Museum. The series has been out of print for many years.

Since his retirement from the Museum, Schmitt has revised his 1931 contribution, and we are fortunate to have available his outstanding general book, **Crustaceans** (University of Michigan Press, Ann Arbor, 1965. 204 pp., $1.95), this time published in the Ann Arbor Science Paperback Series.

The book is written in a style particularly suitable for the layman who is interested in biology; it has only a minimal amount of scientific jargon and technical terminology. The biologist will find that the book has a special appeal because it provides a myriad of personal observations by Schmitt, who has spent his life studying crustaceans.

In revising the book, Schmitt deleted certain sections and added others; however, the total effect is not particularly noticeable, except in the two chapters that deal with classification. Rather recent discoveries of new forms of crustaceans have led to the establishment of several new subclasses and the rearrangement of some orders.

My only criticism of this excellent book is that the reprinting of the halftones has not been uniformly successful. In a few instances, reducing the size of the illustrations used in the 1931 book has produced a halftone in which the crustaceans are difficult to see.

LESLIE W. SCATTERGOOD
Bureau of Commercial Fisheries, Washington, D.C.

Newton's Dynamical Researches, 1664 to 1684

Continuing a tradition well established by the essays of Rigaud and Ball on the *Principia*, John Herivel, in **Background to Newton's Principia** (Oxford Unversity Press, New York, 1965. 352 pp., $11.20), publishes a series of documents and introduces them with an essay. A good decade of research on the Portsmouth manuscripts by various scholars has made it possible for Herivel to publish, as Rigaud and Ball could not, all of the sources that bear on the development of Newton's dynamics until the composition of the *Principia*. The past few years have witnessed the publication of several Newtonian manuscripts, especially the *Correspondence* and the volume of papers edited by the Halls. Herivel's volume can legitimately take its place beside them. If the goal of publishing the entire record of Newton's dynamics has led to the inclusion of several items already available (some of them through Herivel's earlier work), several manuscripts of the greatest importance are published here for the first time. Newton's first steps in mechanics as recorded in an undergraduate notebook, the treatment of impact and other problems in the *Waste Book*, the lectures *De Motu* from 1684 or 1685—no one concerned with Newton can fail to appreciate the importance of these documents. And no one concerned with Newton can fail to appreciate Herivel's analyses of the technically more difficult papers, such as the vellum manuscript on gravity and centrifugal force, or the treatment of rotation in *The Laws of Motion*.

Some aspects of the work are more difficult to appreciate. When Herivel is not concerned with editing and analyzing individual documents, that is to say when he undertakes to explore in a connected essay the very topic promised in the title, the quality of the volume declines markedly. Indeed I can only say that Herivel's approach to dynamics in the 17th century lacks historical perspective. The very sureness of his grasp of dynamics appears to become an obstacle to historical understanding, and, rather than attempting to comprehend the problems as Newton defined them, he seems to be engaged primarily in showing how Newton arrived at results identical to those still employed. In chapter 5, "The motion of extended bodies," for example, he discusses Newton's early treatment of rotating bodies without a single reference that I could find to the state of understanding of the problem when Newton took it up. Considerable space is devoted to the issue of centrifugal versus centripetal force as though it were a problem wholly internal to dynamics. It appears clear, however, that Newton's shift from the word "centrifugal" to the word "centripetal" involved conceptual developments, not within mechanics proper, but within his philosophy of nature. As long as he thought of nature in terms of the mechanical philosophy in which impact alone could alter a body's motion, the concept of centrifugal endeavor offered the only avenue toward a quantitative treatment of circular motion. Once action at a distance was admitted (an admission Newton had not made as late as his letter to Boyle in 1679) centripetal force became both conceivable and quantifiable. His treatment of motion in general underwent a similar alteration. An early manuscript entitled "The laws of motion" concerned itself entirely with impact, whereas the *Principia* devoted a mere two corollaries to the subject. Herivel's discussion of dynamics contains no recognition whatever of these extradynamical considerations.

Perhaps the discussion is nowhere more disappointing than when Herivel takes up the subject of force. The volume is devoted to the development of Newton's dynamics, and the concept of force was the very heart of his contribution to the science. Herivel does not discuss the concept of force before Newton. He does not seriously examine the difficulties in Newton's concept, difficulties that one might expect to find illuminated by the record of their development. Much of the discussion appears to assume that the concept of force was the common property of the entire 17th century. Thus he says (p. 54) that Descartes supposed the endeavor away from the center in circular motion could have the effect of a force; in his example of a particle in a rotating tube, for example, the particle acquires an increasing outward motion, and how can this possibly occur in the absence of some force? "So that when he returns at the end of Art. 59 to the original case of a stone in a sling it is not surprising to find him employing the term *vis* in reference to centrifugal endeavour." If Herivel means what he appears to mean, I can only say that he should have been surprised.

RICHARD S. WESTFALL
Department of History and Philosophy of Science, Indiana University, Bloomington

Herbs in History

Joseph Wood Krutch's **Herbal** (Putnam's, New York, 1965. 256 pp., $20) is a modern presentation of 100 woodcuts of plants and six of animals taken from Pierandrea Mattioli's *Commentaries on the Six Books of Dioscorides*, first issued in folio format in Prague