mainders should be taught before formal division. Thus, when the pupil knows that four sevens are twenty-eight, he should learn that thirty is four sevens and two units remaining. P. 63: The Euclidean method of greatest common divisor is referred to without explanation. P. 74, last paragraph of the example: The reason "Since we get the same answer . . ." is not sufficient and is inexcusable because the real reason is so apparent. In the process of reducing the fractions to their common denominators the numbers 8 and 9 are actually found thus, 4×2, 3×3. P. 99: This is too advanced to be of practical value in the grades. P. 101, last paragraph: Although the author has good precedent for this, it is surely a perversion to teach that "hundredths" and "per cent." are interchangeable. For if so, then 7.07 per cent. could read seven and seven per cent. per cent., an unfortunate confusion. Per cent. is primarily a rate per hundred, and its presentation as such would not exclude the desirable things in the author's subsequent treatment. P. 110 (*a*): "Times greater than" is a loose use of language for "times as great," probably due to the author's effort to carry out an analogy to percentage. Pp. 109–111: This correspondence between percentage and the processes with integers and fractions is not sufficiently significant to warrant its use in the class-room, and is of little value to the teacher. Pp. 126–135: The explanations on these pages are rather complicated, and, taken as a whole, are not teachable in the class-room. It would be better to point out for the teacher exactly the form to be used. Pp. 148–152: One is disappointed not to find a reference to the modern partial-payment problem most frequently met; namely, the one in which limited payments are accepted at stated intervals, usually at interest dates. Pp. 180–181: An expansion and illustration of this topic would be of greater value than the familiar material on pp. 172–175. Chapters VIII.–IX., pp. 196–233, are Herbartian and discuss the teaching process from the standpoint of the subject, instead of from the standpoint of the pupil. Pp. 200–201: The teacher's aim is relatively unimportant. It is the pupil's purpose that controls his activity. Consequently he must have a stronger motive than that suggested at the end of p. 201. In this connection, compare pp. 201 and 203 with the more helpful suggestions on pp. 212 and 218. Pp. 236–242: these lists impress one as more complete than significant. The points made need classifying. The young teacher should be told which of these are most important. It is better to study a few essentials of a model lesson, than to attempt so ambitious a list. Pp. 243–277: Chapter XI. is wholly inadequate, especially in its treatment of the curriculum. The vital question to-day is not, "How shall we parcel out the body of arithmetical science?" but, "What live issues, appreciated by children, shall we choose as the core of instruction?" The curriculum must precede method, hence the prospective teacher should be instructed to observe this order in teaching. Pp. 278–280: Since many of our normal students take one or two modern languages, a few references to foreign works on the teaching of arithmetic might be helpful, particularly the German works of Unger and Knilling.

The foregoing criticisms should not be taken as the estimate of the book. The volume is packed with good suggestions to teachers, and will take its place among the most useful half-dozen available books on the subject.

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Montclair, N. J.,
January 3, 1914

Guide to the Study of Animal Ecology. By Chas. C. Adams. New York, Macmillan. 183 pages.

This book is essentially a bibliographical and methodological manual for field students in ecology. As is stated in the preface the primary emphasis is upon ecological survey work. Thus instrumental measurement of the environment and experimental study are elaborated in the literature cited. The following chapter headings appear: Aim, Content and Point of View; The Value and Method of Ecological Surveys; Field Study; The Collection, Preservation and Determination of Specimens; Scientific Technique; Sources of Information on

Life Histories; Environmental Change; Metabolism, Growth, etc.; Adjustment between the Environment and Animal. Its scientific value lies in the author's outline for the organization of the science.

In the first chapter, the subject is divided into "individual ecology" or the ecology of individuals and species, and "aggregate ecology," or the ecology of taxonomic groups of species, genera, families, etc. These two divisions have usually not been recognized separately. The distinction is good, but the two divisions taken together are coordinate with his third division, "associational ecology," or the ecology of communities. Chapters II.–IV. are devoted to ecological surveys and methods of conducting them. The author rightly deplores the tendency of museums to rate the work of collectors and expeditions on the basis of number of specimens brought back, as this discourages the recording of ecological facts. The methods of collecting, preserving and arranging notes and specimens, and securing proper identification of the latter are given. These chapters will be of material aid to those undertaking field ecological study.

Although divided under several chapter headings, the remainder of the book consists essentially of about 90 pages of classified bibliography. The references are of a diversified type and are intended to guide the worker to needed information, ranging from the making up of the sometimes necessary camping outfit, to the preparation of his results for the printer. They are classified under general headings and many are followed by statements as to contents. Representative papers on the environment, animal communities, struggle for existence, physiology, behavior and many other topics are included. The references are complete enough to give valuable suggestions to workers from almost any point of view in ecology. The comments on the more important older ecological papers make it clear that a considerable number of incomplete attempts at organization of knowledge of animal communities have been recorded. Thus by means of the references, the book gives the history of the development of the science.

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SPECIAL ARTICLES

THE "GOLDEN MEAN" IN THE INHERITANCE OF SIZE

IN bulletin 242 of the New Jersey State College Experiment Station, page 39, appears the following statement:

> The size and shape of the F_1 (tomato) fruits are the geometric means between the size and shape corresponding to those factors of the parents, which were active in crossing.

This statement was based upon the measurements of many thousands of tomato fruits. A mode of inheritance in which $x(F_1) = \sqrt{ab}$ assumes that in the union of gametes representing factors for size a multiplication and the extraction of a square root take place. I was unable at the time to explain how that might occur, and so far no attempt by any one else to interpret the significance of my results has come to my notice. In a forthcoming bulletin I shall present details of F_2 and F_3, and this paper is published solely to set forth the nature of the principle of size inheritance by the "golden mean," to indicate its bearing upon vital questions on subjects in heredity, and to establish the priority of its discovery.

When two factors for different sizes of homologous parts meet in a cross, the resulting F_1 size is commonly intermediate in such parts as are not greatly subject to fluctuation. If a and b represent the parental size characters, it has been tacitly assumed by most investigators that the F_1 size is $(a+b)/2$. In tomato fruits I found it to be $\sqrt{ab}$. On the face of it the average (algebraic mean) seems the more probable, but when used as the basis for the comparable inheritance of lines, surfaces, and volumes, it becomes impossible. For example, let plants be crossed, which have spherical fruits of diameters a and b, and let us assume, for the sake of simplicity, that all cells constituting the volumes of both fruits are of equal dimensions. Then the ratio between parents and F_1 of the number of cells