the sort of material usually found in textbooks on historical geology: the development of Paleozoic and Mesozoic life, with emphasis on the vertebrates; the development of Cenozoic life; geologic history during the later Mesozoic, Tertiary, and Quaternary; a rather chary review of continental drift; and summaries of the origin and evolution of the continent, fossil organisms, and stratigraphic principles and methods. The next to the last chapter, by Dean B. McLaughlin, is a beautifully written, lucid, and well-illustrated discussion of the origin of the earth.

The explosive proliferation of geologic knowledge during the past decade places a heavy burden on those who write textbooks on historical geology. One wonders if it is possible for an individual to keep abreast of developments throughout the continent and to present a broad synthesis that is modern, meaningful, and reasonably accurate. Although the authors of this book make no claim to all-inclusiveness, some geologists, particularly those along the Pacific Coast, will find that their part of the world has been given a rather inadequate and out-of-date presentation.

The text is relatively free of typographical errors. Most of the photographs and line drawings are well done, but they are not well integrated with the text. Some lack sufficient explanatory matter—for example (p. 87), no geographic features of the land are identified on the geologic map of the British Isles. The following are among the numerous minor errors noted: fig. 17-4, *Oistoceras* and *Amaltheus* are interchanged; fig. 18-4, two out of the three ammonite genera illustrated as Cretaceous forms are from the Lower Jurassic; fig. 18-20, the Queen Elizabeth Islands are incorrectly identified as the Queen Charlotte Islands; and fig. 18-21, Colville, Ninuluk, and Topagoruk Formations are misspelled.

The lack of bibliographic references or lists of suggested reading following each chapter or major section is a serious omission, one that diminishes the utility of the book. The editorial standards are not what one expects from this publisher: much of the writing and many definitions are marked by imprecision and a somewhat murky style. This book is perhaps more suited for selected reading assignments than for use as a general textbook in beginning classes on historical geology or stratigraphy.

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Neutron Fields: Production, Transport Character, and Detection

Neutron Physics. K. H. Beckurts and K. Wirtz. Translated from the second German edition (1964) by L. Dresner. Springer-Verlag, New York, 1964. x + 444 pp. Illus. $17.

This text on neutron physics considers in depth only those aspects of the subject that are concerned with the production, transport character, and detection of neutron fields. It does not consider, for example, those aspects that are related to the application of neutron radiation to the analysis of nuclear, molecular, or crystalline structures. It is an excellent text for any neutron physics laboratory, particularly so for a laboratory in which the research is oriented around the use of reactor-produced neutrons. It is also worth noting that, although the book could well serve those interested in the design and engineering of reactor systems, it does not deal directly with the subject of reactor physics. For example, the theory of multigroup computations is touched on in the text, but not in sufficient detail to permit coding and analysis.

The heart of the text is contained in the two central parts entitled "The Theory of Neutron Fields" and "The Determination of Flux and Spectrum in a Neutron Field." The theoretical treatment of these subjects is excellent and in all instances is accompanied by a good qualitative discussion that should provide real insight for the reader. The particular techniques employed in measuring flux and spectrum are also analyzed in detail, so that the text becomes a real working document for those interested in making such measurements. This involvement with foils, choppers, colimators, and other apparatus is useful to experimenters interested in the application of neutron radiation to research generally, but is principally directed toward those interested in precision radiation standards.

Discussion and analysis of additional techniques for the generation and extraction of neutron radiation would also have been of great value to experimentalists, and still within the scope of the text. In particular, the generation of cold or long wavelength neutrons and the methods of piping beams of these neutrons using optical properties is not included in the text, but would have been a welcome addition.

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A History of Chemistry in the 19th Century

The Development of Modern Chemistry. Aaron J. Ihde. Harper and Row, New York, 1964. xii + 851 pp. Illus. $13.50.

Several relatively short histories of chemistry and Partington's recently published, monumental, four-volume work are available, but a treatment that lies between the two extremes and gives more details without serving merely as a reference work is needed. The present volume partially fills that need. However, one qualification must be made. As the title states, this is essentially a history of modern chemistry. Events prior to the 19th century are covered in about 90 pages, and in the remaining 650 pages the modern period is treated, in increasing detail as the most recent times are approached. Thus, what is essentially supplied is a detailed account of the newest developments in all branches of chemistry. No other work gives so much information about this period, and so the volume will serve the unique function of giving the student of chemistry today something he greatly needs: a view of the theories he studies in his current courses, not as isolated items dogmatically presented as revealed science, but as the outgrowth of ideas and experiments that had a logical reason for existence. The many excellent illustrations will also help to bring alive the otherwise meaningless names that are often attached to new developments. It is even to be hoped that some students may be spurred to trace chemical ideas even further back and thereby to find that our modern problems are merely more detailed considerations of fundamental ideas that have concerned the thinking man since ancient times.

This is not to say that the book will be of value only to students. The mature chemist and the historian of chemistry will find much of value here.

Not least important is the very elaborate and critical bibliography, which is arranged by chapter, at the end of the book; this bibliography is one of the most complete guides to the literature of historical chemistry available. The appendices—on the discovery of elements and isotopes, radioactive decay series, and Nobel prize winners in chemistry, physics, and medicine—will be of great value for reference purposes. The book occupies a distinctive place among histories of chemistry and will long be valuable to a wide variety of users.

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A Stocktaking Summary

Science, Technology, and Human Values. A. Cornelius Benjamin. University of Missouri Press, Columbia, 1965. x + 296 pp. $7.

Science, warns the author, "has become a dangerous word—dangerous in the sense of leading to confusion in thinking and producing misleading associations. . . . When anything calls itself science, beware!" In this volume A. Cornelius Benjamin, professor of philosophy at the University of Missouri, seeks to resolve the blur of meanings surrounding "science" in the contemporary world.

Benjamin has produced a comprehensive and competent handbook summarizing all the important literature concerning the method, logic, and metaphysics of science. He sees science as a "value response to the world" that has "much in common with art, religion, morality, politics, work, and play." Science classifies, associates, and orders symbols that refer to things in the natural environment; through measurement it seeks to give exactness to its descriptions.

Science must also rise above mere description by the process of "creative insight." The act of imagination, like that which gives rise to art and religion, enables science to transcend induction and begin to get to the heart of things. Brute facts are brought together "under an unifying conception" and "mysterious happenings yield to rational interpretation." Prediction and control of the natural environment is increased as hypotheses are refined in the face of empirical observation to reach a greater approximation of the verifiable reality: "an explanatory science includes the descriptive science out of which it arose and also statements about theoretical entities, statements about predicted facts, and either the fact so predicted or alternate facts which make their existence impossible." The "explanatory" power of science derives from the great constructs which are essentially artifices of the mind tested for success and refined through manipulation of the natural environment.

If this volume is considered as a stocktaking summary, Benjamin accomplishes his aim, and in so doing makes some wise and clarifying statements. But he leans a bit too complacently on the alleged solidity, reason, and benevolence of science. His distinction between the "pseudofact" of superstition and the "real fact" of science is too pat, as are his assertions concerning technology as the fruit of science, which fail to give emphasis to the converse relationship.

The scientist would perhaps be better occupied "doing science" rather than philosophizing about it; but, for those who desire greater understanding of the nature of his activity and its relationship to other social functions, Benjamin makes a useful contribution.

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Organic Chemistry

Newer Methods of Preparative Organic Chemistry. vol. 3. Wilhelm Foerst, Ed. Translated from the German (Weinheim, 1961) by Henry Birnbaum. Academic Press, New York, 1964. xiv + 544 pp. Illus. $16.

This translation, the third volume of a series, presents 11 reviews selected from among those published in *Angewandte Chemie*. The articles, which cover diverse and useful preparative methods in organic chemistry including examples of experimental details, are authoritatively written and aptly translated, but the literature coverage extends only to 1959 or 1960. The value of the series to the researcher could be increased manyfold by appendices covering the more recent literature. For example, the expertly written chapter (by Schoellkopf) on the Wittig reaction is now supplanted by a more recent and comprehensive review published in *Organic Reactions* (vol. 14).

The first chapter, on reactions of sulfur with organic compounds, is excellent. It includes not only the interesting Willgerodt reaction but some useful applications to heterocyclic compounds and many references to the author's own work and to other work found only in reports and patent literature.

Heterocyclic chemistry is discussed in at least four chapters that cover substitution in the pyridine ring, an area in which the lack of recent literature is being felt: syntheses of aromatic compounds from pyrylium salts; the acyllactone rearrangement which describes largely Korte's work of conversion of α-acyl lactones, thiolactones, or lactams by ring opening and reclosure into furan, pyran, thiophene, or pyrroline derivatives; and the extensive work by Bredereck and his co-workers on syntheses of purines, pyrimidines, imidazoles, and oxazoles by the use of formamide and other amides.

The biochemically interesting topic of synthesis of phosphoric acid esters, amides, and anhydrides is discussed in a brief chapter, but references to work published after 1960 would have been welcome. Other reviews treat the preparative use of chloramine in organic chemistry; reactions of *N*-bromosuccinimide with olefins, alcohols, ethers, amines, heterocyclics, and carbonyl compounds; the chemistry of diazoketones leading to syntheses of a large variety of functional groups (an excellent chapter by Weygand and Bestmann); and the formation of the acetylenic bond.

It is regrettable that the table of contents for each chapter was shortened drastically and that the references were placed at the end of each chapter rather than as footnotes in the text (as they were in the original German edition).

Although it is very questionable whether it is necessary to compile and publish in book form review articles from journals, *Newer Methods* remains a valuable aid to the organic chemist in his efforts in organic syntheses as well as in stimulating new approaches to various subjects discussed.

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