The Constructive Development of Group Theory, with a Bibliography. By BURTON SCOTT EASTON. Philadelphia, Publications of the University of Pennsylvania. Mathematics, No. 2, 1902. 8vo, iv + 89 pp. Ginn & Co., Selling Agents.

"THE purpose of this monograph is to present in a consecutive form the principal features of abstract and substitution group theory." It has been the aim of the author "to examine in detail all memoirs dealing directly with such group theory (excluding, in particular, that of linear groups) and to construct from this material a continuous treatise on the subject." These few words from the preface are sufficient evidence of the importance and difficulty of the task which the author has set for himself.

The monograph consists of two parts — a bibliography, covering pages 5–38; and a compendium, covering pages 39–86. The former is preceded by a prefatory note and a list of periodicals with abbreviations, while the latter is followed by a good subject index. The bibliography includes 157 names and gives under each name the titles and places of publication, arranged in chronological order. As this is the first publication of its kind, it is a very welcome addition to the literature on the subject and will doubtless prove valuable to all workers in this field.

Although great care seems to have been exercised in compiling the bibliography, yet it can scarcely be expected that the first edition of such a comprehensive collection would be free from errors. A few corrections are made in the addenda which closes the memoir. To these should be added Tanner's paper "On the enumeration of groups of totitives," *Proceedings of the London Mathematical Society*, volume 27; Hurwitz, "Algebraische Gebilde mit eindeutigen Transformationen in sich," *Mathematische Annalen*, volume 41; Study, "Sphärische Trigonometrie," *Leipziger Abhandlungen*, volume 20; the algebras of Comberousse and Pincherle, and possibly one or two of the papers of H. Laurent.

Many readers will doubtless regret that the author did not aim to include all papers on linear groups. This subject is so closely related to that of abstract and substitution groups that it frequently seems difficult to decide whether a paper on one of these subjects has sufficient bearing on the other to be classed with its literature. Such an extension would however have made the task of the author still more difficult, and he

can scarcely be blamed for leaving this part to some one else. We may note here a slight typographical error. Under M 24 the word "where" should be replaced by *whose*.

The second part practically consists of the statement of theorems without proof and a comprehensive list of references to works where proofs may be found. These references are arranged in chronological order and tend to make this part even more useful than the first. By employing abbreviations very freely a vast amount of information is crowded on less than fifty pages. It is to be hoped that many of the readers will have the kindness to comply with the author's request and notify him of any inaccuracies which they may observe. The following have been observed by the reviewer:

In no. 134 it should be stated that g is a power of a prime. Otherwise the theorem is not generally true. With this change the theorem belongs under heading 9, "Groups whose order is a power of a prime number." As a special case of this theorem no. 119 should read $m > 6$ instead of "$m > p + 4$." Of course, the latter is true, but it is not as general as the former. In no. 142 the term "subgroup" at the end of the first line should be replaced by *group*, and in no. 146 the expression "two abelian subgroups" should be replaced by *an abelian group*. In no. 166 for $n-1$ read $m-1$, and replace "primitive group" by *primitive perfect group* in 168.

In nos. 171–173 it should be stated that the primitive groups in question do not include the alternating group and *greater than* 3 should be added to the first line of no. 175. A curious oversight is presented by no. 219. The holomorph of G is never the direct product of G and its i-group. In no. 20 the exponents should evidently be $m_1, m_2, \cdots$ in place of $m1, m2, \cdots$

According to Cantor's dictum * "da die Geschichte unwiderruflich die Veröffentlichungszeit als allein massgebend betrachten muss, wo Erstlingsrechte zu vergeben sind" it would appear that the expression "Due to Dd" under no. 103 should either be omitted or replaced by *Due to M.*† The references under no. 105 are somewhat misleading as the theorem was first given in this form by M 13,267. Its proof was directly based upon older theorems and due acknowledgment was made in the first publication.

G. A. MILLER.

* Cantor, Vorlesungen über Geschichte der Mathematik, vol. 2 (1900), p. 811.

† Frobenius, *Berliner Sitzungsberichte* (1896), p. 1348.