This book answers many of the questions we have had; it is the most comprehensive and satisfying of a small group of recent works on instruments. At the same time, it points to many lines of desirable investigation relating to the evolution and use of instruments. Some of these questions—when was the vernier put to use? how was the magnetic declination set off? in what cases did telescopic sights become usual?—may never be very precisely answered. But Bedini offers the best starting point, a work of reference as well as a source of stimulus.

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History of Biology

The Evolution of Biology. M. J. Sirks and Conway Zirkle. Ronald, New York, 1964. vi + 376 pp. Illus. $6.

This book was first written by Sirks during the Nazi occupation of the Netherlands; that manuscript was published in 1942, with a second edition in 1947. Now, with the aid of Zirkle, a longer American version has been prepared.

The authors state that the title of the book was chosen deliberately to emphasize that focus is not on a detailed history of biology but rather on the developmental phases through which biology has passed in its long road to becoming an independent discipline. There are 12 chapters, the first 6 of which ("The beginnings of biology"; "Ex oriente lux"; "The Hellenistic-Roman period"; "A bucolic interlude"; "Retrogression and the beginnings of recovery"; and "Subhi Kazib: The false dawn") are concerned primarily with selected descriptions of early attempts to understand animals and plants and their usefulness to man. The remaining chapters ("Daybreak over Europe"; "The sun breaks through the clouds"; "Depression and revival"; "Specialization"; "Concentration"; and "Broad daylight") trace primarily the changing patterns of biological investigation which began with the Renaissance, intensified in the 17th and 18th centuries as new microscopic worlds were discovered, and came to a focus in the 19th century with the doctrine of organic evolution. Some of the spectacular advances of the present century, particularly the rise of modern genetics, are briefly traced in the last chapters. There is a useful bibliography and an index.

The competence of the authors is evident on every page—in the critical judgment with which they treat the contributions of individual naturalists and scientists and in the interesting and well-selected illustrations. Nevertheless, one may well inquire as to the usefulness of yet another history of biology which concentrates its attention (to the extent of 9 of its 12 chapters) on pre-19th century biology, particularly when very little attempt is made to correlate the impact of intellectual, social, and artistic influences of classical, medieval, and modern civilizations on the evolution of biology, and vice versa. Particularly disappointing, however, is the authors' failure to treat ecological, developmental, and physiological fields as comprehensively as they do those of natural history, heredity, and morphology. Finally, we are, perhaps, too close to the magnificant progress of biology in the present century to review it in proper perspective, but I believe that, in addition to the spectacular breakthrough in our understanding of genetic coding, there are many other areas of modern biology which also deserve thoughtful discussion, and, indeed, whose inclusion is mandatory if we truly are to understand how biology has "attained its present rank among the natural and physical sciences."

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For Students and Laymen

An Introduction to Radioactivity. Eric Neil Jenkins. Butterworth, London and Washington, D.C., 1964. viii + 193 pp. Illus. $5.95.

The general appeal of this little book on radioactivity will probably lie in its historical approach to the subject. It is by no means a history of radioactivity, and the development of subject matter is more logical than chronological, but many historically crucial experiments are described simply and clearly. The series of experiments leading to identification of the alpha particle and the sequence of observations that resulted in the discovery of nuclear fission are presented in strict chronology, but to follow developments in beta radioactivity as they occurred would only echo the early confusion. Fortunately Jenkins does not attempt to do so.

At first sight, the brief treatment of the Bohr atom, which is given halfway through the book, seems out of place, but it is set in context, between the discovery of the nucleus and consideration of the periodic table and nuclear structure. Jenkins stresses the role of Moseley's work on x-ray spectra in the identification of the nuclear charge with atomic number, together with the necessary reordering of the cobalt-nickel inversion anomaly. (These two elements had usually appeared in the periodic table in order of increasing atomic weight.) Curiously enough, however, no connection between Moseley's law and Bohr theory is noted, and the expression for atomic energy levels is never written to show its dependence on nuclear charge. Today the actual record seems curious in view of subsequent successes of the Bohr model: Moseley made the familiar comparison of x-ray wavelengths with Bohr theory only in his preliminary paper (*Phil. Mag.*, December 1913) and refrained from all mention of theory in his more complete report (*Phil. Mag.*, April 1914). Jenkins is content with the empirical arguments of the later paper.

The brief excursion into atomic structure suffices as a background for the consideration of artificial radioactivity and the chemistry of fission products. Modern applications are mentioned from the start—for example, the use of radioactive sources of ionization to eliminate static electricity in textile mills and a chapter on the uses of radioactive isotopes. The biological effects of radioactivity are discussed, both for their use in medicine and in connection with safety precautions. The author remarks repeatedly on the social and political implications of his subject and is "convinced that the subject of radioactivity provides ample useful starting points for general humane and cultural studies in sixth forms and technical colleges." It is difficult to know exactly what he means by "ample," but his inclusion of human interest and motivation in science certainly contributes to the value of his book for science students and for nonscientists.

Most of this book could be read

with understanding by a person with only high school physics, but the level is probably more appropriate for students who have completed a year of freshman physics in college. It is hardly quantitative enough to serve as a textbook in a college course, but it should be a valuable addition to a reading list for elementary courses. It also makes a welcome contribution to scientific literature for the adult nonscientist who takes science rather seriously.

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A Usage-Conscious Dictionary

Dictionary of Herpetology. James A. Peters. Hafner, New York, 1964. vii + 392 pp. Illus. $11.50.

In this lightweight dictionary, which weighs about 1½ pounds and contains approximately 3000 entries, Peters presents the current status of words as they are used in context by herpetologists. Over 10,000 articles and books were screened for literature citations. Not surprisingly, the same word may have varied connotations in herpetological writings, and different words may convey the same intent. Where writers differ about the use of a word, Peters largely refrains from prescribing or proscribing a given usage. The vocabulary of herpetology is recorded but scarcely judged. This will please some individuals and provoke others.

As Peters states in his preface, only words of special significance or application in herpetology were selected. The selection is skillful and the definitions—rather, the descriptions—are commendably clear and concise. The greatest number of terms has been drawn from the area of morphology, but other aspects of the biology of the reptiles and amphibians have not been neglected. The range of expressions extends from *abdominal pore, cinobufotalin,* and *fanning* to *neoteny, tail waving,* and *zeugopodium*. Especially praiseworthy are the instructive discussions of terms that have been used interchangeably (but questionably), such as *prevomer* and *vomer*. The purposes of the volume are well served by extensive references to specific articles in which the words have been employed.

Abbreviations abound in all scientific writings, and they are no less plentiful in the herpetological literature. Those who chafe at abbreviations now have a ready source to provide the meaning of AT., AZR., B.R., C.I., C.L.D., F.I., LOA., M.C.T., M.H.D., PBT., T.R.T., and VT. Two surprising, but hardly distressful, omissions are AOR and DOR, which have frequently been used to denote the state of being of animals captured in the wild: "Alive on Road" and "Dead on Road," respectively.

Thirty clear pen drawings, assembled at the end of the book, will undoubtedly aid the user to visualize certain structural features. However, these pictorial illustrations cover but a small proportion of the terms in the dictionary. Many more diagrammatic sketches, placed more appropriately with the terms where they occur, would have been more welcome.

The origins or derivations of the words are not traced, nor are pronunciations indicated. But Peters makes no claim to being an etymologist or a true lexicographer. Indeed, his dictionary does not purport to be historical or definitive. The book is exactly what it was designed to be, namely, a simple, handy guide to the working language of the herpetologist. As such, this deftly compiled volume will certainly find its way into the hands of many amateurs and professionals.

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Mathematics Textbook

Fundamentals of Modern Mathematics. J. M. Calloway. Addison-Wesley, Reading, Mass., 1964. x + 213 pp. Illus. $6.75.

This book of some 200 pages and eight chapters (on sets, mathematics and logic, sets of numbers, relations and functions, sequences and limits, calculus, counting and probability, and mathematical systems) was written for nonscience liberal arts students and stresses concepts more than manipulation. Required and suggested readings, which are listed at the ends of the chapters, are to be used as supplementary assignment materials if this book is used as the primary text. In reading the text and working the exercises, students are expected to have at hand and to use Webster's unabridged dictionary and the *Mathematics Dictionary* by James and James.

Although there are no formal prerequisites, it seems to me that to read this volume with profit students should know how to solve simple quadratic equations, should be able to handle simple inequalities, should know the basic theorems of Euclidean geometry, and should have some facilities with simple formulas.

The language of sets and the fundamentals of logic (truth tables, implications, valid arguments, indirect proofs, quantified statements) needed to understand theorems and their proofs are developed in chapters 1 and 2.

In chapter 3 Calloway begins with Peano's characterization of the natural numbers and then develops successively the systems of integers, rational numbers, and real numbers, each as an extension of the preceding system. In this treatment the integer 2 and the natural number 2 are the "same thing," although the integer 2 is first introduced as an ordered pair of natural numbers, as (5, 3). I feel that the idea of treating (5, 3) and 5—3, or 2, as the same thing does some violence to the language and concepts of sets on which modern mathematics is based. I believe that the concept of an isomorphism can be used effectively with elementary classes in developing the hierarchy of number systems in elementary mathematics.

I have no quarrel with the mathematics in the rest of the book. Indeed, the book is well written and there is an adequate supply of good exercises. There is ample material for a 1-year course of 100 lessons. A good semester course of 40 or 50 lessons can be based on material selected from chapters 1, 2, 3, 4, 5, and 6, or from chapters 1, 2, 3, 4, 7, and 8. Most nonscience liberal arts students who take a course based on this text will need the sympathetic assistance of an instructor to help them bridge the gap between the level of sophistication of portions of the text and the level of sophistication at which they are capable of operating. Nevertheless, instructors who are looking for a textbook to be used in a course in which attaining a degree of mathematical maturity is more important than covering a specified amount of material would do well to consider this book.

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