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

a complete knowledge of the life histories of all American frogs and toads. E. A. A.

Behavior of the Lower Organisms. By H. S. Jennings. New York, The Macmillan Co. 1906. Pp. xiv + 366; 144 figs.

This volume, which is the tenth in the series of biological treatises published by Columbia University, is a timely exposition of the behavior of the lower organisms by an author who has devoted a large part of his time to an investigation of this subject. The distribution of the materials in the volume follows an admirable plan. The first part of the book deals with the behavior of unicellular organisms, especially *Paramecium*. The second part takes up the behavior of the lower metazoans, including the cœlenterates, echinoderms, worms and crustaceans. The third part treats of the theoretic aspect of the subject, and the volume is concluded by a bibliography and a good index.

The first and second parts, which are naturally more concerned with statements of facts than with speculative matters, are a very full and adequate description of the reactions of the protozoans, lower metazoans, etc., and form, in the reviewer's opinion, the best digest of this subject that has yet appeared. They entirely supersede such recent works as that of Lukas and others, and with their bibliographical references they form a most serviceable introduction to the subject.

The third part of the volume is much less happily conceived. This opens with a chapter in which the essential similarity of the reactions of unicellular and of multicellular animals is pointed out and the true relations of a nervous mechanism to these reactions is made clear, and it closes with chapters on the development of behavior and the relations of behavior to psychic factors, etc., avowedly hypothetical matters. The body of the third part, however, is taken up with a discussion which turns in the main on a comparison of the tropism theory and the author's own views about animal orientation, etc. It is possibly asking too much to expect an author to make a plea for the opposing side, and yet truth is best served by looking facts squarely in the face. Almost no one nowadays, aside from Jennings, would accept the definition of the tropism theory given by him in Chapter XIV. To be sure, it is easy to find in the older literature the form of the theory that he describes, but practically every one at present who believes in the tropism theory at all has discarded as unessential that portion of it that asserts that the stimulus always influences directly the reacting organ. To retain this and demolish it in the belief that the tropism theory falls with it is rather Quixotic than clear-headed. If the modern tropism theory were as weak as Jennings would have us believe, the experimental evidence upon which it rests ought easily to be explained away. Yet it has always seemed to the reviewer that the characteristic circus movements performed by animals immersed in a homogeneous stimulant, but with sense organs unilaterally obstructed, are explainable only on the basis of this theory. There are other crucial observations in favor of the tropism theory and yet none of these have been satisfactorily accounted for by Jennings.

Jennings is perfectly correct in his insistence on the importance of what he formerly called the "motor reaction" as an explanation of the way in which many of the lower animals become distributed or massed, but to prove that this explanation holds in certain cases is not to disprove the tropism theory. The two theories are not mutually exclusive and the processes implied by them may perfectly well take place at the same time in a given animal. It would seem that Jennings in his enthusiasm for his own views had become blinded to the real strength of the tropism theory and not only was unable to accord it fair treatment, but also lacked appreciation of its real value. It is to be regretted that a book excellent in so many particulars should be marred by so considerable a defect. G. H. P.

SCIENTIFIC JOURNALS AND ARTICLES

The American Naturalist for September contains articles on "The Structure of Cilia,