HISTORY OF MATHEMATICS.

Historical Introduction to Mathematical Literature. By Prof. G. A. Miller. Pp. xiii + 302. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 7s. net.

DETAILS of the history of mathematics are better left to specialists, who still have plenty of occupation in clearing up doubtful points and amending errors. But there is a growing opinion among teachers that not only for themselves, but also for their pupils, some knowledge of the course of mathematical discovery is eminently desirable. Besides being a factor in a general education, it is stimulating to the learner, and supplies to the teacher a view of human activity and invention which ought to be suggestive from the psychological side. If there be a "natural" order of learning mathematics, it cannot be wholly different in the race and the individual; though, of course, this consideration ought not to be turned into a fad. A year should not be wasted on heuristic acquisition of the multiplication table.

To serve the purposes indicated, we want books which are not too long, put the main facts into proper perspective, avoid doubtful assertions, and show the trend of mathematics at the present time. In all these respects Prof. Miller seems to us to be successful. As to the perspective, a considerable proportion of the space is given to modern mathematics; this is quite justified by the remarkable progress, and in some ways revolution, of recent times. But the earlier history is by no means neglected; thus we have accounts of ancient and medieval arithmetic, geometry, and algebra, including the theory of irrationals—all in broad outline, but very well arranged. Among modern topics, we have a chapter on the development of mathematics since the close of the eighteenth century, and one on mathematical literature; the last ought to be very useful to those who are serious students of the subject.

The last chapter gives brief biographies of twenty-five deceased mathematicians, ranging from Euclid and Archimedes to Lie and Poincaré. The list could scarcely be improved upon, and the notices, on the whole, are excellent. For instance, justice is done to Cauchy's great achievements, at least those in pure mathematics, and the author scarcely professes to deal with applied mathematics. At the same time, notice is taken of Newton's theory of gravitation and of Poincaré's work on celestial mechanics, so that we cannot help being surprised when we find nothing said about Rowan Hamilton's contributions to dynamics or even his researches on systems of rays. It is curious how many seem to think of Hamilton as the inventor of quaternions and of nothing else.

The appendix gives a brief list of books, and is, we think, the most uneven part of the work; it almost seems as if the author had looked round his bookshelves and put down the titles of those volumes that caught his eye. For instance, under "Bibliographies and Encyclopædias" we have, among twenty entries, Mr. Somerville's bibliography of non-Euclidean geometry; the value of this is indisputable, but it is far too special a work for a list of this kind. Again, under "Teaching and Philosophy," we have the "Monographs" edited by Prof. J. W. A. Young; these are quite special things, like the Cambridge Tracts and other such publications, and to put them here among eighteen entries shows a lack of proportion.

Two things may strike the reader of the biographies: the full names are not always stated, and no indication is given of Jewish nationality. The last is a small matter; but the comparatively large number of Jews who have become eminent mathematicians and physicists is certainly remarkable.

Prof. Miller has the great merits of being lively and enthusiastic, and appreciating the beauties of his science. His anecdotes and *obiter dicta* are always interesting, and sometimes highly amusing; for instance, Abel writes of Cauchy: "Ses travaux sont excellents, mais il écrit d'une manière très confuse." Unless we are greatly mistaken, Abel deserves this criticism much more than Cauchy. Again, it will be news to most people that "Omar Alkhayami" (FitzGerald's Omar Khayyám) "made a statement in his algebra which seems to imply that he was able to determine the coefficients of the successive terms in the expansion of a binomial raised to any positive integral power."

We hope that copies of this book will find their way into many of our school libraries; quite a large part of it ought to be thoroughly enjoyed by a mathematical boy. It is well printed, too, and comparatively cheap.   G. B. M.

OUR BOOKSHELF.

The Origin of the Earth. By Thomas Chrowder Chamberlin. Pp. xi + 271. (Chicago: The University of Chicago Press; London: At the Cambridge University Press, 1916.) Price 6s. net.

THIS book forms the third of a series of publications intended to "present the complete results of series of investigations which have previously appeared only in scattered articles, if published at all." Needless to say, it is occupied mainly with a presentation of the planetesimal hypothesis, associated with the name of the author and his collaborator, Prof. F. R. Moulton. The original investigations on the planetesimal theory have perhaps been rather more scattered than most, so that an account of them in a compact and continuous form is especially welcome.

Prof. Chamberlin's theory is frankly tentative and speculative, and the reader is invited throughout to form his own judgment of the value of what is offered for his acceptance. The reader will proceed with caution, as indeed he is advised to do, for the progress of astronomy makes it evident