Review: Chemistry and Biochemistry

Reviewed Work(s):

Advanced Organic Chemistry by Reynold C. Fuson

Advances in Radiochemistry and in the Methods of Producing Radioelements by Neutron Irradiation by Engelbert Broda

Chemistry and Biology of Proteins by Felix Haurowitz

Fluorine Chemistry by J. H. Simons

The Solubility of Nonelectrolytes by Joel H. Hildebrand; Robert L. Scott

Carotenoids by Paul Karrer; Ernst Jucker

Organic Syntheses by Arthur C. Cope

The Biochemistry of B Vitamins by Roger J. Williams

Bacterial Polysaccharides: Their Chemical and Immunological Aspects by Martin Burger

The Enzymes: Chemistry and Mechanism of Action by James B. Sumner; Karl Myrbäck

Organophosphorus Compounds by Gennady M. Kosolapoff

The Science of Petroleum: Crude Oils, Chemical and Physical Properties by Benjamin T. Brooks; A. E. Dunstan

Ralph L. Shriner; Glenn T. Seaborg; Philip P. Cohen; E. T. McBee; J. D. Porter; F. P. Zscheile; Elwood V. Jensen; T. H. Jukes; William S. Preston; Eric G. Ball; Richard H. Wiley; Robert W. Schiessler

Science, New Series, Vol. 113, No. 2938. (Apr. 20, 1951), pp. 448-454.

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The Theory of Valuations. O. F. G. Schilling. New York: American Mathematical Society, 1950. 253 pp. $6.00.

A valuation is a generalization of the concept of an absolute value. The absolute value $|u|$ of a real or complex number u satisfies the laws

A1: $|u|$ is a real number, $|0| = 0$, $|u| > 0$ if $u \neq 0$.
A2: $|uv| = |u|\,|v|$.
A3: $|u+v| \leq |u| + |v|$.

A rational number $u \neq 0$ will be of the form $u = p^a r/p^b s$ where p is some fixed prime, and r and s are integers not divisible by p. We may define a function $f_p(u) = 2^{b-a}$ for $u \neq 0$ as above and $f_p(0) = 0$. Here the laws are

B1: $f_p(u)$ is a real number, $f(0) = 0$, $f(u) > 0$ if $u \neq 0$
B2: $f_p(uv) = f_p(u) f_p(v)$
B3: $f_p(u+v) \leq \text{Max}\,[f_p(u), f_p(v)]$,

and the third law B3 is definitely stronger than A3. A valuation $V(u)$ is a generalization of this second arithmetical "absolute value" $f_p(u)$ in that we consider a function $V(u)$ with arguments u from a general division ring D and values $V(u)$ in a simply ordered group Γ. Here the laws are

V1: $V(u)$, $u \neq 0$ is an element of a simply ordered additive group Γ. $V(0) = \infty$ is greater than any element of Γ.
V2: $V(uv) = V(u) + V(v)$.
V3: $V(u+v) \geq \text{Min}\,[V(u)\ V(v)]$.

Here for the rational field we may take $V_p(u) = a - b$ with $u \neq 0$ as above; i.e., $V_p(u) = -\log_2 f_p(u)$, and so $V_p(u)$ is in an additive group where $f_p(u)$ was in a multiplicative group. Since the law V3 is stronger than the corresponding triangle law A3, valuations are in general, like V_p for the rationals, bound up with arithmetical properties.

Hensel's theory of p-adic numbers, with its theory of p-adic convergence, threw new light on problems of congruences associated with the ideal theory of algebraic numbers. Similarly the realization that formal power series were sufficient for the study of algebraic curves opened the way to the study of algebraic geometry over general fields. Both p-adic series and formal power series may be regarded as convergent with respect to an appropriate valuation.

By every standard this is an advanced treatise and the reader will find in Appendix II, "Facts about Linear Algebras," a measure of the background required. But one of the most commendable features of the book is the careful way in which the author has indicated at every stage precisely what background is needed. The book is abundantly supplied with remarks and examples which clarify the motivation and give point to the distinctions made in the definitions. Only the absence of an index will cause the reader any regrets.

In a division ring D with a valuation $V(u)$, those u's with $V(u) \geq 0$ form a ring O and those u's with $V(u) > 0$ form a two-sided prime idea P in O. The residue class ring of O modulo P is again a division ring *D*. If D was an algebra over a field F, then *D* will be an algebra over a field *F*. Thus the valuation is an appropriate tool for studying the "local" theory relating properties of D and F to those of *D* and *F*.

The first two chapters are devoted to general theory of valuations, including the completion of D with respect to $V(u)$ as a metric. The next four lead up to local class field theory, the norm residue symbol being defined by means of the Brauer class group for simple algebras. A final chapter is devoted to a study of the structure of complete division rings, regarded as topological algebras with respect to the valuation.

MARSHALL HALL, JR.
Department of Mathematics
The Ohio State University

Chemistry and Biochemistry

Advanced Organic Chemistry. Reynold C. Fuson. New York: Wiley; London: Chapman & Hall, 1950. 669 pp. $8.00.

This is a textbook for graduate students, containing the reactions, syntheses, and concepts of organic chemistry that are really useful in research. The book is not an omnibus volume, but a carefully selected and organized treatment of specifically valuable processes for which yields can be, and are, cited throughout.

The material is not arranged according to homologous series or functional groups, as in most first-year textbooks. Instead, the chapters deal either with certain large classes of compounds, such as hydroxy compounds, halogen compounds, derivatives of carboxylic acids, carbonyl compounds, active methylene compounds, nitro, nitroso, and oximino compounds, amines and amino compounds, azo and diazo compounds, and organic sulfur compounds, or with general reactions or processes. As examples of the latter may be mentioned cleavage of carbon-carbon bonds, aliphatic substitution, organometallic compounds in synthesis, carbon monoxide in synthesis, oxidation, hydrogenation, aromatic substitution, ring closures, conjugate addition and polymerization. This organization gives the student a different viewpoint and permits correlations of reactions and mechanisms.

The useful and fundamental behavior of organic compounds is well presented and very well indexed. The text is full of solid organic chemistry, no descriptive or "essay material" being given. Do not look in this book for stories about vinegar, violets, vitamins, or veronal; but do look in it for all well-known "name" reactions, chelation, isoster concept, vinylogy, Blanc's rule, decarboxylation, telomers, cyclization, acylation, nucleophilic substitution, cyanoethylation, oxo reaction, etc. Reactions important in industry are given, as well as those of theoretical value. Older work is cited by references to *Annual Reports, Chemical Reviews, Organic Syntheses, Organic Reactions,* and *Organic Chemistry,* by Gilman. Specific literature

citations are given to recent work resulting in up-to-date treatment.

The book can be recommended to graduate students and to all research chemists who want a modern and critical evaluation of organic chemistry from the research standpoint.

RALPH L. SHRINER
Department of Chemistry and Chemical Engineering
State University of Iowa

Advances in Radiochemistry and in the Methods of Producing Radioelements by Neutron Irradiation. Engelbert Broda. New York: Cambridge Univ. Press, 1950. 152 pp. $2.75.

In the words of the author, this monograph deals primarily with advances since the appearance of the last comprehensive works on radiochemistry, namely, Paneth's *Radioelements as Indicators* (1928) and Hahn's *Applied Radiochemistry* (1936). Actually the coverage does not postdate these books, since the chapters are written with so much historical background that they can be considered to include concise treatment of much of the older as well as the recent work.

The book begins with a discussion of the definition of radiochemistry, which seems appropriate in view of the various viewpoints on this matter. Broda essentially defines radiochemistry as the chemistry of bodies detected through their nuclear radiations, and this certainly seems adequate as a present-day definition. This is consistent with the usage in which the broader term "nuclear chemistry" is used to include the fields of radiochemistry and a number of other areas of nuclear science in which the chemist works and makes his contributions.

Following the introductory material, there are chapters discussing the distribution of tracer quantities between solids and liquids (radiochemical carrying), tracer quantities in gases, and the electrochemistry of radioelements. These are of especial interest to those of us who might be classed as latecomers to the field of radiochemistry, in view of the excellent and compact review of the early work involving natural radioactive substances, in addition to the review of more recent contributions to these areas.

Work on the production of radioelements by nuclear synthesis, largely through neutron irradiation, and the work on nuclear fission from the chemist's point of view are then reviewed, followed by a chapter on new radioelements of special interest, including the neptunium $(4n+1)$ radioactive series, the transuranium elements, other rare or missing radioactive elements (Nos. 43, 61, 85, and 87), tritium, and radiocarbon.

Specific radiochemical effects for chemical excitation due to nuclear reactions are subsequently treated. Only the work on specific effects, such as the Szilard-Chalmers effect, chemical separation of nuclear isomers, and aggregate recoil, is reviewed, whereas the work on indiscriminate action of radiation beyond the immediate neighborhood of the spot of the nuclear reaction—i.e., the subject of radiation chemistry—is excluded. The book concludes with a section describing new developments in the technique of radiochemical measurements. In this area the coverage is not as complete as that throughout the rest of the book, with many of the newer instruments not described at all.

The book is written in a very concise style and is abundant with references to the original literature. It is perhaps too specialized to have a broad interest, but will certainly find its place on the bookshelf of practically all nuclear chemists and of many others in related fields.

GLENN T. SEABORG
Department of Chemistry and *Radiation Laboratory*
University of California, Berkeley

Chemistry and Biology of Proteins. Felix Haurowitz. New York: Academic Press, 1950. 374 pp. $5.50.

In this book, Haurowitz attempts to bring under one cover most of what is known today about the structure, properties, and mode of action of proteins. Because proteins play a role in practically every aspect of modern biochemistry, the author has had to discuss a wide variety of topics. As a result of this diversity, he has been forced in most cases to skim the surface of his subject matter, leaving the interested reader the alternative of reading a large number of original papers, which are included in the bibliography, or else remaining content with brief, one-sentence summaries of fundamental experiments. The book purports to be a textbook of protein chemistry, but unless it is conceded that the aims of modern pedagogy are the instillation of large numbers of facts in the student rather than the elucidation of principles and development of a critical attitude, one would not find this very satisfactory as a textbook. On the other hand, the subject is treated more extensively than is customary in the modern review literature, and so perhaps the author's own words could be used to describe the work most fairly—namely, that this book represents a "uniform outline of the present state of the protein problem."

The book is well written and contains approximately 1,500 references to the original literature. It is relatively free of typographical errors. The main topics discussed are (1) structure of proteins, (2) biological activity of proteins, and (3) biosynthesis of proteins. For the most part these subjects are treated objectively. Topic (1) tended to be too empirical in nature, many unnecessary facts being included (e.g., conditions of a particular fractionation scheme). Topic (2) was handled rather sketchily, but perhaps this was inevitable in view of its ambitious title. Topic (3) was of necessity highly speculative. At times it was difficult to separate Haurowitz's speculations from the experimental conclusions presented in the papers he was discussing. The author, however, has succeeded in gathering and correlating in a systematic manner most of the old and recent experiments which shed

some light on the nature of the protein molecule. Because of this, the book performs a valuable function and can be heartily recommended to anyone interested in the protein problem.

PHILIP P. COHEN
Department of Physiological Chemistry
University of Wisconsin

Fluorine Chemistry, Vol. I. J. H. Simons, Ed. New York: Academic Press, 1950. 615 pp. $12.00.

During the past 30 years, and especially since the beginning of World War II, great strides have been made in the knowledge of fluorine and fluorine-containing substances. The contributors to *Fluorine Chemistry* have given excellent up-to-date reviews of certain areas of this very comprehensive field. There are some duplication and lack of concentration of subject matter, especially on the theoretical aspects of fluorine chemistry, resulting from the multiple authorship. The book is especially recommended for those interested in inorganic fluorides.

In "Nonvolatile Inorganic Fluorides," H. J. Emeleus presents a superb review and discussion of the occurrence, preparation, and properties of the fluorides of many metals. The chemistry of "Volatile Inorganic Fluorides," by A. B. Burg, is likewise very well done. These first two chapters give the reader an excellent summary of the chemistry of the fluorides of the elements, except for the subject matter covered in special chapters. W. Lange has given a very complete review of the art in "The Chemistry of the Fluoro Acids of Fourth, Fifth, and Sixth Group Elements." The preparation and physical properties of "The Halogen Fluorides," by H. S. Booth and J. T. Pinkston, Jr., are adequately covered. However, the discussion of the chemical properties of these substances is brief.

In "Boron Trifluoride" Booth and D. R. Martin have given a good review of their book on the same subject. For general information on the preparation and properties, including catalytic properties of boron trifluoride, the reader will find this chapter adequate. The editor has demonstrated a competent knowledge of "Hydrogen Fluoride" and "Hydrogen Fluoride Catalysis." These chapters not only cite 211 references, but also give a very good discussion of the properties, especially catalytic, of hydrogen fluoride. The principles and technical problems of the "Preparation of Fluorine" have been excellently discussed by G. H. Cady. The review of the literature and the discussion of industrial methods are brief. A concise summary of the "Physical Properties of Fluorine" is given by Cady and L. L. Burger. In an area where the experimental data are so incomplete and contradictory, G. Glockler has provided a worth-while discussion of "The Theoretical Aspects of Fluorine Chemistry" through the use of empirical relationships. "The Action of Elementary Fluorine upon Organic Compounds," by L. A. Bigelow, gives a commendable analysis of the art and limitations in the use of this very reactive reagent.

The most salient feature of "Fluorocarbons and their Production," by the editor, "Fluorocarbons—their Properties and Wartime Development," by T. J. Brice, and "Fluorocarbon Derivatives," by W. H. Pearlson, is the unique and frequently inconsistent system of nomenclature. The reviewer is of the opinion that this system of nomenclature will not be adopted by the American Chemical Society. The sections on fluorocarbons are interesting and instructive. A good but very brief review of the preparation of "Aliphatic Chlorofluoro Compounds," by J. D. Park, is supplemented by a long table listing physical properties of a large number of such compounds. It would require a small volume by itself to completely cover this subject. "Fluorine Compounds in Glass Technology and Ceramics," by W. A. Weyl, is interesting and well done and completes the material to be found in this new treatise.

E. T. MCBEE
Department of Chemistry
Purdue University

The Solubility of Nonelectrolytes. 3rd ed. Joel H. Hildebrand and Robert L. Scott. New York: Reinhold, 1950. 488 pp. $10.00.

In preparing this new edition the authors have drastically revised the 14-year-old second edition and have considerably more than doubled its size.

Molecular and thermodynamic properties determinative or descriptive of solubility behavior are treated at length, and gaseous and solid, as well as liquid solutions, are included. Recent advances in our knowledge of intermolecular forces and of the nature of the liquid state have been fully utilized, as have the results of the very active cultivation of the field of high polymers during the past decade. The latter field, covered in a 50-page chapter, has provided some extreme cases of nonideal solutions—which, however, the authors' theoretical treatment is able to take in its stride. In these solutions the heat of mixing is very small, and the enormous deviations from ideality (e.g., activity coefficients of 10^{-4}!) are due to the highly anomalous entropy of mixing of the long-chain polymer molecules.

A major aim of the book is the semiquantitative prediction of solubilities from the properties of the solvent and solute. Such prediction is now possible in a useful number of cases. The authors, however, are under no illusions about the work still to be done before the numerous exceptions are brought into line. They admit, furthermore, that "if one must know a solubility to one percent, he should measure it."

Physical chemists will be most interested in the theoretical viewpoints developed, whereas the possibility of applying these to make approximate predictions of solubility will appeal to organic chemists and chemical engineers. For metallurgists there is a chapter on liquid and solid solutions of metals. Biologists whose work is concerned with matter at the molecular level may find suggestive the authors' approaches to the behavior of molecules in mixtures.

A review on solutions of nonelectrolytes written by

the authors for the first volume (1950) of the *Annual Review of Physical Chemistry* is reprinted in an appendix.

The book contains a considerable number of misprints and minor errors, but the reviewer noticed none that seriously interferes with understanding. The margins are too narrow for the notations which many users will want to make, and the printing is rather unattractive.

J. D. PORTER

Department of Chemistry
Union College
Schenectady, New York

Carotenoids. Paul Karrer and Ernst Jucker; trans. and revised by Ernest A. Braude. New York: Elsevier, 1950. 384 pp. $8.50.

English-speaking workers will particularly welcome this translation of the 1948 work published in German by the same authors. Moreover, some corrections were made and newer work included in the translation.

The first 100 pages deal with carotenoids in general, with chapters on formation and occurrence of carotenoids in nature, methods of isolation and study, chemical constitution, isomerism, color, and synthesis. The remainder of the book deals with specific pigments. Each major pigment of known constitution is discussed systematically under the headings history, occurrence, isolation, chemical constitution, formation, properties and physical constants, derivatives, and isomers. The hydrocarbon carotenes are discussed first, followed by xanthophylls, carbonyl compounds, and carboxylic acids. Finally, a large group of partially characterized carotenoids is described in the same manner so far as present information permits. The number of carotenoids discussed is over 70. Thus the subject matter is developed in a very orderly manner. It is unfortunate that recent developments regarding *zeta*-carotene and phytofluene are not mentioned.

In the appendix are several reproductions of considerable interest to experimentalists in this field: (1) colored plates showing crystals of 12 different carotenoids and giving the solvent from which they were crystallized, and (2) a section consisting of 28 figures, reproduced from numerous research papers, showing absorption spectra of many carotenoids. Most of these spectra extend well into the ultraviolet region. Comparison would be facilitated if more uniform units of absorption had been employed throughout this series.

An extensive index of vegetable and animal sources precedes the subject index. No author index is given. References are presented copiously throughout the book at the ends of chapters and in many tables. The paper and binding are of good quality, and the printing and structural formulae are very clear and easily read.

Several tables of outstanding value for the student may be mentioned specifically. The structural formulae for all carotenoids of known structures are presented together. Chemical relationships are indicated. Absorption maxima for carbon bisulfide solutions are given for many pigments. Numerous tables and 440 associated references deal with the distribution of carotenoids in nature.

The subject of *cis-trans* isomerism is outlined in a brief chapter, and numerous references are given. This subject is understandably too large for full treatment in this volume. Such isomers are discussed briefly under some of the specific pigments.

Two phases of carotenoid work of the past decade have been neglected in this volume. The increasing significance of genetic relationships relative to possible improvement in the nutritional value of certain food plants through increase of provitamin-A content could well have been discussed briefly. These considerations are also important for studies of carotenoid synthesis and its various steps. It is disappointing to find that spectrophotometric work, especially with regard to absorption coefficients in relation to analytical applications and methods, is not more fully represented in a volume of this coverage. The absorption curves of the collected spectra are in some cases as old as 18 years, having been determined long before the full significance of *cis-trans* isomerism was appreciated. The reader should consult more recent sources for accurate data of this nature. In Fig. 31 the legend is confused.

This book is highly recommended as a very comprehensive reference on the subject of carotenoids. The organization of its subject matter is excellent.

F. P. ZSCHEILE

Division of Agronomy
University of California, Davis

Organic Syntheses, Vol. 30. Arthur C. Cope, Ed. New York: Wiley; London: Chapman & Hall, 1950. 115 pp. $2.50.

The present volume is a valuable addition to the series of *Organic Syntheses*. In it specific directions are given for preparing the following 41 compounds:

9-Acetylanthracene, 3-aminopyridine, *p*-aminotetraphenylmethane, DL-aspartic acid, benzoylcholine iodide and chloride, *n*-butylacetylene, β-carbethoxy-γ, γ-diphenylvinylacetic acid, chloroacetonitrile, *trans*-2-chlorocyclopentanol, 4,4′-dichlorodibutyl ether, diethyl *cis*-Δ^4-tetrahydrophthalate, diethyl *cis*-hexahydrophthalate, 1,4-diiodobutane, ethanedithiol, ethylenimine, 5-ethyl-2-methylpyridine, ethyl phenylcyanoacetate, fumaronitrile, glutaric acid, hexahydro-1,3-5-tripropionyl-*s*-triazine, 2-iodothiophene, 2-mercaptobenzimidazole, methanesulfonyl chloride, N-methyl-2,3-dimethoxybenzylamine, 1-methyl-3-ethyloxindole, methyl β-thiodipropionate, 1-naphthaldehyde, *o*-nitroacetophenone, phenylacetylene, *trans*-1-phenyl-1,3-butadiene, α-phenyl-α-carbethoxyglutaronitrile, α-phenylglutaric anhydride, phenylsuccinic acid, 2,3-pyrazinedicarboxylic acid, 1,2,3,4-tetrahydrocarbazole, *cis*-Δ^4-tetrahydrophthalic anhydride, tetraphenylarsonium chloride hydrochloride, *o*-tolualdehyde, vanillic acid, and vinyl laurate.

In cases where the name of the preparation differs from the *Chemical Abstracts* indexing name for that

compound, the latter designation is given as a subtitle, and the substance is indexed under both names. Inasmuch as this volume begins a new unit of ten volumes, its index includes only compounds described within the volume.

As is the custom in this series, each preparation described has been rechecked in the laboratory of a member of the editorial board; the reader can thus be assured that the product can be obtained in the yield promised without unexpected difficulties. There is a more detailed description of the synthetic procedure than is usually found in the experimental portion of journal papers. The notes following each preparation give the reasons for certain of the experimental precautions, information which is often of considerable value to the student.

In the opinion of the reviewer, the collection of reproducible preparative methods represented by this and previous volumes of *Organic Syntheses* is a commendable project and one of extreme usefulness to organic chemists.

ELWOOD V. JENSEN

Department of Surgery
The University of Chicago

The Biochemistry of B Vitamins. Roger J. Williams, *et al.* New York: Reinhold, 1950. 741 pp. $10.00.

Each of the four contributing authors to this book has written a section that contains a large amount of information pertaining to the B-complex vitamins. The first section, entitled "Characterization, Distribution, Assay and Biogenesis of B Vitamins," contains an interesting discussion of the definition of these substances. There are some statements in chapter IIA which may need further scrutiny; examples are the finding that ascorbic acid "disappears from the liver after the tenth day" in chick embryos (p. 21), and the footnotes to Tables 1 and 2 stating that "the material given represents the only data on the subject that are available" with respect to the B-vitamin content of whole organisms and human tissues. It is concluded that wheat and brewers yeast are the poorest sources of biotin, which is not in agreement with data published elsewhere (*J. Nutrition,* **23,** 11 [1942]). On page 89, a paragraph on the biogenesis of vitamin B_{12} has apparently been omitted.

A great deal of the published data relating B vitamins to the action of specific enzymes and biochemical reactions is brought together in a useful way in the second section, dealing with the catalytic functions of the B vitamins. There is considerable speculation involving processes in which B vitamins may be concerned by inference—for example (p. 230), "Biotin . . . could function in some fashion in the process responsible for the formation of the unsaturated linkages in the sterol molecules in a manner comparable to its possible function in the formation of the ethylenic linkages in oleic acid."

"The Role of the B Vitamins in Animal and Plant Organisms" is perhaps even more speculative, although the wide scope of the subject matter is excellent. Some of the data illustrated in Figs. 10–14 do not have any experimental basis. Criticism rather than repetition of certain published statements would have been welcomed. Examples of such statements are the unfounded suggestion that a pteridyl aldehyde photofission product could cause undesirable neurological effects in pernicious anemia (p. 296; incidentally, references 174a–174f are missing from the bibliography), as well as the material on "pyracins" (p. 421), and on *p*-aminobenzoic acid "requirement" (p. 327) and "deficiency" (p. 429).

The fourth and most intricate section, bearing the sweeping title "The Comparative Biological Activities of the B Vitamins and Related Compounds," deals largely with antagonist-metabolite relationships. The first two chapters are devoted to an exposition of the author's proposals regarding "inhibition analysis." This is an approach to the study and assay of unknown growth factors by measuring their effect on a specific competitive-analogue-metabolite inhibition of a biological system. The introduction of the term "erythrotin" is probably unnecessary—indeed the author himself alternates between it and "vitamin B_{12}" (p. 475). The third chapter is devoted to an exhaustive summary of the work on *p*-aminobenzoic acid and its antimetabolites, with 432 references, and the next four chapters, dealing with biotin, folic acid, nicotinic acid, and pantothenic acid are no less comprehensive. The concluding four chapters deal with vitamin B_6 riboflavin, thiamine, choline, inositol and their inhibitors.

Typographical errors were noted on pages 89, 123, 182. 193, 206, and 227.

The volume is a comprehensive addition to the reference literature on the B vitamins and will be welcomed by workers in the field.

T. H. JUKES

Lederle Laboratories Division
American Cyanamid Company

Bacterial Polysaccharides: Their Chemical and Immunological Aspects. Martin Burger. Springfield, Ill.: Thomas, 1950. 272 pp. $6.00.

One would assume the intent of this monograph to be the presentation of a critical and up-to-date integration of the knowledge of bacterial polysaccharides of value to the chemist and immunologist. On reading it. it is difficult to decide to what audience it is addressed.

After a very brief introductory chapter, which merely outlines that bacteria elaborate polysaccharides, the author summarizes in a series of chapters the literature covering the well-studied carbohydrate fractions of several groups of bacteria. Specifically, the various coccal organisms, the anthrax bacillus, mycobacteria, vibrio, brucella, hemophilus, and the gamut of the enteric organisms are covered. A chapter devoted to enzyme studies is interposed following consideration of the pneumococci. Here is presented a brief consideration of enzymes acting on bacterial carbo-

hydrates, a few antibiotics of the gramicidin type, and a gesture toward hyaluronidase and similar "mucolytic" preparations. In the chapter devoted to the typhoid bacillus, pyrogen (*sic*) is discussed. An appendix is concerned with technical details for the preparation of selected polysaccharides.

Unfortunately, the book does not represent an up-to-date approach to the subject and is devoted mainly to a summarization of well-known factual material, with unfortunate emphasis on many outdated ideas. There is little critical evaluation, and conflicting information is dismissed with such comment as "more work is needed."

As a compilation of brief, descriptive summaries of investigations on bacterial polysaccharides, to a limited audience, the book has merit; as a critical discussion of the field, it leaves much to be desired.

WILLIAM S. PRESTON

Department of Bacteriology
University of Michigan

The Enzymes: Chemistry and Mechanism of Action, Vol. I, Part 1. James B. Sumner and Karl Myrbäck, Eds. New York: Academic Press, 1950. 724 pp. $13.50.

Two volumes, each consisting of two parts, are planned for this new encyclopedic work on enzymes. In the foreword to this volume, the editors state that it is their aim "to present systematically the accumulated knowledge in the various phases of enzymology as a comprehensive survey which will be the most efficient service both to those already working in the field and to those preparing to enter it." To accomplish this task they have enlisted the aid of 75 scientists in the United States, Europe, and Australia. A total of 77 chapters is planned, each written by one or more individuals and with no one individual an author of more than two chapters. That such a plan leads to a treatise less homogeneous than a book written by one individual is admitted by the editors in their foreword.

Volume 1, Part 1 consists of 19 chapters. The first eight discuss general aspects of enzymes and include treatments of the physical chemistry, chemical kinetics, specificity and inhibition of enzymes. A discussion of the relation of enzymes to genes, viruses, hormones, vitamins, and immunology; the localization of enzymes within the cell; and the adaptive formation of enzymes complete this group of chapters. The remaining 11 chapters deal with enzymes largely concerned in the catalysis of hydrolytic processes involving acetylcholine, phosphoric and sulfuric acid esters, sucrose, glucosides, galactosides, mannosides, thioglycosides, glucuronides, starch, and glycogen. The phosphorolysis of carbohydrates is to be treated in Part 2 of Volume 1.

As one might expect, some chapters are well done and others can be rated only fair. The chief difficulty seems to be in the failure of the authors of certain chapters to treat their subject critically. In these cases, as unfortunately with so many review articles today, an exhaustive recitation of all the findings in the literature seems to be the main goal of the author. On the whole, however, the editors have gathered together a commendable team of writers. The task they have undertaken is a difficult and worth-while one, and there seems little doubt that when the two volumes are completed they will constitute a major source of information for those interested in enzymes.

ERIC G. BALL

Department of Biological Chemistry
Harvard University Medical School

Organophosphorus Compounds. Gennady M. Kosolapoff. New York: Wiley; London: Chapman & Hall, 1950. 376 pp. $7.50.

The author has undertaken a difficult task in attempting a comprehensive treatment of this broad field of organic chemistry. Chemists will be grateful, as this reviewer is, for this addition to the literature. The task is made difficult by the extensive literature in the field and the lack of a generally accepted system of nomenclature. For these and other reasons, the chemist working in the field will welcome this volume. To such workers this book is recommended, with certain qualifications, as a valuable addition to previously available treatments: namely, Goddard (Vol. XI, Part III, of Friend's *Treatise*); Courtot in Grignard's *Treatise*; and the volumes of Beilstein, where much of the material is conveniently collected. The general reader will be more exacting than the specialist, particularly in terms of the success with which the author is able to organize the information and to coordinate it. Such readers will find that this volume falls short of achieving this objective.

Dr. Kosolapoff has divided the field into eleven sections, each of which is assigned a chapter. Methods of synthesis of each type are simply listed—running to 25 in one chapter, 33 in another—with no summary listing and in no apparent order. It is necessary to hunt through 26 pages of Chapter 9 and 22 pages of Chapter 7 to find the discussion of a given synthesis. Tables describing specific compounds are given at the ends of the chapters, again according to arbitrary subdivisions, so that it becomes quite annoying to find the listing of a specific compound. The inadequate index and omission of a detailed table of contents accentuate the problem. This lack of adequate organization of the material detracts significantly from the quality of the volume.

The nomenclature adopted by the author is different from other systems, and suffers from lack of a comprehensive comparison. Reference could well have been made to the activities of the committee of the American Chemical Society which is working on this problem. The existing International Union rules and the Beilstein usage should have been quoted.

The reader may find the author's style annoying in its verbosity and misusages. The phrases "formation of a spectrum of derivatives" and "poorly stable" are

used over and over. The use of "monolithic" for basic; "primitive" for simple; "venerable" for long-known; and "fountainheads" for beginnings are examples of misusages. The statement in the introduction that alchemical reactions "might be called heterogeneous in the fullest sense" is meaningless. The statement on page 190 that "The availability of the necessary trioxide is essentially negligible," for which one can substitute "The trioxide is not readily available," is illustrative of many verbose constructions.

Reference is made to recent important developments in this field, with the notable exception of the use of radioactive phosphorus. New insecticides, poisonous fluorides, and techniques in synthesis of naturally occurring phosphate esters are included but are sometimes difficult to find. In general the subject matter is thoroughly covered.

RICHARD H. WILEY

Department of Chemistry
University of Louisville

The Science of Petroleum: Crude Oils, Chemical and Physical Properties, Vol. V, Part I. Benjamin T. Brooks and A. E. Dunstan, Eds. New York: Oxford Univ. Press, 1950. 200 pp. $11.00.

The first four volumes in "The Science of Petroleum" series were published in 1937. Volume V, part I, deals both with new subjects and with several that supplement subjects previously covered. Under such conditions some repetition of material is obviously unavoidable, and Volume V is a substantial contribution to the series. Two further parts are planned to revise the coverage of the chemistry, physics, and chemical engineering of petroleum.

For Section I entitled "Crude Oils," the chapter by H. M. Smith provides excellent coverage of production and reserve data for all major oil fields in the U. S. for 1935–45. The principal characteristics of the crudes are discussed by the states in which they are found, and analytical data are given for crude oils representative of 76% of the total production in 1945. By comparison the chapters on Venezuelan, Saudi Arabian, and Bahrein Island crude oils present very meager data, indeed, possibly because of the sparsity of available information. The chapter on Middle Eastern oils is somewhat better. A brief chapter is included on the evaluation of crude oils and oil stocks that is essentially an introduction to the subject. Although seemingly out of place in a treatise on the science of petroleum, the chapter on economic developments in the petroleum industry is interesting and well written.

The first chapter in Section II, "Chemical and Physical Properties of Petroleum Hydrocarbons," by A. N. Sachanen, covers the methods of separation and determination of the hydrocarbons in petroleum, lists the percentage composition of various fractions from several typical stocks, and describes methods of classifying crude oils. Although there is some overlapping with a later chapter by Rossini, and much material published since 1938 is overlooked, the coverage is extensive and informative. The succeeding three chapters on the chemistry of paraffin naphthene and aromatic hydrocarbons are brief but well-written reviews of developments since 1937. The extensive treatment of the chemistry of olefin and diolefin hydrocarbons is a reflection of the great expansion of knowledge in this area since the previous article in 1938. The excellent chapter by F. C. Whitmore on the mechanism of organic reactions is a welcome addition to the treatise, although a more complete coverage of the mechanisms of *hydrocarbon* reactions would seem desirable. For example, the mechanism of hydrocarbon oxidation is untouched. The article on "Fractionation, Analysis, and Isolation of Hydrocarbons in Petroleum" is a review of the intensive work of the American Petroleum Institute Project 6, principally covering a crude oil from the Ponca City, Oklahoma, field. A chapter on the chemical thermodynamic properties of hydrocarbons summarizes the collection of thermodynamic data made by the American Petroleum Institute Project 44. The final article covers high-pressure vapor-liquid equilibria in cycling operations and should interest production engineers.

This volume is a valuable addition to "The Science of Petroleum" series as well as an essential reference work for libraries. The treatment is very uneven; however, this is almost inevitable in a treatise of such scope. A huge gap remains in the coverage of the science of petroleum, since much recent work on the physical properties of hydrocarbons is untouched. Perhaps later volumes will rectify this situation.

ROBERT W. SCHIESSLER

School of Chemistry and Physics
Pennsylvania State College

The Biological Sciences

The Life of Vertebrates. J. Z. Young. New York: Oxford Univ. Press, 1950. 767 pp. $8.50.

The aim of this large book is thus defined by its author: "The present book has gradually grown into an attempt to define what is meant by the life of vertebrates and by the evolution of that life. Put in a more old-fashioned way, this represents an attempt to give a combined account of the embryology, anatomy, physiology, biochemistry, palaeontology, and ecology of all vertebrates."

It cannot be expected, and the author has not claimed, that a single book can really give a full account of such varied aspects of vertebrate life, or even a smoothly balanced summary of all of them. The degree of success is, nevertheless, brilliant. The book is a first-rate account of the functional anatomy and evolution of the vertebrates.

"A glance through the book will show that I have not been successful in producing anything very novel," the author modestly adds. The organization of the text, to be sure, is not a radical departure from such time-honored works as Parker and Haswell.