

by names in English, French and German. In the List of Elements, the symbols recommended in the 1957 IUPAC rules are used. These are written in Roman type and arranged alphabetically. Each symbol is followed by its atomic number and its name in Japanese, English, German, French and Russian.

Non-adopted rules, recommendations and reports which appeared in the 1957 edition are included in this book.

In the appendix, the following material is again included:

- (1) Miscellaneous Chemical Prefixes; (2) Symbols, Signs and Abbreviations; (3) Pronunciation of Chemical Words; and (4) How to Use *Chemical Abstracts*.

The table of contents and the index are given in Japanese and in English.

CHEMICAL ABSTRACTS SERVICE  
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**Microbial Genetics.** Tenth Symposium of the Society for General Microbiology held at the Royal Institution, London, April 1960. Edited by W. HAYES and R. C. CLOWES, Medical Research Council, Microbial Genetics Research Unit, Hammersmith Hospital, London, W. 12, England. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1960. x + 300 pp. 16 × 25 cm. Price, \$7.50.

Every year the Society of General Microbiology in England sponsors an international symposium on a theme or problem of current interest and importance to microbial investigators. The volumes that have emanated from these symposia have proved their usefulness in many ways, some having become important reference works (*e.g.*, *Adaptation in Microorganisms*, *Bacterial Anatomy*, *Virus Growth and Variation*), and they have set high standards for international conferences of this kind. The present volume, the tenth in the series, is an excellent contribution to the field of Microbial Genetics, despite the fact that in recent years considerable attention has been paid by symposium organizers to this rapidly developing and extremely important field of research.

Several notable qualities raise this volume in distinction and value in comparison to other works covering the same field. The first of these qualities is its sensible organization; one gains the impression that as much care was given by the editors to the selection and arrangement of topics and areas for discussion as to the choice of eminent investigators as authors. The symposium is treated as the unfolding of the present state of our knowledge of the hereditary determinants, or genes, of microorganisms. At first, these genes are described as they occur as a group or assembly, namely, as part of a chromosome. Then their individual behavior is analyzed in terms of their fine structure, their recombinational interactions, and their activity in the metabolic economy of the cell. Further study then is made of their structure and function at the molecular level. Finally, some consideration is given to how they cooperate in the running of the complex society of which they are a part, the cell as a whole.

Another valuable quality of this volume is the number of papers that are sufficiently comprehensive and broad in scope to assure the adequacy of the review of the field and to provide some foundation for the other papers which deal with more specific aspects or problems. Especially commendable in this regard are the excellent reviews by Hayes on the bacterial chromosome, by Pritchard on the genetic fine structure of microorganisms as revealed by recombination analysis (a paper in which the author laudably attempts to bring together the divergent information that has been obtained from cytomorphological, cytochemical and genetic investigations, and in the higher forms of life as well), by Catcheside on the relation of gene structure to enzyme specificity, and by Brown on the role of the nucleic acids in the synthesis of specific proteins.

The remaining papers are uniformly of great interest. Kellenberger addresses himself to the structure of the bacterial chromosome as revealed by electron microscopy, and tries to correlate this information with other chemical information about its mode of replication. Jacob, Schaeffer and Wollman introduce a new concept, that of episomes, which are hereditary determinants that may be added to the genetic constitution of the cell (rather than replace some

determinants already present in the cell) and exist in either an autonomously replicating condition or in an integrated state. The notion of episomes not only unifies our understanding of lysogeny, colicinogeny and the sex factor of bacteria, but stimulates interesting hypotheses concerning the regulation and differentiation of cells of higher plants and animals as well. Clowes reviews what has been learned of the fine structure of bacterial genes through use of the mode of genetic transfer known as transduction. Esther Lederberg emphasizes in particular the bacterial genes governing galactose metabolism. Harriett Ephrussi-Taylor raises some critical questions regarding the heterocatalytic activity and replication of infectious deoxyribonucleic acid during the process of genetic transformation. Garen furnishes a lucid account of an elegant procedure for understanding the control of the gene over the functional specificity of an enzyme through the particular case of alkaline phosphatase. Gierer brings us up to date on the structure and function of ribonucleic acid in the group of small viruses, which includes the tobacco mosaic and the poliomyelitis viruses. Maaløe deals with the integration of the genome, the protein-synthesizing particles in the cytoplasm, the enzymes and their substrates and end products in the regulation of growth. Danielli summarizes the results of recent experiments by himself and co-workers on the hereditary effects of nuclear exchanges between amoebae of different species.

For the initiate Stocker provides a necessarily brief and condensed introduction to the concepts and terminology of genetics. Nevertheless, those unfamiliar with microbial genetics are not recommended to launch upon this volume without first assimilating some more elementary essays or reviews on the subject. Biochemists, however, will find extremely useful those papers dealing with the molecular aspects of gene structure and function, whatever difficulty they may experience with the purely formal aspects of genetic organization.

For biologists in general, and for geneticists in particular, this book should prove its worth, not only now but for some time to come.

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**Organosilicon Compounds.** By C. EABORN, Ph. D., D. Sc., Reader in Physical-Organic Chemistry, University of Leicester. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. x + 530 pp. 15 × 22.5 cm. Price, \$15.00.

This handsome new book is the largest and most ambitious work on organosilicon chemistry to appear in the English language. Dr. Eaborn, reader in physical-organic chemistry at the University of Leicester, has concentrated within it everything that has come to light during his intensive study of the kinetics of the reactions of silicon compounds, and has used his ideas on the mechanisms of such reactions to correlate a vast amount of previously published material.

The plan of the book embraces 17 logical divisions, starting with preparative methods and general bond characteristics, then proceeding through reactions of all the major types of compound, and ending with a discussion of physical properties and analysis. An indication of the book's thoroughness is the inclusion of 10 pages and 6 extensive tables on the molecular spectra, interatomic distances and dipole moments of organosilicon compounds. Each chapter contains an exhaustive bibliography, and the reader is further helped by an unusually detailed table of contents and by a 23-page index of compounds and subjects. It is practically impossible to get lost in the book.

In his preface, Dr. Eaborn writes: "While I have drawn frequent parallels with carbon chemistry, I have, against my inclinations, not related the organic chemistry of silicon to that of other metalloids or metals." Just why he should go against his inclinations in this way is not clear to the reviewer (in whose experience the chemistry of silicon is closer to that of boron, germanium and tin than to that of carbon), unless it be out of loyalty to his university title or his past training.

Dr. Eaborn also explains in his preface that he has placed considerable emphasis on reaction mechanisms as a means of "introducing order into accounts of fragmentary and unrelated researches." In this he succeeds very well. The

reader is left with very little doubt that organosilicon chemistry can indeed be organized around this point, and that Dr. Eaborn has established a secure niche for himself by doing so. What needs to be pointed out here, however, is that mechanisms are not thrown about irresponsibly; one would expect the young author to overreach himself in his zeal, but he does not. Instead, he holds to a sensible view: "I have tried to set down the experimental facts in such a way that they will be apparent even where my speculations and assertions about them are confounded by the advances of the next few years" (quoted from the preface). And so we come to the enormous service which Dr. Eaborn has rendered to chemists but has not advertised: he has taken a long, thorough look at *all* of organosilicon chemistry, as published through 1958, and has distilled it into a clear,<sup>1</sup> logical account. It is the only comprehensive review that carries up this far,<sup>2</sup> and it would have carried further (or appeared earlier) if it had not been caught up in a printer's strike for several months.

Several books about the technical and industrial aspects of silicones have appeared recently, all of which (for good reasons) have given scant attention to the basic chemistry of organosilicon compounds. Dr. Eaborn's book properly avoids all but "an elementary outline" of industrial silicones, and concentrates 480 pages on fundamental chemistry. In your reviewer's opinion, it will be indispensable to those working in the field, and to chemists in general it will be worth its price several times over.

(1) American readers may be slowed by English spelling and phraseology, but never by loose grammar or unnecessary words.

(2) *THIS JOURNAL*, **82**, 2405 (1960).

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EUGENE G. ROCHOW

**Crystal Growth.** Discussions of the Faraday Society. No. 5, 1949. By the Faraday Society. Butterworth and Co. (Canada), Ltd., 1367 Danforth Avenue, Toronto 6, Ontario, Canada. 1959. 366 pp. 16 × 25 cm. Price \$12.00.

"This General Discussion of the Faraday Society was first published in 1949. It has long been out of print, and since its publication many of the papers it contains have become classic. It is reprinted and published in response to the very many requests received by the Faraday Society" (from the paper wrapper).

The reviewer can add little to this, except to concur in the desirability of rendering this discussion of the theoretical, experimental and industrial aspects of Crystal Growth permanently available. Many of the problems so ably presented and discussed at the 1949 meeting are still being followed up, and where some final answer seems to emerge it is often a development of views proposed at the conference. The mass of ideas and observations brought together at this meeting of the most experienced crystal growers remains fascinating.

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**Gas Chromatography.** Second Edition. By A. I. M. KEULEMANS, Research Chemist, Koninklijke/Shell-Laboratorium, Amsterdam, Holland. Edited by C. G. VERVER. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1959. xxi + 234 pp. 16 × 23.5 cm. Price, \$7.50.

During the period 1952 to date the field of gas chromatography has progressed from a laboratory curiosity to a full pledged scientific tool. The appearance of the first edition of this book was hailed by many for providing the first definitive coverage of the available theoretical and experimental knowledge. Since the author, A. Keulemans, was a leader in developing certain of the areas of gas chromatography, his writing stemmed from a first-hand knowledge of the field.

Since 1957, the field has moved ahead at what seems to be an unabated speed. Thus, the second edition of this book is as welcome now as the first edition in 1957. The changes are largely in the practical and implementation areas with little change in the theoretical discussions. The principal changes include a discussion of many of the latest and more advanced applications, the use of gas-solid chromatography for characterizing catalyst surfaces, isotope separation and as a highly sensitive detection device and the extension of previous concepts to the case of columns with a very large number of theoretical plates. In addition all of the material of the first edition has been brought up to date.

As in the first edition the writing is extremely clear and concise and the ideas are well developed. This second edition should prove as valuable to workers in the field of gas chromatography as did the previous edition.

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**Fuel Cells.** A Symposium held by the Gas and Fuel Division of the American Chemical Society at the 136th National Meeting in Atlantic City. Edited by G. J. Young, Alfred University, Alfred, New York. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1960. v + 154 pp. 16 × 23.5 cm. Price, \$5.75.

This excellent book should be considered as required reading for all those concerned about fuel cells.

The introduction by H. A. Liebhafsky and D. L. Douglas and the articles entitled "The Hydrogen-Oxygen Fuel Cell With Carbon Electrodes" by K. Kordesch, "High-Temperature Fuel Cells" by G. H. J. Broers and J. A. A. Ketelaar and "Carbonaceous Fuel Cells" by H. H. Chambers and A. D. S. Tantram are especially fine and lead quickly to a fundamental understanding of the subject.

The other articles are: "Catalysis of Fuel-Cell Electrode Reactions" by G. J. Young and R. B. Rozelle, "Electrode Kinetics of Low-Temperature Hydrogen-Oxygen Fuel Cells" by L. G. Austin, "The High-Pressure Hydrogen-Oxygen Fuel Cell" by F. T. Bacon, "Nature of the Electrode Processes in Fuel Gas Cells" by E. Gorin and H. L. Recht and "Molten Alkali Carbonate Cells With Gas-Diffusion Electrodes" by D. L. Douglas.

All the authors agree that hydrogen is the ideal fuel and that methane is not well suited for use in fuel cells. However, the use of catalytic converters to produce H<sub>2</sub> and CO from hydrocarbons looks promising.

Since oxygen in air is the most readily available oxidant on earth and does not function well in acid, all the articles pertain mostly to fuel cells with alkaline electrolytes. When halogens are used as oxidants in acid, higher voltages and current densities can be obtained, but the energy output per unit weight of combined fuel is less because of the lower equivalent weight of oxygen.

Fuel cells appear well suited to special applications where large amounts of electrical energy are required over longer periods than can be supplied by conventional batteries. However, fuel cells do not look promising for use in central power stations, although there may be an occasional large scale installation for which cost is secondary.

It is emphasized that fuel cell efficiencies can be misleading since over-all efficiencies of 90% or more usually pertain to operating conditions where current densities are so low as to be impractical for many purposes. Low capital investment, long life and low upkeep are particularly uncertain today for large fuel cells.

Significant improvement in fuel cells appears to await much additional basic research regarding (1) the mechanisms of electrode reactions, (2) the role of catalysts in electrode reactions and (3) energy and charge transfer processes in liquid and solid systems and across membranes. Some applicable basic research may have been done in connection with the development of conventional alkaline batteries.

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