Organization's dictionary, *World Neurology* (September 1961), or the *Merck Index*. Three common names are included and cross-indexed with the official name. Physiological solutions for bathing or perfusing tissues are presented in tabular form in an appendix.

Provision is made in the tabular format of this manual for the addition of supplemental data, and blank pages are provided for the registration of new agents.

Some descriptions of activity are cryptic. "Cardiovascular," or "cardiovascular and respiratory," used advisedly to save space, were inserted in spaces that are large enough for descriptions that would be more enlightening to neophytes or scientists who work in ancillary disciplines.

The list of contributing firms and individuals is impressive, perhaps unique. So is the manual.

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An Editorial Overview

Chemical Reactions of Polymers. E. M. Fettes, Ed. Interscience (Wiley), New York, 1964. xxii + 1304 pp. Illus. $40.

As one of the editors of the series, "High Polymers," it is my duty to keep a watchful eye on each volume of the series and to appraise the value of each of them for the readers from a short-range and long-range point of view. As a result of such a check it became evident that some volumes are highly specialized and, perhaps, even too narrow in scope, whereas others are rather general and, in some cases, perhaps even somewhat superficial. It would appear to me that, of the 20 volumes published in the series to date, none combines breadth and depth as well as this compendium that Fettes has planned and produced. The treatise bristles with details but, nevertheless, maintains perspective. The innocent word "edited," which is used to describe Fette's role in the creation of this book, embraces the choice of the individual chapters, the selection of the best author or authors for each, the specification of each chapter's scope, the integration of all chapters, and the careful polishing of the final manuscript.

Virtually all possible and certainly all important reactions that can be carried out with individual polymers are included in *Chemical Reactions of Polymers*, and in each case there is an introduction to the fundamental aspects of the process, an indication about how the process is carried out, and, finally, a record and complete description of the property changes that can be achieved by each individual reaction. In this manner the reader is informed on the fundamental aspects of polymer reactivity (chapter 1), on reactions of unsaturated hydrocarbon polymers (chapter 2) and of their saturated counterparts (chapter 3). Chapter 4 treats end-group reactions of addition polymers, whereas chapters 5 and 6 are devoted to cellulon and proteins. Interchange and cleavage reactions are presented in chapters 7 and 8, whereas the next chapters contain information on intermolecular reactions (chapter 9), branching reactions (chapter 10), and coupling processes (chapter 11). The other chapters are devoted to somewhat more specialized processes—surface reactions (chapter 12), oxydative processes (chapter 13), mechano-chemical changes (chapter 14), fiber-reactive dyes (chapter 15), and to the chemical finishing of cellulosic fibers.

Fettes, as the result of his efforts, has earned the gratitude of the editors and publishers of the High Polymer Series, but, much more important than that, he can be sure of the approval and indebtedness of all readers and users of his volume.

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Nuclear Power Technology

Plutonium. Mieczysław Taube. Translated from the Polish edition (Warsaw) by Eugeniuez Lepa and Zbigniew Nanowski. Pergamon, London; Macmillan, New York, 1964. vi + 258 pp. Illus. $8.50.

In this book, M. Taube of the Institute of Nuclear Research (Warsaw, Poland) attempts to draw together a concise review of the properties of plutonium which are important with respect to its utilization in nuclear power reactors. Although the general purpose of the book is nowhere explicitly stated, the tenor of the treatment is obviously directed toward emphasizing the importance of the role that plutonium will eventually play in the development of nuclear power, particularly in fast breeder reactors using the uranium-238–plutonium-239 cycle.

In view of the many books, devoted entirely or partially to plutonium, that have been published in recent years—most notably *The Metal Plutonium*, edited by Coffinberry and Miner; *The Chemistry of the Actinide Elements* by Katz and Seaborg; and *Extractive and Physical Metallurgy of Plutonium and Its Alloys* by Wilkinson—one might wonder what particular need the author sought to satisfy. Apparently the work was prompted by the fact that no single volume treats all aspects of plutonium technology, including nuclear physics, chemistry, separations technology, health physics, fuel fabrication, reactor technology, and economics. It is to this formidable task that the author addressed himself. The result is a fairly thorough, largely descriptive review of the literature. But the volume is typical of the books in which authors treat areas of technology that are under intensive investigation in that it is unfortunately out of date in several areas. This factor, together with some apparent delay in the publication of the English translation, results in a book that can be considered a qualitative review of this broad field through 1961.

The subject matter is well organized into six chapters. The first chapter summarizes the properties of the isotopes of plutonium and the methods of production, and compares the fission characteristics of plutonium-239 with those of uranium-235 and uranium-233.

Chapter 2, "Chemical properties of plutonium," treats the basic chemistry of plutonium metal, alloys, and compounds and of plutonium ions in solution. Chapter 4, "Plutonium technology," which includes information closely related to that in chapter 2, describes chemical processes that are used in the recovery and purification of plutonium. Chapter 2 draws heavily on the book by Katz and Seaborg, but it will serve the plutonium chemist as an organized introduction to Russian articles in the field. Chapter 4 contains schematic flowsheets of all the known experimental and production processes for plutonium separation, from the bismuth phosphate process to pyrochemical methods. There is a table in which all known plutonium recov-

ery plants are described. Perhaps too much emphasis is placed on the advantages of high-temperature and nonaqueous recovery processes, but this emphasis very probably reflects the author's interest in these methods.

Chapter 3 is a brief survey of the physiological effects of plutonium and the health physics aspects of handling plutonium. This chapter is marred by several errors, which may have occurred in translation. For example, on page 94 "two fatal cases of plutonium poisoning" are discussed. In the original reference [E. R. Russell and J. J. Nickson, "Distribution and excretion of plutonium," in *Industrial Medicine on the Plutonium Project* (1951), p. 256] it is clearly stated that plutonium was administered to incurably ill individuals and that death was due to other causes, *not* to plutonium poisoning. To my knowledge, there have been no cases reported to date of fatal poisoning by plutonium.

Chapter 5 is concerned with plutonium fuel technology, and chapter 6 with considerations of energy resources and of the economics of nuclear power. I am more familiar with the chemistry of plutonium than with reactor technology, but it appears to me that the advantages of fast breeder reactors using plutonium fuel are presented without adequate discussion of the contrary arguments and the significant problems of engineering and physics that are associated with fast breeders. Little attention is given to the thorium-232–uranium-233 breeding cycle. There is an interesting tabulation and comparison of 21 thermal and fast reactors that have been reported fueled with plutonium.

The quality of the translation is generally good, although there are numerous typographical errors and mistakes in punctuation that are distracting. The bibliography contains some 370 references of which approximately 25 percent cite Russian articles. The latest references are to articles published in 1961. There are more than 100 illustrations.

In summary, to one skilled in the field, this book will be of use only as an organized source of reference to the literature prior to 1961. To one seeking an introduction to the use of plutonium as a nuclear fuel, the book will be a useful starting point.

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Mathematics and Biology

A Modern Algebra for Biologists. Howard M. Nahikian. University of Chicago Press, Chicago, 1964. xii + 236 pp. Illus. $10.

As N. Rashevsky points out in the foreword, this is an exposition of certain topics in modern algebra (set theory, relations, probability, graph theory, semigroups, groups, and linear algebra) aimed toward the relational biology of Rashevsky, Rosen, and others. The bulk of the mathematical exposition, about 128 pages, is devoted to linear algebra—that is, to vectors, linear transformations, matrices, and determinants. Some 25 to 30 pages are used to sketch indications of applications. In most cases the applications are rather general, descriptive ones in which no precise problem of theoretical biology is stated or solved.

The swift exposition of sets, relations, elementary probability, and linear graphs (chapters 1 and 2) is on approximately the same level as *Finite Mathematics*, by Kemeny, Snell, and Thompson. Nahikian provides similar elementary problem material, with the addition of a little on computing the information-theoretic entropy of chemical reactions.

In chapter 3 there is a seven-page exposition of semigroups with unit (monoids), followed by a three-page "partial development" of a paper in which R. Rosen applies the structure theory of monoids to coding problems with respect to DNA. The extreme condensation leaves the mathematical and the biological expositions in unsatisfactory state. Chapter 4, an exposition of group theory, is probably too brief for a biologist who is being introduced to it for the first time. The celebrated Polya combinatorial theorem on the group of a graph is mentioned in conclusion, but without a statement of the theorem. No applications are indicated.

The only detailed mathematical exposition is in the linear algebra section—chapters 5, 6, and 7. Here the author goes somewhat beyond the special requirements of the applications that he has in mind. This exposition is precise and has numerous illustrative examples, although it is rather technical in both notation and language. Gaussian elementary row operations could have been used more, linear transformations and determinants less, to provide a simpler route to the indicated objectives. The principal indicated applications of matrices involve the matrix of transition probabilities for change of state, the matrix representation of a dominance relation, and the direct sum decomposition of the connection matrix of a neural network.

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History of Geology

Hydrogeology. J. B. Lamarck. Translated from the French (Paris, 1802) by Albert V. Carozzi. University of Illinois Press, Urbana, 1964. viii + 152 pp. Illus. $4.75.

Originally published in 1802, *Hydrogeology* is the geological magnum opus of the man now remembered principally as a forerunner of Charles Darwin. Lamarck hoped this work would revolutionize geology and mineralogy, although, as he was bitterly aware, some of his earlier publications had been greeted by almost universal silence. His hopes were frustrated once again, and, as Carozzi remarks, *Hydrogeology* "fell into oblivion almost immediately," is now barely known to geologists and historians of geology, and has become a bibliographical rarity.

Despite Lamarck's failure, this first English translation of *Hydrogeology* will surely be welcomed by geologists and historians. The title, it should be noted, is misleading, since the work deals with the significance of fossils, the formation of the earth's crust, geological time, and other topics commonly treated in the numerous "theories of the earth" produced during the 18th century. Lamarck's ideas, as one might expect, are often original and bear the stamp of a bold, speculative, and very strange mind. His discussion of the origins of mountains is a case in point: he observes, analyzes, reasons without observation, and finally, in chapter 4, rejects the theory propounded in chapter 1 and offers a substitute. Although his insights were often remarkable, Lamarck also rejected the ideas of many contemporaries, notably those concerned with chemistry, and *Hydrogeology* is thus a unique blend of brilliance and fantasy.