from Normal and Pathologic Subjects as Determined from Calorimetric Studies of the Extremities." It is possible that Dr. Stewart did not appreciate the fact that my article in SCIENCE is, in large part, only an abbreviated report of my conclusions and does not contain the data which I believe support them. The complete paper, together with the separate contributions on this general topic by two of my colleagues, will appear shortly in the *Journal of Clinical Investigation*. It does not seem to me either necessary or desirable to make any further comment, inasmuch as I should be rehearsing selected and hence disconnected portions of the data and discussion given in the complete paper. I am prepared to rest my case upon the materials contained in the full text of my experiments and conclusions.

CHARLES SHEARD
MAYO CLINIC AND MAYO FOUNDATION,
ROCHESTER, MINNESOTA

SCIENTIFIC BOOKS

The Growth of Biology. Zoology from Aristotle to Cuvier, Botany from Theophrastus to Hofmeister, Physiology from Harvey to Claude Bernard. By the late WILLIAM A. LOCY. New York, Henry Holt and Company, 1925.

HAVING used Locy's "Biology and Its Makers" (Third Edition, 1915) as a text-book for a number of years, I have, in common with many others, a sense of deep obligation to its author. The historical method of treatment has many advantages, not the least being that the human story always arouses and holds the interest of students. Locy succeeded in writing a book which was at once sound, reasonably comprehensive and attractive. It was no small task, especially as the greater part necessarily dealt with the labors of Europeans, and many desirable works of reference were not easily obtained. It was only too possible to be misled by imperfect or erroneous information, or to fail to preserve a balance between the various subjects and men according to their importance. Yet the book has stood the test of use very well, and among current text-books easily ranks as one of the best. One obvious criticism related to the title, which led us to expect a history of biology, whereas botany was practically ignored. This was inconvenient, because it is common to treat the history of biology as a whole, and the teacher of such a course, using this text, had to prepare supplementary matter dealing with the botanical side. Even so, botany could not be adequately presented, and the course was to that extent lopsided. Evidently the author came to feel that this was true, so he set to work to write another book, which should actually cover the whole biological field. Unfortunately, this was not finished at the time of his death in October, 1924, but there was enough to make a volume, about equal in bulk to the earlier text. This is now before us, and bears the title "The Growth of Biology." It fully maintains the author's previous standard, and while there are many passages borrowed from the other book, there is very much that is new and extremely interesting. Very appropriately, we begin with a discussion of those early biological studies represented by the wonderful work of paleolithic man. While the mammoth was still alive, there were zoological artists (as we should now call them) to picture the great beast with skill sufficient to indicate its disposition as well as its form. Although Locy does not say so, it is evident that the ancient cave man discovered the principle of the moving picture. The running herd of reindeer is shown with the horns of the hindmost animals greatly elongated, indicating speed. The infuriated mammoth appears to have several trunks, showing how he waved his trunk in the air when enraged. Between this period and that of Aristotle was a very long story of human culture, and, as Locy remarks, no wonder the Greek philosopher spoke of the "ancients." However, it is pointed out that before the time of the Greeks "science was an anonymous social product," growing by slow degrees as observations were added to current tradition. It is still in that stage among uncivilized tribes. But certain individual Greeks made it their business to collect and arrange scientific data, and thus we have the beginnings of organized zoology, botany and physiology. Full justice is done to the versatility and learning of Aristotle, passages of whose works sound extraordinarily modern even to-day. Theophrastus, as the father of botany, is dealt with at some length. Then we pass up through the centuries, and there is a good account of the early printed books on natural history, with copies of the often crude illustrations. Brunfels's figure of the plantain (p. 129) is upside down. The fabulous "Su," figured on p. 296, appears to have been based on some one's recollection of a woolly opossum (Caluromys). The early microscopes and the discovery of micro-organisms are discussed, with copies of the old figures. It has been suggested that Roesel's "kleine proteus" was not the amoeba, but Pelomyxa, the latter being more recognizable on account of its larger size. But Roesel's original figure, copied by Locy, is evidently that of the amoeba. We are also shown Leeuwenhoek's original illustrations of bacteria; how little could he realize the tremendous importance of the group of organisms he had discovered! There is a most interesting chapter, "The Period of Hofmeister; with a Digression on Text-books and Improvements in

University Teaching." Evolution, genetics and the later history of bacteriology and protozoology are among the important subjects which unhappily failed to receive treatment. Consequently, the teacher is puzzled to know which book to use. He can not very well require students to purchase both. The omissions from the newer book are so serious that it seems to me they are not balanced by the gains. What we now need is a combination of the two books, with such condensation as may be necessary to keep the size down to reasonable limits. Certain modern researches should if possible be described, if only to show the fruition of earlier investigations. Aside from use as college texts, both books are well adapted for general reading, and should be in all public libraries. They can also be used to great advantage as reference books in high schools, on account of the many and excellent illustrations, which clarify the moderate technicalities of the text.

Personally, I do not like the method of splitting up the work of authors according to subjects, so that, for example, Leeuwenhoek is dealt with on pages 206 to 218, and again on pages 250 to 253. To overcome the confusion in historical perspective I have, in using the earlier book, prepared chronological tables by means of which the student may see what were the principal events in the whole field of biology at any particular time. Tables of this sort would form a useful appendix to the book. However, anything which may be said in criticism is of very small moment compared with the great services which Locy has rendered to the history of biology, and thereby to education.

T. D. A. COCKERELL

SCIENTIFIC APPARATUS AND LABORATORY METHODS

VACUUM TUBES FOR THE STORAGE AND SHIPMENT OF BACTERIA[1]

IN December, 1924, a progress report was made on "The Preservation of Bacteria in Vacuo."[2] The method described and still in use for the preservation of most of our stock cultures consists in drying the cultures on small bits of filter paper placed in small cotton stoppered tubes within pint milk bottles with specially ground covers. After establishing a fairly high vacuum the bottles are kept in the refrigerator. Under these conditions most bacteria remain alive for several years.

[1] From the Department of Pathology and Bacteriology of Johns Hopkins University, Baltimore, Maryland.

[2] Brown, J. Howard, "The Preservation of Bacteria in Vacuo." *Abstracts of Bacteriology*, Jan., 1925, ix, 8.

For certain purposes it has seemed desirable to preserve cultures in individual vacuum tubes rather than in pint bottles, especially for shipment by mail.

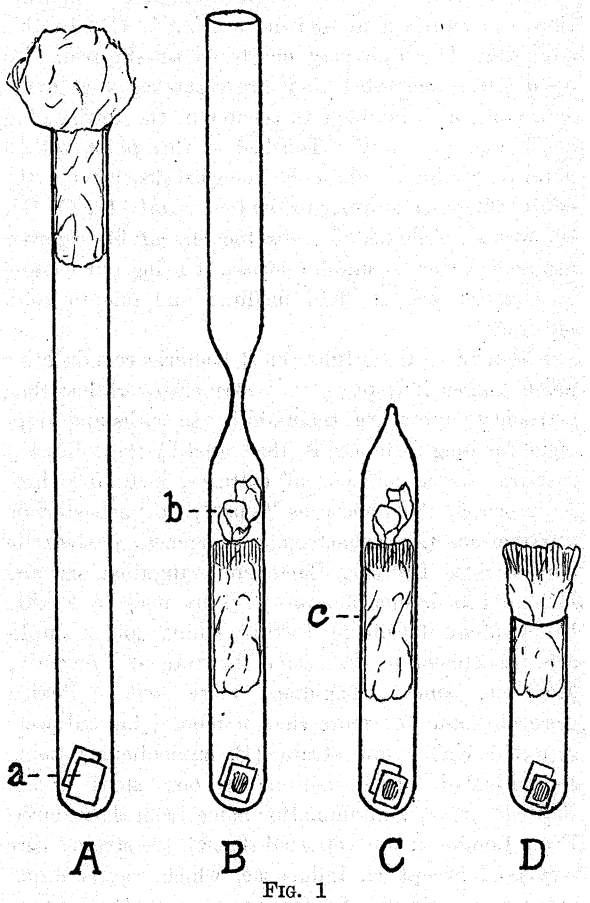

FIG. 1

For this purpose small test tubes (Fig. 1, A) about seven mm in diameter and nine cm long are employed. The tubes contain two small bits of filter paper (a), are plugged with cotton wool and sterilized by dry heat. Broth cultures are mixed with an equal volume of blood or serum. Agar slants should have two or three drops of blood or serum added to the condensation fluid. A loopful of the mixture is placed on each of the bits of filter paper within the tube. The cotton plug is then cut off with scissors just above the mouth of the tube; the plugged end of the tube thoroughly flamed and with a rod or pair of forceps the plug is pushed down into the lower half of the tube just above the filter papers. Two or three lumps of calcium chloride (previously sterilized by dry heat) are placed above the cotton plug, as shown at b in Fig. 1, B. In the small flame of a blast lamp or of a micro-burner a constriction is made at about the center of the tube, care being taken not to obliterate the lumen (Fig. 1, B). The tube is now to be connected