cally written, the list of contributors is a distinguished one, and it is likely that most physical chemists will find at least one of the contributions to be of interest and value.

The text, which is reproduced by an offset process, does not make a good appearance, but it is quite legible and the reproduction of the figures is good. The reviewer is not convinced that this book will be a permanently valuable work of reference and believes that it might have been more suitably published in soft covers with greater dispatch and at a considerably lower price.

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Advances in Catalysis and Related Subjects. Volume XII. Edited by D. D. ELEY, Nottingham, England, P. W. SELWOOD, Evanston, Illinois, and PAUL B. WEISZ, Paulsboro, New Jersey. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. x + 324 pp. 16 × 23.5 cm. Price, $11.00.

This volume includes six reviews: 1. The Wave Mechanics of the Surface Bond in Chemisorption, T. B. Grimley; 2. Magnetic Resonance Techniques in Catalytic Research, D. E. O'Reilly; 3. Base-Catalyzed Reactions of Hydrocarbons, Herman Pines and Luke A. Schaap; 4. The Use of X-ray K-Absorption Edges in the Study of Catalytically Active Solids, Robert A. Van Nordstrand; 5. The Electron Theory of Catalysis on Semiconductors, Th. Wolkenstein; 6. Molecular Specificity in Physical Adsorption, D. J. C. Yates.

Only a handful of aging chemists share this reviewer's memories of the remote era in which chemical bonds were described in pre-quantum mechanical language. Progress is always not merely painful, but painfully slow. The gay hope that all chemistry would flow without effort from the solution of wave equations has been utterly shattered, and there is no indication that the fastest computers now contemplated can put it together again. Even as a language, quantum mechanics brought no easy millenium. Lewis was able to express profound truth without it, as Kekulé had done long before; yet other distinguished chemists have always been able to write complete nonsense about chemical bonds in the most advanced language available to them. No one would consider that these qualifications contradict the transcendent importance of wave mechanics in shaping our concept of the chemical bond.

The application of quantum mechanics to the electronic structure of semiconductors has now reached a stage where it can contribute importantly to the understanding of many phenomena in catalysis by solids. Chemists will not learn this new language easily. They are handicapped not only by its intrinsic difficulty, but by the absence of cases in which simple, familiar statements can be translated into the new language. In these circumstances, all catalytic chemists should welcome the review by Grimley of Liverpool, and especially that by Wolkenstein of Moscow, who has played a major role in these developments. I shall make no attempt here to provide an easy two-sentence summary. It is my function merely to urge your attention.

Pines and Schaap have written a brief but fascinating account of a new chapter in hydrocarbon chemistry. These things could have been done fifty years ago, somewhat more painfully for the lack of modern analytical techniques. I have no doubt that fifty years from now this kind of work will still be rewarding. The frontiers are not all on the moon.

The other three reviews share the common characteristic that I could learn nothing by reading them at home in the absence of a complete scholarly library, which is the only reading opportunity I have. The problem is illustrated by the Yates review, in which the first half rests squarely on the concept that solids have a surface *tension*, an actual force which resists stretching of the surface, which is numerically distinct from the surface energy. I do not believe this. I consulted the reference to Gibbs, and found it irrelevant. The other references I could not consult, and the review contained no hint of their content. I may well be wrong in this matter, and some reader of these remarks may take the trouble to enlighten me. I expect, however, that a review will educate me directly, and not by such a devious and ironical process.

These remarks lay on my desk for days while I struggled with the feeling that they missed the real point. It comes to me now, from Isak Dinesen's "Out of Africa." You cannot capture the colors, she found, by shooting the Iguana. "It was the live impetuous blood pulsating within the animal, which had radiated out all that glow and splendor." And so you cannot, I believe, capture the spirit of a catalyst in magnetic resonance or absorption edges. Grimley, Pines and Wolkenstein, in their diverse ways, have dealt with live impetuous catalysts, and the other reviewers, however skillfully, with gray corpses.

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Advances in Enzymology and Related Subjects of Biochemistry. Volume XXII. Edited by F. F. NORD, Fordham University, New York, N. Y. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1960. v + 567 pp. 16.5 × 23.5 cm. Price, $14.00.

"Advances in Enzymology" has long been established as a standard biochemical reference, and as a series has maintained a broad coverage of subjects of biochemical interest by means of authoritative articles. The present volume is a tribute to the editor, who has succeeded again in organizing a work of significance to workers and students in many areas of current activity. The range of topics extends from biologically-oriented articles on Genetic Control of Enzyme Activity (Fincham) and Induced Synthesis of Proteins (Halvorson) through descriptive biochemistry, including Synthesis and Hydrolysis of Sulfate Esters (Roy), Biosynthesis of Cholesterol (Popják and Cornforth) and Biochemistry of Sulfonium Compounds (Shapiro and Schlenk), to theoretical analysis of The Active Site and Enzyme Action (Koshland) and Coenzyme Binding (Shifrin and Kaplan) and also includes a non-enzymatic description of Synthesis of Nucleotide Coenzymes (Baddiley and Hughes) and an article on the technique of Column Chromatography of Enzymes (Turba).

The variation in subject matter is accompanied by differences in the state of development of the topics considered, and these differences are reflected in the manners in which the authors have treated their articles. The two discussions by Fincham and Halvorson consider two aspects of the question of protein synthesis. The intimate relation between gene and enzyme has been clearly established in the numerous examples cited by Fincham of single mutations causing modifications of the properties of individual enzymes. These studies demonstrate the mutual contributions of genetics and enzymology. The expression of gene action through qualitative and quantitative changes in enzymes is seen as a major (if not exclusive) property of mutations, and one that is increasingly susceptible of analysis. The altered enzymes and the components of enzymes obtained from appropriate mutant organisms offer novel materials for studying the relationship between enzyme structure and function. Halvorson's discussion of enzyme induction considers this phenomenon only in microörganisms, but the wealth of material available from this source permits a very complete analysis of the properties of induction and the current hypotheses of protein synthesis. These two articles are excellent summaries of very active fields of research. Both are organized to illuminate the questions that are of great interest at this time; they both summarize the literature thoroughly and carefully distinguish between observations and hypothesis.

The articles on sulfate esters and sulfonium compounds are comprehensive reviews of these aspects of sulfur biochemistry. They are unsatisfying only to the extent that they treat subjects that have not been cleared up adequately. The recent demonstrations of sulfate activation and transfer and the pluripotential properties of active methionine offer hope that some of the other reactions mentioned in these articles may be the subjects of successful investigation: that enzymes will be obtained in purer form, that anomalous kinetics will be explained, and that over-all conversions will be resolved into discrete enzymatic reactions. The elucidation of the biosynthesis of cholesterol is one of the dramatic developments of recent years, and the review by Popják and Cornforth, both major contributors to this development, beautifully outlines the evolution of the problem and de-

scribes the properties of the individual reactions. While several questions and hypotheses are presented, the accomplishments of the last three years, especially those of the authors, Bloch, Lynen and their asssociates in describing the reactions of mevalonic acid, the isoprenyl pyrophosphates and squalene, justify the optimism of the authors in predicting rapid progress in revealing the obscure portions of the picture.

Koshland's discussion of the active site of enzymes is necessarily preliminary and speculative. The justification for reviewing this subject is contained in the summary, which metaphorically proclaims the availability of methods for elucidating enzyme structure and function. The compilation of suggestive information about numerous enzymes is organized to show systematically the sorts of information that can be obtained by a large variety of techniques. Since no single enzyme has been analyzed sufficiently to permit a description of its catalytic properties in terms of its structure, it is to be hoped that future work will combine and extend the approaches outlined and that subsequent reviews may describe how specific enzymes do work.

Coenzyme binding, an essential component of studies on reactive sites for a prominent group of enzymes, is described in comprehensive detail by Shifrin and Kaplan, but no generalizations are drawn and little attempt is made to evaluate critically various findings. This article reports the properties of many individual enzymes, primarily those that use pyridine nucleotides, but also those that use flavines, pyridoxal phosphate and thiamine pyrophosphate.

The synthesis of nucleotide coenzymes defines the principles involved in forming phosphate derivatives. Essentially all of the naturally occurring small nucleotides have been synthesized, along with many analogs. The properties of acid anhydrides, carbodiimides and phosphoramidates are discussed, and numerous examples of their uses are described. Column chromatography of enzymes is discussed in an article that makes a gallant attempt to produce a theory without mathematics. Unfortunately, our dependence on incompletely understood resins and completely undefined proteins would seem to offer little hope at this time for a useful theory even with mathematics. A large number of examples of chromatograms of various enzymes is included, but the prospect seems unfortunately clear that the separation of individual enzymes from other proteins will remain empirical.

There are many functions to be served by review articles. All of those included in this volume will be valuable to those seeking a compilation of literature on the topics included. Of the articles on enzymatic subjects three are especially noteworthy in that they do more for the reader. The review on cholesterol biosynthesis presents a coherent picture that orients those outside the field and clearly indicates the problems of current interest. The two articles on genetics and enzyme induction similarly make the questions being investigated today not only comprehensible, but exciting to the general reader as well as the expert. These articles and the optimistic approach to the question of active sites are certain to provoke experiments, which alone would justify the publication of this interesting volume.

LABORATORY OF BIOCHEMISTRY
NATIONAL INSTITUTE OF DENTAL RESEARCH
NATIONAL INSTITUTES OF HEALTH ALAN H. MEHLER
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Annual Review of Physical Chemistry. Volume 11. H. EYRING, Editor, University of Utah, C. J. CHRISTENSEN, Associate Editor, University of Utah, and H. S. JOHNSTON, Associate Editor, University of California. Annual Reviews, Inc., Palo Alto, California. 1960. vii + 588 pp. 16 × 22.5 cm. Price, $7.00 (U.S.A.); $7.50 (elsewhere).

Volume 11 of this valuable series includes 21 chapters contributed by 31 authors. Almost uniformly the authors have reviewed articles available to them through some time in December, 1959. The *Annual Review of Physical Chemistry* is truly annual. Sixteen of the chapters deal with topics or some phase of topics which have been reviewed annually in this series for four to ten years. Of 4201 references only some 830 were published prior to 1958, and over 60% of these occur in the remaining 5 chapters. Two of these cover subjects never before reviewed in this series, namely, dielectric polarization and fused salts. The topics of the other three chapters, the statistical theory of transport, combustion and flames, and photosynthesis, have not been covered for a number of years. The chapters on fused salts and combustion and flames reflect the current lively interest in high temperature chemistry. The chapter on aspects of the statistical theory of transport, dedicated to the late John G. Kirkwood, is a short monograph.

It is no reflection on the importance of the subject, or the competence of the survey of such subjects as are reviewed annually, to say that one finds the chapters dealing with initial treatments and less frequent treatment of subjects more rewarding. While the rather strictly 'annual" reviews of fields in which the number of contributions is large may serve the specialist already at home in the field largely as a check against careless oversight, they are valuable to the many others who have only secondary interests in these fields, and to the young research worker beginning his special interest.

The authors are generally very helpful in pointing out other reviews and monographs, as well as limitations on coverage under which their chapters have been written.

A special feature of the current volume is the cumulative index by author and by chapter title of the first eleven volumes of the series. The 237 articles are listed by chapter titles under 42 subjects. Though there are significant variations in the areas covered by articles under the same subject, it may be noted that 20 of the subjects have been reviewed 6 to 11 times. This index is extremely valuable, for with it one may make much more efficient use of the set as a whole. The editors, the late Gerhard K. Rollefson and Henry Eyring, and their editoral boards deserve our thanks and praise for the skill and devotion with which they have nurtured this well-planned and useful project.

The price is reasonable and should encourage those who have an interest in physical chemistry to become regular purchasers.

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Inorganic Syntheses. Volume VI. Editor-in-Chief, EUGENE G. ROCHOW, Harvard University. McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y. 1960 xi + 272 pp. 16 × 23.5 cm. Price, $7.75.

Volume VI of "Inorganic Syntheses" follows the same general pattern as previous volumes. Each synthesis is an individual entity including a brief historical introduction, the procedure, a general description of the properties of the compound and a bibliography. All procedures have been independently checked in a laboratory other than the one from which submitted.

There are several novel features in this volume which are worthy of mention. There is an increase in the number of contributors from abroad indicating increased international prestige for this series. All foreign articles have been translated into English. Articles on the synthesis of sulfur nitrogen compounds by Professor Goehring, and dibenzenechromium by Professor E. O. Fischer are included. In addition, there are contributors from India, Poland, Austria, England, Australia, etc.

A most welcomed inovation are the procedures submitted by F. P. Dwyer, *et al.*, on the resolution of several optically active complexes. A partial asymmetric synthesis also is included.

The syntheses of deuterio compounds have been included for the first time and it is hoped that more isotopic syntheses will be forthcoming in view of the many research applications of these materials.

A general discussion on the syntheses of halomethyl derivatives of silicon, germanium and tin by using diazomethane is very well written and quite informative. Several procedures for synthesizing compounds which are currently popular are also included, *e.g.*, S_4N_4, $Ni(PCl_3)_4$, $[PNCl_2]_3$, $[PNCl_2]_4$, $TiCl_3$, dibenzenechromium and magnesium cyclopentadienide.

As in past volumes, there also appear in Volume VI several procedures in the area of metal ion complexes that are obvious. What is needed in this area is a set of general procedures applicable to the synthesis of most complexes.