tische Annalen, volume 43 (1893). The given list of six does not include any American author, but all the writers included therein were very influential in starting work along this line in our country and some Americans, including E. V. Huntington, made further studies relating to the simplification of the postulates of the group concept. While Heinrich Weber may now be reasonably regarded as the first man who fully mastered the group concept (1893), it is of some interest to note that about three years thereafter he made an erroneous assertion relating thereto in the first edition of the second volume of his "Algebra" (1896) when he stated (page 54) that the most important example of a commutative group is the system of our natural numbers when they are combined by multiplication.

On account of the wide use of this algebra this error was often repeated by later writers and seems not to have been publicly corrected before the appearance of the second edition of this volume about three years later. It may remind one of the error committed by Sophus Lie on page 163 of volume 1 of his "Transformationsgruppen" (1888) where he asserted in effect that the numbers which are less than unity form a group when they are combined by multiplication. This error was repeated by Felix Klein several years later in the *Mathematische Annalen,* volume 43, page 66 (1893). It is, however, less striking than the one by Heinrich Weber to which we referred, since neither Sophus Lie nor Felix Klein ever definitely adopted the now common postulates of an abstract group.

Contrary to what might naturally be assumed, all the possible abstract groups of certain low orders were determined long before a satisfactory system of postulates of the group concept was published. Forward steps in the development of mathematical subjects frequently preceded the establishment of a solid foundation of the subject. The history of the development of the theory of ordinary complex numbers furnishes many instances of such forward steps. There is, however, no satisfactory evidence now extant for the assertion that "as early as the fifteenth century mathematicians were compelled to introduce symbols for the square roots of negative numbers in order to solve all quadratic and cubic equations." This assertion appears on page 92 of the valuable volume entitled "What is Mathematics?" by Richard Courant and Herbert Robbins (1941).

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WHEAT GRAINS WITHOUT EMBRYOS[1]

A CRITICAL examination of several thousands of wheat grains of the 1941 crop for separation of kernels only slightly affected by sprout injury showed occasional grains which had a slightly concave area where the embryo usually produces a convex area. This at once suggested the embryoless seeds described by Lyon.[2] Some of the grains were sent to Dr. George H. Conant for sectioning, and these sections show clearly the embryoless condition.

Miss Lyon was especially interested in studying the respiratory activity of such seeds because previous comparisons of activity of embryo and endosperm had been made from samples from which embryos had been removed. She did not discuss the origin of embryoless seeds. Her work was the first report of this condition in wheat. Harlan and Pope[3] had reported the first case in cereals, finding five such seeds in many thousands of barley. They suggested that either the fertilization from which the embryo is formed had failed to occur or that development had been arrested shortly afterward, since there was not more than a doubtful trace of embryo cells.

Miss Lyon found that such seeds were not infrequent in wheat, finding about 0.1 per cent. in 150,000 grains, using six different varieties representing both winter and spring wheats. The North Dakota material examined was chiefly one sample of Ceres, a hard red spring wheat developed at the North Dakota station, and the proportion was similar to that found by Miss Lyon. This adds another variety to the list and supports her conclusion that it is not an uncommon occurrence.

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SCIENTIFIC BOOKS

VERTEBRATE EMBRYOLOGY

Introduction to Vertebrate Embryology. By WALDO SHUMWAY. Fourth edition. 372 pp. New York: John Wiley and Sons. 1942. $4.00.

THIS text, having reached the fourth edition, has quite evidently established itself. The present issue is considerably altered, but retains the general method of comparative treatment, *i.e.,* each of the four animals, amphioxus, frog, chick and man, is compared in its development in each system or part. Physiology is also stressed as formerly. The changes relate principally to increased attention to organogeny, to de-

[1] Contribution from the N. D. Agricultural Experiment Station. Published with the approval of the director.

[2] Mildred E. Lyon, *Jour. Agr. Res.,* 36: 631–637, 1928.

[3] H. V. Harlan and M. N. Pope, *Am. Jour. Bot.,* 12: 50–53, 1925.

creased space given to genes and chromosomes, and to condensation of the material dealing with the anatomy of vertebrate embryos into an atlas. Much of the book has been rewritten, partly in an effort to include recent work. The illustrations are numerous and clear, but sometimes rough. There are nineteen chapters, including one on embryological technique, a glossary and twenty pages of index. The book is clearly the outgrowth of much use, and represents a practical adaptation of this experience.

Fundamentals of Comparative Embryology of the Vertebrates. By ALFRED F. HUETTNER. 416 pp. New York: The Macmillan Company. 1941. $4.50.

HERE is another book which has grown out of the experience of the author, more than half of the many excellent figures having come from his own hand. This is an important matter in this case, because they furnish the foundation of the entire work and are beautifully prepared. There are again nineteen chapters, but this time, after four chapters dealing with protoplasm and the cell, development of sex, chromosomes in development, gametes and fertilization, these take up in turn amphioxus, 1 chapter; frog, 3 chapters; chick, 7 chapters; and mammals, 4 chapters. There is thus quite a contrast in the general treatment, as compared with Shumway, and an evident lack of continuity in the account of the different systems. Another instance of similarity in the two books is the use of the same four animals for study.

One would expect accuracy in the treatment of general topics, such as the chromosomes, but does not always find it. Thus in discussing the process of mitosis it is stated that "Mitosis is initiated in the nucleus by the precipitation of chromatin granules and fibers which form an entangled thread-like structure called the *spireme*. . . . These are the chromosomes, their shape being constant from one cell generation to the next in spite of the fact that they disintegrate in the interphase nucleus and are built up from it again in the next mitosis." This gives a very faulty interpretation of the process, for, instead of disintegrating and reforming, they preserve their form by a continuous existence, which is the essence of their being. The number of chromosomes for Anasa is stated to be twenty-two, without indication that that is the female number. In describing the history of the X-chromosome in the grasshopper it is stated to divide in the first spermatocyte, instead of in the second. Such errors as these are unfortunate, but do not affect the general character of the book, which is excellent.

A Manual of Experimental Embryology. By VIKTOR HAMBURGER. 213 pp. University of Chicago Press. 1942. $2.50.

HERE is a book quite different from the preceding two. Its approach is experimental and it details the requirements which this method calls for, including instruments and equipment, Part I. Part II deals with experiments on amphibian embryos. Here we find a discussion of living material, including breeding habits, rates of development, culture media and rearing and feeding larvae. Under experiments there are sections devoted to technical procedures, embryonic areas, pregastrulation stages, transplantation methods, morphological fields, embryonic induction, parabiosis, external factors in development and the development of behavior patterns. Part III concerns itself with the chick embryo, and under the heading "Material and technical procedures" treats incubation, limb bud stages, equipment for operations and staining cartilage *in toto*. The experimental technique here deals with vital staining, chorio-allantoic grafts and intraembryonic transplantations. Part IV takes up regeneration experiments upon Planaria and amphibian larvae, producing the various two-headed and two-tailed larvae, tail regeneration, limb regeneration and lens regeneration effects. Finally in Part V there is a special treatment of the gradient theory of Child, with experiments on Planaria and chick embryos. For each section there is a bibliography, which deals only with the subject-matter treated. It is the opinion of the author that "a course in an experimental branch of biology not only should acquaint the student with new facts but should strengthen his power of reasoning and his logical acuity as well." The experiments outlined are all simple and do not demand any unusual apparatus or special installation. They are all routine class exercises, and none of them require the use of sections for their study. Furthermore they are so planned and stated that they may be taken up in any convenient order at the desire of the teacher. This book is sure to be a successful addition to the series of worthwhile American texts on embryology.

C. E. MCCLUNG

MATHEMATICS

Calculus. By G. E. F. SHERWOOD and ANGUS E. TAYLOR. xiv + 503 pp. New York: Prentice-Hall, Inc. 1942. $3.75.

"CALCULUS" sets a new high standard for text-books for the first course in differential and integral calculus. The topics treated and the order in which they are presented are those which have become largely standard in American texts: differentiation, with the usual applications, comes first; later, integration with geometric and physical applications; finally, partial differentiation, hyperbolic functions, multiple integrals and infinite series. The unique features of the book are to be found in the treatment of the material: