute of Technology, on June 12, 1937.

flaps are opened the streams of cold air continue to fall on the knife and paraffin block so that no serious change of temperature takes place.

In a box of the size mentioned no difficulty is experienced in turning the wheel of a rotary microtome, although it is not easy to adjust the paraffin block to proper cutting position. This can be accomplished by sliding the microtome out of the box to make the adjustments. A better method is to remove the floor of the box so that the microtome can stand on the table. In the latter case the entire box can be pushed back to expose the microtome.

Should the tissue and paraffin become too cold push the dry ice container away from the window until the proper temperature conditions are reestablished. Two pounds of dry ice costing ten cents will adequately "air condition" a microtome for five or six hours.

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A METHOD FOR STUDYING ENVIRONMENTAL CHOICES OF LABORATORY ANIMALS

A PIECE of research on the white-footed mouse, *Peromyscus leucopus noveboracensis,* demanded a study of the activity of the animals during periods of light and darkness. It was also necessary to determine how much time an animal spent in the light when it was free to make a choice between the two environmental factors. The apparatus to be described records such information continuously for as long as ten days if desired. It is hoped that other workers may find the method useful as adapted to their particular problems.

A two-compartment cage of a size suitable for the animal under investigation was constructed of light wire. (See the accompanying illustration.) One compartment, D, is made light tight and is connected by a tunnel, T, to the other, O, which is left uncovered, open to the environmental condition of light. Nesting material, food and water may be assigned to the two portions of the cage as seen advisable.

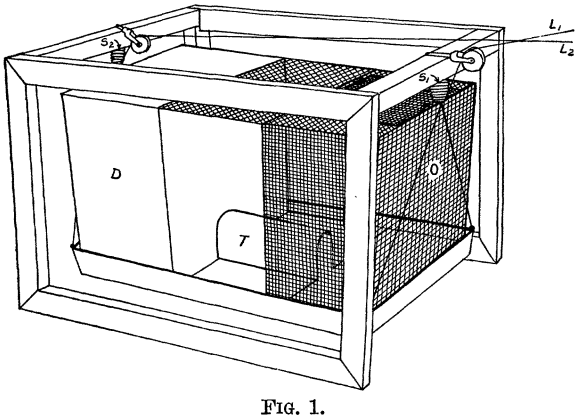

FIG. 1.

The cage is suspended to a suitable support by springs, S_1 and S_2. When the animal is active the cage moves up and down. When the weight of the animal is moved to one compartment the corresponding end of the cage is depressed, while the other is elevated. This shift may be exaggerated by moving the attachments of the two springs nearer to each other. Threads L_1 and L_2, connected with the ends of the cage and running through suitable pulleys, are attached to light heart levers on a ring stand. The levers make contact one above the other with the smoked paper of a slow moving kymograph. Movements of the animal are registered by both levers. If the upper lever is actuated by L_1 from the front end of the cage there is a spreading of the lines of the record when the animal is in front, O, whereas the lines approach each other when it is in the back compartment, D. An interval marker (alarm clock making electrical contact by either hand at twelve o'clock) leaves a time record every hour and a special mark at noon and midnight. A record of time and duration of the illumination of the unit is added by hand. Examination of the fixed paper reveals the time of activity and the position of the animal relative to light and darkness at any time during the experiment.

This method might be applied to various studies of animals heavy enough to move light heart levers in suitably constructed cages, except fish and others which must live in water continuously. That is, the choice an animal makes between two different environments which can be maintained in one cage can be determined and readily studied. For example, temperature choices of frogs, light choices of snails or moisture choices of certain insects might be recorded.

WAYNE L. WHITAKER

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BOOKS RECEIVED

BROWN, S. LEROY. *Electricity and Magnetism.* Pp. v + 310. 126 figures. Holt. $2.80.

MAYNARD, LEONARD A. *Animal Nutrition.* Pp. xiv + 483. 36 figures. McGraw-Hill. $4.00.

Research Memoranda on the Depression. Bulletin 27, Crime in the Depression. Pp. 133. *28, Education in the Depression.* Pp. 173. *29, The Family in the Depression.* Pp. 221. *30, Internal Migration in the Depression.* Pp. 86. *31, Minority Peoples in the Depression.* Pp. 252. *32, Recreation in the Depression.* Pp. 124. Social Science Research Council, New York.

ROBERTSON, JOHN K. *Atomic Artillery.* Pp. xiv + 177. 26 figures. Van Nostrand. $2.25.

TRUE, ALFRED C. *A History of Agricultural Experimentation and Research in the United States, 1607–1925.* Pp. 321. Illustrated. U. S. Department of Agriculture.