and to the latter as a summary of experimental and theoretical work in the areas covered. The first eight chapters primarily present essential theory, and the remaining 12 deal in a systematic fashion with various classes of organic compounds and specific types of spectroscopic studies. Throughout the latter chapters experimental results are effectively summarized, interpretations outlined, and original literature references indicated. Its organization and approach make the book a useful reference text for those who want a concise introduction to a given class of compounds. Probably its greatest single asset is, however, that it gives many specific examples of how one may relate absorption spectra to electronic and molecular structure.

This volume will doubtlessly be widely used, and for this reason its limitations should be carefully noted. The most apparent of these is that, despite its all-inclusive title, the book is, with the exception of a chapter on inorganic complexes and one that contains considerable material on emission phenomena, concerned almost exclusively with room temperature solution spectra of organic molecules. This observation is not made critically but to point out that important topics in electronic spectroscopy are not covered here, since to deal with even this more limited area in one volume is certainly a formidable task in itself. It is disappointing, however, that the authors did not emphasize more strongly the role of polarization determinations in theoretical and experimental studies of electronic absorption spectra, especially since polarized emission techniques seem to be a natural topic for consideration in the chapter that deals with fluorescence and phosphorescence.

From an interpretive point of view, the authors have essentially limited themselves to a molecular orbital and free electron approach. Especially noticeable is the omission of references to the resonance force (or exciton) theory that has been applied to such compounds as the polyenes and azodyes and to aggregates.

Technically, the book is generally well organized and very readable. There are some typographical errors and some minor errors of fact, but, for the most part, these will not confuse readers. However, some consternation may arise from the confusion in the listing of the polarization directions in Table 12.13 and from such errors as the inversion of the connection between ground and excited state vibrational frequencies and structure in emission and absorption, which occurs on page 553.

This book represents a welcome and extremely useful effort to fill a rather serious void in the chemical literature, and it is to be hoped that it will inspire further efforts aimed at completing the coverage of this area.

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Harper's Geoscience Series

Structural Geology of North America. A. J. Eardley. Harper and Row, New York, ed. 2, 1962. xviii + 743 pp. Illus. $21.50.

All geologists and geophysicists should welcome this second edition of a well-known book. Its general arrangement and appearance are similar to those of the first edition, but extensive revisions have been made without greatly increasing the number of pages. Stratigraphy and igneous geology, as well as tectonics, are fully treated.

The major divisions of the book are based on geological chronology, but the subdivision into chapters is based primarily on geographic distribution. The first three chapters are introductory. The remaining 40 chapters are arranged in six major units: Precambrian tectonic belts (1 chapter), Paleozoic tectonic belts (12 chapters), Mesozoic tectonic belts (12 chapters), Cenozoic tectonic belts (4 chapters), igneous provinces of the western Cordillera (6 chapters), and provinces in the northern and southern parts of the continent (5 chapters).

The author says that the "book is not intended to stand entirely alone. The reader or instructor should have the following maps for ready reference, preferably mounted and hanging on the wall at short range." He then lists seven maps, such as the geological maps of North America and Canada.

Evidence that the author has covered the literature exceedingly well is the list of approximately 1100 references assembled on pages 709 to 738. Fifteen colored page-size maps, 14 of which are tectonic maps for the various periods, deserve special commendation. Many of the 491 figures are direct or slightly modified copies from the original publications. Some, however, are new diagrams prepared with great thought and care for this book. The significance of recent seismic and gravitational data is thoroughly analyzed. Moreover, the numerous discussions of theoretical and genetic aspects of regional geology are most stimulating.

The book is not without deficiencies. Some of the maps lack scales. On many maps the latitude and longitude are not given—essentials in locating the area readily on the national geological maps recommended at the beginning of the book. In the structure sections more care should have been taken to show the vertical scale where it differs from the horizontal scale, and to indicate the amount of the vertical exaggeration. Good coherent descriptions of some very important areas are lacking, such as the Sierra Nevada and the Klamath Mountains. However, considering all the problems involved, Eardley has done a magnificent piece of work in assembling and presenting this material.

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Uranium Alloys

Uranium Metallurgy. vols. 1 and 2. vol. 1, *Uranium Process Metallurgy* (772 pp. $18); vol. 2, *Uranium Corrosion and Alloys* (745 pp. $16). W. D. Wilkinson. Interscience (Wiley), New York, 1962. Illus.

W. D. Wilkinson, the author of *Uranium Metallurgy*, must be congratulated on an excellent attempt to discuss and assimilate the available information on this technologically important material. Wilkinson, a senior staff member in the International Institute of Nuclear Science and Engineering at the Argonne National Laboratory, obviously had an unusual opportunity to scrutinize the literature, technology, and uses of uranium and its alloys. Many of the thousands of references that are documented here (and these extend right up to 1961) refer to relatively unavailable, unpublished reports which only recently have been declassified. The two volumes will undoubtedly be the main source of authoritative information on uranium and its alloys for some time to come.

A point of minor criticism is that the titles—*Uranium Process Metallurgy* and *Uranium Corrosion and Alloys*—do not correctly convey the contents of the volumes, which are far broader than their titles imply. About one-half of the first volume is devoted to the extractive metallurgy of uranium and its purification and reprocessing as a fuel material; the other half is devoted to powder metallurgy, fabrication, and safety practices with uranium. Only the first 100 pages of the second volume's 700 pages cover corrosion; the remainder is devoted primarily to physical properties of uranium alloys. Valuable appendices at the end of the second book include crystallographic data on uranium compounds and 40 binary phase diagrams for uranium alloy systems. There is some duplication between Wilkinson's volumes and Holden's earlier monograph, *Physical Metallurgy of Uranium* (Addison-Wesley, 1958). However, Holden covered, in the main, the properties of pure uranium, whereas Wilkinson places emphasis on the properties of alloys.

The price of the volumes—volume 1 is $18 and volume 2, $16—will prevent a mass buying spree by average scientists, but the books certainly belong in all technical libraries, and they should prove invaluable to those involved in the field of uranium research and technology.

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Comparative Anatomy

Chordate Morphology. Malcolm Jollie. Reinhold, New York; Chapman and Hall, London, 1962. xiv + 478 pp. Illus. $8.75.

Although fighting rearguard actions may be more popular in biology than in certain other scientific disciplines, one seldom sees the task accomplished with such conspicuous gallantry as Malcolm Jollie displays in his new *Chordate Morphology*. At a time when comparative anatomy has already been dropped from the undergraduate curriculum of more than one great university, Jollie has produced a big new book devoted to the factual basis of vertebrate morphology and morphogenesis. The 475 double-columned pages of his handsome new volume carry an almost unrelieved recital of facts, covering everything from the tip of the os carunculae to the end of the gephyrocercal tail.

The book proceeds in the traditional manner from a survey of the vertebrate classes through the several organ systems. About a third of the volume is devoted to the skeleton, with considerable attention being given to extinct forms. Among the extant vertebrates not only the species familiar to comparative anatomy courses but also an impressive array of less well-known species are described in detail. For example, the skulls of more than 40 vertebrates are illustrated from different aspects. The chapters on the soft parts similarly deal with numerous representatives of all vertebrate classes.

Chordate Morphology resembles most recent comparative anatomy texts in that some space is given to developmental considerations. Chapter 7 deals with cleavage, gastrulation, and body formation in frog and chick, but also manages to include matters like the development of *Clavelina, Torpedo,* and *Epatretus*, among others, as well as placentation in the dogfish, lizard, and opossum. Since the chapter is 23 pages long, it is not necessary to say that the topics are treated superficially. Nor is early development presented in a way that provides the student with any basis for understanding the descriptions which are included of the development of organ systems. For example, the derivatives of the visceral arches and pouches are dealt with in several chapters; but the embryonic visceral arch system itself is not even mentioned.

In other respects *Chordate Morphology* represents a reversion from current trends in teaching comparative anatomy. With the exception of the chapter on the integument, there is no treatment of histology. Physiological considerations fare even worse. The respiratory functions of both gills and lungs are covered in 78 words.

The value of Jollie's book will depend entirely on the use that is made of it. Well-illustrated and on the whole carefully and accurately composed, the volume is an excellent source of information on vertebrate structure. As a reference work, or as a text for advanced courses, *Chordate Morphology* will be of real service. But its relentless terminology, its esoteric detail, its avoidance of generalization (except in a brief prologue and epilogue) make it altogether unsuitable for use by innocent sophomores whose initial interest in comparative anatomy arises from the fact that the course is the next item in the curriculum. As an assigned text in the hands of such students, the book is most likely to serve as an instrument for throttling a budding interest in biological science.

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Applied Kinetics

Chemical Reaction Engineering. An introduction to the design of chemical reactors. Octave Levenspiel. Wiley, New York, 1962. xv + 501 pp. Illus. $10.75.

In recent years the steady improvement in our understanding of the effects of physical conditions on the course of chemical reactions, coupled with a greatly increased knowledge of chemical mechanism and with the availability of high-speed computers to overcome the mathematical difficulties involved, has paved the way for detailed kinetic analysis of almost every chemical reaction now utilized in large-scale production or intended for such use. This new book could play a major rôle in convincing both experienced engineers and neophytes that such analyses should be made and in helping them to know how to proceed.

Levenspiel deals primarily with the physical factors that have been the most neglected in the previously published texts. The book's title is taken from the name of two international symposia (Amsterdam, 1957 and 1960), and their proceedings are reflected in the contents, along with much additional related literature. The topics treated include an introduction to reactor design, holding time and space time, multiple-reactor systems, optimum temperature progression, residence-time distribution of fluid in vessels, axial dispersion, characteristics of a fluidized bed, and contacting patterns for two-phase systems. In the chapters on noncatalytic fluid-solid reactions and heterogeneous fluid-fluid reactions more attention is given to the interrelation between material-transfer rates and chemical kinetics than in previous texts.

On the chemical side, Levenspiel presents a survey of introductory kinetics that is somewhat more complete than