The work as a whole is a concise summary with complete marginal references to practically all of the publications and conclusions of previous observers on the Carboniferous rocks of the Appalachian basin. It is by far the most elaborate and comprehensive study ever undertaken of the Appalachian Carboniferous, and it will long remain the chief book of reference for the stratigraphic relations of these great series of deposits, the most important economically on the continent.

Dr. Stevenson was peculiarly qualified for the great task he undertook, having himself spent about forty years of his life in the study of the Carboniferous rocks, and having personally seen more of the Appalachian basin than any other geologist. Then, too, in Dr. Stevenson's library, the most complete of any in publications dealing with the Appalachian Carboniferous, is to be found practically everything that other geologists had written. The study and digestion of this immense mass of data scattered through hundreds of publications was in itself a task of enormous proportions, and the writer has put all of his brother geologists of the present, as well as those of the future, under lasting obligations by the long and arduous "labor of love" involved in the publication of this great work which is destined to remain the chief monument of its distinguished author.

One of the principal causes for friction between the U. S. Geological Survey and the other geologists of the country, not connected with that organization, has been a failure of the United States geologists to recognize properly the work of previous observers in the same area, except occasionally when these observers had made some glaring mistakes. The absence of some such publication as Dr. Stevenson's may have been the principal reason for this apparent want of courtesy and fairness in the recognition of previous work, but hereafter there can remain no "extenuating circumstances" for such neglect so far as the Appalachian Carboniferous is concerned.

Regarding the conclusions of the author upon some mooted questions like the western limits of the Catskill, the identity of certain coal beds of wide extent, the equivalency of the Kanawha Black Flint, and other questions of like nature, there will evidently not be entire concurrence on the part of geologists. The reviewer also thinks that the great apparent thinning of both the Monongahela and Conemaugh formations along their northern and western margins is based upon mistaken identifications, that while there is much thinning of these formations shown toward the northwest, it is not really so great as indicated by the author. These are minor matters, however, and confined to regions where, owing to absence of accurate maps and careful measurements, there is much room for doubt as to identifications.

The author rightly gives proper credit to the monumental work of David White, whose skillful and untiring paleobotanical studies have assisted so much in the solution of the many intricate stratigraphic problems connected with the Pottsville and Kanawha formations, and their great southwestward thickening.

Geologists will look forward anxiously for the appearance of Dr. Stevenson's promised paper upon the origin of coal and his discussion of the many related problems for which the wide study and field work of this eminent teacher and geologist have given exceptional qualifications.

I. C. W.

A General Catalogue of Double Stars within 121° of the North Pole. By S. W. Burnham. Part I., The Catalogue, pp. lv + 274. Part II., Notes to the Catalogue, pp. viii + 828. Published by the Carnegie Institution of Washington. 1906.

We run little risk in saying that this is the most important astronomical publication of the year. Although devoted to a highly technical division of the science, it will surely command the attention of astronomers everywhere and long remain a reference of extraordinary excellence. It has been many years in preparation. In the introduction, the author states that its first form was a manuscript catalogue that he began to construct in Chicago in 1870, soon after receiving his six-

inch Clark refractor, an instrument which he used almost entirely in the observation of double stars and which brought him a larger number of discoveries than any other telescope that he has used in his long and varied astronomical career. At that time no complete list of the known double stars existed, and there were few books in Chicago relating to them. The small refractor showed many pairs not recorded in any of the books available, and to make certain that these were new, he had to search far and wide through nearly the whole range of modern astronomical literature, to see what stars had previously been recorded as double. Observatories were visited and their libraries consulted; books were borrowed and what they contained relating to this particular subject was laboriously copied by hand; books and memoirs were also purchased, making the beginning of a library devoted to this special subject that has since become practically complete.

The manuscript catalogue which Professor Burnham formed at the beginning has been kept continuously posted to date, by adding accounts of new discoveries whenever made, and of new observations wherever published. To make room for the new material, a second manuscript edition eventually became necessary, and later still a third, which finally passed into the hands of the printer and now appears in finished form.

This great work divides into two parts. The first contains a catalogue of 13,665 double stars within 121° of the north celestial pole, and the second, the notes to this catalogue. Besides the catalogue, Part I. includes the introduction, indexes, precession tables and appendix, filling altogether 329 closely printed quarto pages. Part II. makes a similar volume of 836 pages.

To state the number of pages gives but a faint notion of the magnitude of the labor it has been to collect the information compressed within these somewhat extended limits. The labor would have been materially less had it been a mere compilation. This, however, is far from being the case. The predominant virtue of this work is its trustworthiness, and this springs not so much from what has been gathered from the published observations as from the author's long hours at the telescope, searching, verifying, measuring, and from his continuous investigations from all the data available. For many years he has been a most industrious observer, and his energy, devotion and sound judgment have had much to do with placing double-star astronomy in its present satisfactory condition. No matter at how great a cost in time and labor, he has made it his business to know the truth concerning these distant systems, consistently following stars in rapid motion during their critical periods, measuring those suffering from neglect, and in a larger degree than any one else, comparing the double stars in the sky with the record of them and bringing the two into harmony.

This work is arranged in a very convenient and satisfactory form and is beautifully printed. In both volumes the stars are arranged in the order of their right ascensions for the epoch 1880, and are numbered consecutively. The usual double-star numbers, star names, constellation letters and numbers are also given, making identification easy by whatever mode a pair may be designated.

The catalogue in Part I. is in tabular form, with eleven columns to the page. The data there given, in addition to the numbers and names just mentioned, are the position angle, distance and epoch of the earliest reliable measures; magnitudes; indication of the observers and the number of nights on which measures were made; references and brief notes, relating chiefly to notation and colors of components. These are the data most useful to the observer, and they are presented in a form eminently suited to his needs.

The notes in Part II. are usually brief and always to the point. They are generally reduced to a few lines to the star, giving in a few words a synopsis of the history of each pair, measures corresponding to selected epochs, statements respecting relative and proper motions, and complete references to all published observations and to important papers. The stars whose components have

moved considerably since the first reliable measures were made are accompanied by diagrams, which by picturing the movement give a clearer indication of the nature of the change than would be possible in any other way. As a rule, observations are quoted sparingly, often not in sufficient numbers to enable one to form an independent opinion respecting the motion. The proper motions are usually quoted from the latest reliable sources, and converted into direction and distance so as to be immediately available in this department. With the exception of Beta Delphini, the only element given of the orbits of the binaries is the periodic time. This is the element that seems to interest the author most. The others are also of importance, and indeed necessary if exact comparisons between observed and computed places are to be made, and it is a distinct loss not to have them quoted also.

The absence of collected information respecting the double stars has in the past made it very difficult for observers to arrange programs which should have the maximum effectiveness in promoting the advancement of this department of science. Many popular stars have been measured repeatedly, sometimes quite unnecessarily, while hundreds of others have been neglected for long intervals. This condition is entirely changed by the appearance of these volumes, and in consequence advance from now on should be accelerated. Professor Burnham has endeavored to bring the histories of all pairs as nearly to date as possible, and this has necessitated the reobservation of the neglected stars. For several years he has devoted himself to this task, and among the observations presented in the notes are the mean results of several thousand measures made for this special purpose, as many as most observers would make in a lifetime, and forming a large and important contribution to knowledge.

The value of this work as a reference is enhanced by the tables following the introduction. Here, in remarkably compact form, the double stars discovered by modern observers, that is, since about 1840, are conveniently indexed, so that any pair of importance, whatever its designation, may be very readily found. These indexes are followed by a provisional grouping of the double stars into classes according to their motions, so far as these may now be determined. Convenient precession tables are also provided, for the reduction of star places from one epoch to another.

Even with the data available, as given in these volumes, it is not possible to make more than a beginning in the separation of the double stars into their various classes. According to the tables given, the number in each class is as follows:

Binaries with computed orbits	88
Binaries without computed orbits	94
Stars probably binary	112
Stars of the type of 61 Cygni	38
Stars with common proper motion	579
Stars with rectilinear motion	387
Total	1,298

These lists include less than ten per cent. of the stars which have been catalogued as double, and to a certain extent they serve as an index to the slowness with which changes in the relative positions of the stars take place. The great majority of all the pairs listed have either remained sensibly fixed, or have moved so little since their first measures were made that it is not now possible to classify them in respect to their movements. In the course of time many more will doubtless be added to the lists above, and rapid accessions may be expected in a few years when the close double stars which have recently been discovered in such large numbers come to be remeasured. To the present the information of value resulting from double-star investigations, rich as it is, has come from a comparatively small number of objects, hardly more than enough to furnish types. In the future, statistical studies, which are now of precarious value, will doubtless hold an important place and yield many interesting results. Professor Burnham has realized this to the full. He has preferred to rely upon the substantial facts derived from observation rather than upon insecure theory and specula-

tion. The volumes before us are singularly free from all attempts to draw far-reaching conclusions from insufficient data.

The publication of this work marks an epoch in the history of double-star astronomy. It becomes at once an authoritative exposition of the state of the sky in respect to the class of objects it considers, and a reference that will take the place of hundreds of publications. No single work has been more pressingly needed these many years, and none could have filled the requirements of practical observers and of astronomers generally more satisfactorily. It will be an instrument of progress, leading and directing; an example to be followed, not only in its own field, but also in other departments.

W. J. HUSSEY

ANN ARBOR, MICH.,
September, 1907

The Frog Book: North American Toads and Frogs, with a study of the habits and life-histories of those of the Northeastern States. By MARY C. DICKERSON. New York, Doubleday, Page & Co. 1906. Pp. 253. $4.00.

This book is the twelfth volume in that noteworthy series "The Nature Library." In it we find a most satisfactory solution of the difficult problem of how to make a popular book really good, although of large size and about a group of animals that is not a large group and is less attractive to the layman than birds, fish or insects.

Like others in the series, it is profusely illustrated with original photographs, some 290 of them in 96 plates and 30 in text figures. Most of these show the living frogs and toads exceedingly well in black and white, while 16 plates are nicely colored. Some of the text figures are merely embellishments and twelve plates are photographs of attractive scenery representing the haunts of frogs.

The text begins with an introduction of 40 pages. With this is an artificial key for finding out the names of all the frogs and toads throughout the United States.

The main part of the work is a description of the 56 frogs and toads of this country taken up in systematic order in their seven families and twelve genera. The common toads, their eggs and young, are well treated and their value to agriculture emphasized, but the practical side of the subject is not exaggerated and the author's real interest in nature is expressed in such sentences as: "We also find the toad's song one of the most beautiful sounds in nature. The effect of a 'chorus' of toads is harmonious indeed—a crooning sound that seems a fit companion for amorous spring, bursting flower buds and the feeling of new life in our hearts."

Some thirty-six pages of text and many of the well-colored and spirited illustrations of the book well represent the tree-frogs; one of which on a "Jack-in-the-pulpit" makes the charming frontispiece. Here as elsewhere there are suggestive new facts, such as the statement that some tree-frogs of the species *Hyla squirella,* shut in a pail with no change of condition, continued for some hours to change their colors; which of course emphasizes the fact that color changes in frogs may be brought about without light or other outside cause.

The descriptions of the common larger frogs of our ponds, woods and meadows take up the remaining seventy pages of the volume, which ends with a bibliography of one hundred titles, embracing such diverse works as Wiedersheim's "Anatomy" and White's "Natural History of Selborne."

Not only are the habits of the common frogs well portrayed, but the eggs and tadpoles are figured, as has not been done before, and throughout the work the author's genuine sympathy with nature is in evidence. The naturalist will be glad to have the pictures in this book accessible and the layman should find the book both attractive and useful, while school nature-study could make excellent use of it.

The large amount of original observation made by the author will best be appreciated by those whom the book should stimulate to add more to the facts accumulating towards