however, that most biologists are now aware that the proliferation of books is an almost casual response to the unmanageable inflation of channels of traditional communication. The average book neither deifies scholarship nor especially berates it. Against such a background this book will pass as an interesting account of some mitotic problems, as these problems are conceived by some workers in the field.

HERBERT STERN
Botany Department,
University of Illinois

"Life" Science Library

Mathematics. David Bergamini and the editors of *Life*. Time, Inc., New York, 1963. 200 pp. Illus. $3.95.

To enjoy this book is easy. To evaluate its contribution to the public understanding of mathematics is more difficult.

Attempting the latter made me recall a conversation at the high table in Proctor Hall at Princeton in the mid-1930's. Einstein and Dean Eisenhart were discussing the books by Jeans and Eddington that gave popular accounts of the then fashionable cosmological theories. The Dean asked Einstein if he did not think such books were useful, and Einstein replied that he did but that he had misgivings lest the readers mistake the speculative fringe of scientific investigation for the great body of firmly established knowledge. This richly illustrated and handsome first volume in the new series, *Life* Science Library, does not, I think, risk this particular danger.

That the story progresses, in the first 30 pages, through counting methods from hand signals to digital computers does imply great brevity and some superficiality in the treatment, so I fear some readers may have reinforced their impression of mathematics as an impenetrable mystery. Hopefully, the rich detail woven into the visually delightful presentation will lead many to read other books, perhaps chosen from among the 36 listed in the bibliography.

"The shapely thinking of the ancient Greeks," which disposes of ancient geometry in a dozen pages, is followed abruptly by photographs of 11 men now working as mathematicians in the United States. Of these deservedly distinguished 11 only one, Eilenberg, would be regarded as working in the heartland of current research in pure mathematics; the others spread as far afield as Godel (mathematical logic at the level of philosophy) and Szebehely (space mechanics). This points up a partial and necessary failure of the book: the solid center of today's mathematics depends so heavily on symbolism and is so far removed from sensual reality that it cannot be described in nontechnical language or illustrated visually. It also underscores the folly of regarding research in mathematics as dominant over the practice of mathematics.

The format is one in which historical development leads to contemporary topics within each chapter of the four which describe algebra, analytic geometry, calculus, and probability. The work of Gauss, Riemann, and Einstein provides an exciting chapter, which is followed by "Mathematics today: Deeds, doubts, dreams." A 4-page appendix gives an inadequate description of the changes that are being made in mathematical education. There is an index.

My favorite quotation is on page 169: "Like the hordes and horses of some fabulous khan, today's mathematicians have ridden off in all directions at once, conquering faster than they can send messages home."

WALLACE GIVENS
Argonne National Laboratory,
Argonne, Illinois

Earth Sciences

The Earth Sciences. Arthur N. Strahler. Harper and Row, New York, 1963. xiv + 681 pp. Illus. $9.95.

Elements of Geology. James H. Zumberge. Wiley, New York, ed. 2, 1963. xii + 342 pp. Illus. $6.50.

Strahler's book is directed to geology teachers. In the preface, the author states that "the teaching of the full spectrum of the earth sciences should be recognized as the responsibility of each geology department within the larger fold of the natural sciences. Too long has the conventional two-semester sequence of physical and historical geology dominated our offerings; around us an explosive growth of new scientific knowledge of the atmosphere and oceans, the earth's interior, and the solar system have largely been ignored in the introductory offering." Thus, Strahler believes that the earth sciences should be introduced as a unified whole, rather than as a more detailed treatment of geologic principles that pertain only to the crust of the earth.

The distribution of major topics in Strahler's book reflects his views: About 27 percent of the book is devoted to the earth as a planet, including the earth's orbit, time, illumination, tides, the solar system, and the earth's gravitative and magnetic fields. Nearly 25 percent is devoted to the atmosphere and the oceans, including physical meteorology, physical oceanography, and climatology. Over 40 percent is devoted to topics that pertain to physical geology, including rocks and minerals, the earth's interior, the oceanic and continental crusts, ground water, stream systems, erosion, landscape evolution, and weathering and soil. About 2 percent is devoted to the mtehods of historical geology, and the remainder of the book consists of appendices illustrating principles of maps. It is suggested that professional geologists may find Strahler's book an excellent reference source for basic information on those aspects of the earth sciences missing in their own backgrounds.

Strahler's book is well written and contains an abundance of clear and forceful illustrations. The line drawings are exceptionally well done, although most of them appeared in the author's book, *Physical Geography*, which was published in 1960.

Zumberge's book is intended as a text for a one-semester introductory course in which physical and historical geology are combined. It is addressed to beginning students of science. Its scope is more or less traditional. About 60 percent of the book is devoted to topics pertinent to physical geology, including the earth's setting in the universe and in the solar system, rocks and minerals, the earth's interior, weathering and soil, ground water, and wind, rivers, and waves as agents of erosion and deposition. The remaining 40 percent is devoted to historical geology, which is approached period by period. The book is also well written and is accompanied by judiciously chosen photographs and by line drawings of exceptional clarity and simplicity. One might question the merit of a period-by-period approach in historical geology in a book whose emphasis is on principles. It might have been more appropriate to dwell on the methods by which historical geology is

interpreted, rather than on the details of history itself. However, there is room for differences of opinion on the scope and emphasis of historical geology.

For their intended purposes, both books are to be warmly commended. Strahler's book would seem best suited as a text for mature students who are beginning their study of the earth sciences. It is rigorous, and yet almost totally nonmathematical. Zumberge's book, on the other hand, would seem to be best suited to less-mature students, for example, students that might be found in a typical junior college. Zumberge is generally patient and careful in his explanations.

JOHN W. HARBAUGH
Department of Geology,
Stanford University

Nuclear Engineering

The Design of Gas-Cooled Graphite-Moderated Reactors. D. R. Poulter, Ed. Oxford University Press, New York, 1963. xii + 692 pp. Illus. $13.45.

This book treats an important and timely, but rather specialized, subject in the field of nuclear power generation. It was written for practising engineers who are interested in the design of large nuclear power stations and for students who have a broad background in nuclear engineering. The contributors are well-qualified specialists who have worked with these design problems in the power reactor program in England.

Most of the discussion is concerned with the factors that must be considered in designing a complete nuclear plant for producing economically competitive electric power. Chapter 1, which treats the general design concept and points out subtle features and interrelationships that are easily overlooked, might be called "design philosophy." In the remaining chapters, specialists discuss the details of power plant design; this discussion begins with a short review of reactor physics and includes chapters on reactor control and instrumentation, safety, materials, fuel elements and fuel handling, graphite structure, gas coolant circuits, shielding, steam plants, electrical systems, structural engineering, and future developments. Thus practically all phases of power plant design are considered.

Although the discussion in each section is mostly qualitative, it includes a few general equations and some of their modifications for special cases; occasionally figures are quoted to illustrate a point. The book is not intended as a design manual. Neither solved examples nor any general method of design is provided. Such information would be particularly useful to the advanced student who wishes to round out his education in nuclear engineering with a more of less detailed power plant design. From this book, the student will derive some general qualitative notions and ideas about things to include and things to avoid, but he will receive little help in setting up a design method. Unfortunately, the references will not direct him to sources of design information, although I presume they are adequate to support the qualitative conclusions.

The book provides a good summary of the design experience in this particular field, but it was not intended to include quantitative design methods or comparisons of different methods.

HARRY H. STEINHAUSER, JR.
Department of Chemical Engineering,
Rensselaer Polytechnic Institute

Transuranium Elements

Man-Made Transuranium Elements. Glenn T. Seaborg. Prentice-Hall, Englewood Cliffs, N.J., 1963. viii + 120 pp. Illus. Paper, $1.50; cloth, $3.95.

This book provides a brief account of the preparation, utilization, and properties of the presently known 11 elements that follow uranium in the periodic table. Chapter 2, roughly one-quarter of the book, presents the salient experiments and some anecdotes concerned with the identification and the isolation of weighable quantities of these elements when achieved. The actual dates on which these ingenious experiments were carried out and the names of the co-workers are given. The experiments involved fantastic techniques and were performed mostly as classified work in the Radiation Laboratory at the University of California (Berkeley). The next five chapters include discussions of the location of these elements in the periodic table, and the special chemical methods which are required to handle the minute quantities of the elements as well as the severe radiation hazards involved. Applications of the transuranium elements for nuclear explosions, power reactors, and special radioactive sources are described. Predictions about possible extension of presently known techniques to the preparation and identification of new elements are offered. Part 2, the latter half of the book, which is considerably more technical in its treatment, surveys production methods, the chemical and physical properties of the elements and their compounds, and finally the nuclear properties of the elements. A complete isotope table of elements 93 to 103 is included as an appendix.

The book, which was prepared to provide supplementary reading for use in the Chemical Education Material Study—that is, the CHEM Study program—is pitched at a level that is too advanced for all but the most exceptional high school students; indeed, part 2 appears to be directed to senior college students in the physical sciences at the very least. The volume will be a most useful reference book for advanced students and specialists, since it briefly and efficiently summarizes the significant knowledge concerning the transuranium elements. Important chemical and nuclear properties have been delineated. Also, developments in modern theories of electronic and nuclear structure, based on the information derived from these new elements, are sketched clearly and concisely.

DON S. MARTIN
Department of Chemistry,
Iowa State University

New Books

Mathematics, Physical Sciences, and Engineering

Structure and Ultrastructure of Microorganisms. An introduction to a comparative substructural anatomy of cellular organization. E. M. Brieger. Academic Press, New York, 1963. 343 pp. Illus. $10.

Tropical Meteorology in Africa. Proceedings of a symposium (Nairobi), December 1959. D. J. Bargman, Ed. Published by Munitalp Foundation, Nairobi, 1960 (available from World Meteorological Organization, Geneva). 462 pp. Illus. Paper.

The Use of Artificial Satellites for Geodesy. A symposium (Washington, D.C.), April 1962. G. Veis, Ed. North-Holland, Amsterdam; Interscience (Wiley), New York, 1963. 436 pp. Illus. $14.

Viscosity and Flow Measurement. A laboratory handbook of rheology. J. R. Van Wazer, J. W. Lyons, K. Y. Kim, and R. E. Colwell. Interscience. (Wiley), New York, 1963. 426 pp. Illus. $14.