given. The only advantage that Clarke's projection can have is that it can be constructed graphically without the use of numerical tables or computations; but this advantage disappears as soon as we attempt to construct a large map.

The combination of Airy's development (or some projections still more appropriate) with Helmholtz's method of mechanical similarity should enable us to interpret our laboratory experiments intelligently, so that from these we may construct a close approximation to the general circulation of the atmosphere.

I consider it extremely desirable that these experiments should be made on a large scale, with due regard to all numerical, statistical and mechanical details in some laboratory where the study of meteorology is prosecuted as a branch of mathematical physics.

SHORTER NOTICES.

Breve Storia della Matematica dai tempi antichi al medio evo. By GAETANO FAZZARI. Milano, R. Sandron, 1907. 268 pp. Price, 4 lire.

IT is rather strange that Italy, the country that produced the most learned bibliophile in the domain of mathematics, Prince Boncompagni, and that furnished to France another well-known collector of early works, the historian Libri, should have published so little relating to the general development of the science. It is true that Favaro and Loria have contributed very acceptably to the history of certain periods or topics, and that Riccardi's bibliography of the early mathematical works of his own country will always be a standard book of reference, but in spite of all the encouragement of men like these, and all the patriotism that would lead an Italian to write the story of a science that so largely developed on his native soil, such a work as a worthy general history of mathematics does not exist in the language of Italy. It is for this reason that such an attempt as Professor Fazzari's should be particularly welcome, the more so as it was written on the island in which Archimedes spent most of his life, which Pythagoras visited, and to which Maurolycus brought no small amount of glory in the period of the Renaissance.

The aim of Professor Fazzari has been to write a work of about the character of Ball's and Cajori's popular histories, one that tells the story of mathematics in such a simple manner as to appeal to the younger student rather than to the mature scholar, leading him to higher fields in the science by an interesting recital of its progress. He has not, therefore, felt it necessary to pay attention to the original sources of information, but has gathered his material from a few of the standard writers, setting it forth in a pleasing conversational style. The general range of the subjects may be seen from the table of contents: Chapter I, Decimal numeration; Chapter II, The Egyptians; Chapter III, The Babylonians; Chapter IV, Logistica among the Greeks; Chapter V, The pre-euclidean period, including Thales and the Ionic school, the mathematics of the fifth century B. C., and the Academy; Chapter VI, The golden period of Greek geometry; Chapter VII, The Greek mathematics of the second century B. C.; Chapter VIII, The period of decadence; Chapter IX, The Romans; Chapter X, The Indians; Chapter XI, The Arabs; Chapter XII, The Byzantine school; Chapter XIII, The middle ages, from the seventh to the fifteenth centuries inclusive. It will thus be seen that the general field covered is about what would be expected, and that the result must be helpful to students and teachers in Italy if the work has been tolerably well done.

It is a little difficult to answer the question which the preceding sentence suggests. What is meant by "tolerable" in such a work? Where does the intolerable begin, and what is the norm of comparison? The book is better than Hoefer's, as in the natural order of things it could hardly help being; it is not so good as Ball's, and indeed it would be difficult to improve upon the popular style of that writer; it is not in the same class with such scholarly productions as those of Montucla, Libri, and Cantor, and of course this was not to be expected. It is but just to say that it is pleasantly written and that it covers the leading topics down to the opening of the sixteenth century; but it cannot be said that it shows a very wide range of reading, or that Professor Fazzari has produced an entirely reliable work.

With respect to the authorities consulted, the care shown in securing data, and the weighing of evidence, a few illustrations will suffice. In speaking of the Roman numerals, but two theories are given to explain the symbols, both rather antiquated, and no evidence is shown of any knowledge of the important investigations of Friedlein, Hoüel, Zangemeister, Mommsen, and R. Bombelli. As a consequence, the treatment of the subject has no real value, if, indeed, it can be called fairly reliable. In the rather fanciful etymologies of the lower numerals, the Humboldt-Curtius theory as to *quinque*, now generally agreed to be untenable, is given as the latest pronouncement in the case. The illustration (Fig. 3) from the Ahmes Papyrus is not only incorrectly drawn (having the hieroglyphic for 37 instead of 33), but it is not from the papyrus at all, being merely Eisenlohr's hieroglyphic rendering of the hieratic original. The positive statement that Heron of Alexandria was living in the period 120–100 B. C. shows that the author has not consulted Schmidt's 1899 edition of the Opera, and the passing of the name of Menelaus with no reference to the anharmonic ratio shows that he has not consulted the Abhandlungen for 1902. The treatment of algebraic symbolism (page 127) leaves an entirely wrong impression as to the early use of the common signs of operation and relation, and it seems doubtful if the author himself is entirely clear in this matter. On the question of the origin of the Hindu-Arabic numerals evidently no attempt has been made to trace these forms back to any of the pre-Christian cave inscriptions, and the statement on page 177 indicates that the author is not aware of the existence of these sources. That the numerals came primarily from the Sanskrit alphabet, as stated on page 179, is now an abandoned theory.

These criticisms fairly represent the lack of scholarly effort in the preparation of the work. Similar ones will suggest themselves to the reader at intervals so frequent as to lead him to regret that the author did not put more time upon the preparation of his manuscript and revise the proof more carefully.

As to the description of the Babylonian numerals, it was not to be expected that the recent Hilprecht discoveries would be known to Professor Fazzari, but these make his treatment of the matter seem very elementary.*

As a piece of bookmaking the work leaves much to be desired, and the absence of an index in such a publication is indefensible. Of the minor errors, chiefly in the proof-reading, the following are types: Händbuch for Handbuch (p. 19), the letter sigma for stigma (p. 35), und for and (p. 56), 1491 for 1494 (Paciuolo, p. 127), Ceilan for Ceulen (p. 171), Geometria for La géométrie as the title of the first edition of Descartes (page 184), and the double spelling of Bhaskara (pages 153, 173)

* See the BULLETIN, vol. 13, p. 392.

and Paciuolo (pages 127, 259). The form "Mohammed ben Musa Al Hovarezmi" is probably the least satisfactory of any for the name of the great Arab mathematician, particularly as it is followed by the statement that he was a native of Chwarizm, and as the form "Alhowarizmi" appears on page 207. It is unfortunate that we have as yet no generally accepted norm for such transliterations, but there is no good authority for such a mixture of languages as this. A similar criticism might justly be passed upon most of the other oriental names in the work, particularly Al Fahri (page 194), Al Karhi and Alkarhi (pages 194, 195), and Alhayyami (page 199).

DAVID EUGENE SMITH.

Leçons de Géométrie Supérieure. Professées en 1905–1906 par M. E. VESSIOT. Lyon, Delaroche et Schneider, 1906. 4to., 326 pp. (autographed).

THESE lectures delivered by Vessiot during the year 1905–1906 were published in the present form at the demand of his students. The author remarks in the preface that he is hopeful that they may be of service to those who are beginning the study of higher geometry and may serve them as a good preparation for the reading of original memoirs and such works as Darboux's Théorie des surfaces. It is the opinion of the reviewer that the lectures serve these purposes admirably. The attack is direct and the end to be reached is kept clearly before the reader, in fact the whole presentation is such as to lead the beginner to an appreciation of the subject. A glance at the table of contents will convince one that the book will serve as a good introduction to the study of Darboux.

The principal object of the lessons is the study of systems of straight lines but owing to the close relation between lines and spheres it is quite natural that systems of spheres should be studied also. It is assumed at the outset that the student is familiar with the elementary notions of twisted curves and surfaces (tangent planes, tangent lines, etc.), and that he has some acquaintance with the elements of the theory of contact.

In Chapter I, Frenet's formulas for twisted curves are derived and the simple properties of developable surfaces obtained. The rectifying and polar surfaces are discussed as examples of developables. Chapters II, III, and IV are devoted to the general surface theory. Throughout these chapters the importance of the two differential forms of Gauss