by integrals and monotonic rearrangements of sets by decreasing rearrangements $\bar{\varphi}(x)$.

In this connection a paper by Haskins[1] should be mentioned, which seems to have escaped the attention of the authors. Haskins defined (p. 184) the "momental constants" of a bounded measurable function $f(x)$ on an interval $a \leqq x \leqq b$, which except for a constant factor are somewhat specialized cases of the means $\mathfrak{M}_r(f)$ of Hardy, Littlewood and Pólya. He showed (p. 185) that the values of these constants are characteristic of the class of rearrangements of a function, as defined in the last paragraph above, and describes (p. 194) the increasing rearrangement of a function as typical of the class. Furthermore he proves (p. 189) that the means $\mathfrak{M}_r(f)$ have the effective upper and lower bounds of the function $f(x)$ as limits when r approaches $+\infty$ and $-\infty$, respectively. These results are very closely related to some of those given in the book here reviewed. I understand from Professor Haskins that the paper by Schlömilch, referred to in the book, was not available to him in the war-time year, 1916, when his paper was written. Schlömilch's paper deals with similar conceptions for continuous functions and Riemann integration.

No description of the book here reviewed would be complete without mention of the very valuable lists of theorems and examples at the ends of the chapters. If proofs were given for all these results the book would be expanded beyond reason, but in most cases the necessary arguments are clearly indicated or references are cited. This is only one of many features which insure the great value of the book as a contribution to our modern mathematical literature.

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BIOLOGY FOR EVERYMAN

Biology for Everyman. By SIR J. ARTHUR THOMSON. Two volumes; pp. 1561. New York, E. P. Dutton and Company. 1935.

AMONG the biologists living during the last fifty years, perhaps no one has had such wide and diversified interests as the late J. Arthur Thomson. It must be at least forty years ago that a reviewer, contemplating one of his comprehensive works, expressed doubt concerning the possibility of covering so wide a field. He said that he was quite willing to concede that professors knew more about these matters than any one else, and that of all professors, Scottish professors knew most, and yet, after all, what were the limitations of the human mind? At a later date, it was Thomson himself who, in his charming little book on Herbert Spencer, commented on a result of that philosopher's universality; "we can hardly picture the man who has not some crow to pick with Spencer." So it must be, yet with our scientific babel of tongues, it is a saving grace that there are some, if only a few, who can approximate to a universal language and give us an understanding of the whole drama of life, rather than isolated fragments. In attempting to do this, there are two possible methods. One is to condense and simplify, describing vital phenomena in general terms, but not discussing details. Huxley knew how to do this to perfection. But this synthesis, to be rightly appreciated, must rest on a background of knowledge previously acquired. The other method, followed in the book now reviewed, is to describe details in such a manner as to give a vivid impression of living things in all their diversity, while at the same time constantly recurring to the underlying philosophy which relates them to a whole. The reader is stimulated and delighted to discover how much of interest is going on in this world of nature, indeed, in his own immediate vicinity; so much to observe and enjoy which he has not hitherto noticed. Yet as the Reverend Wm. Kirby, famous pioneer entomologist, said over a hundred years ago, all these things can be seen to illustrate the wisdom and goodness of God. We probably do not express ourselves in theological terms, but it comes to much the same thing if we say that we perceive the harmony and unity of nature, the marvelous creative power which we describe as evolution. So we are alternately, or almost simultaneously, analytic and synthetic, guided by the feeling which Tennyson tried to express in his poem on the "Flower in the Crannied Wall." Sir Arthur Thomson knew well how to set these matters forth in interesting languages for the most part intelligible to any educated person. His book is extremely "readable." But neither Thomson nor any one else can simplify biology in such a way as to excuse the reader from any intellectual effort. In truth, we are dealing with the most complex and marvelous phenomena in the universe and those who have grown old in their investigation still feel like beginners. It is this eternal freshness of biology that constitutes one of its principal charms, for those who care to think.

It is encouraging to note that throughout this country there is an increasing interest in biological subjects, an impetus which, when given sufficient opportunity for development, may carry us far. Thomson, in his concluding chapter, sums up the reasons for being interested in biology, as follows:

(1) Biology can spread our table and increase the amenities of life, ameliorating the struggle for existence.

[1] On the measurable bounds and the distribution of functional values of summable functions, *Transactions* of the American Mathematical Society, vol. 17 (1916), pp. 181–194. See also Jackson, *ibid.*, pp. 178–180; Van Vleck, *ibid.*, vol. 18 (1917), pp. 326–330.

(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.

T. D. A. COCKERELL

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

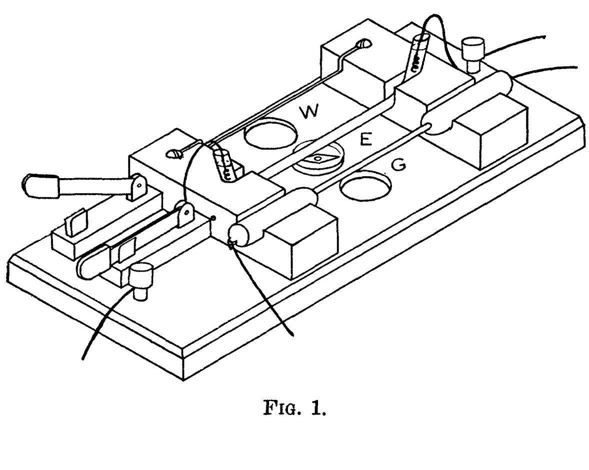

FIG. 1.

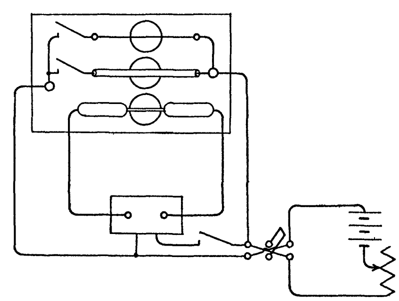

FIG. 2.