of product functions of given symmetry from elementary functions of fixed symmetry." Well, now his prayers have been answered. John S. Griffith has admirably outlined the theory of coupling and recoupling coefficients for groups of finite symmetry and tabulated their values in his handsomely bound book on "The Irreducible Tensor Method for Molecular Symmetry Groups."

During the past few years a number of books have appeared on the market dealing with irreducible tensorial methods in quantum mechanics from one viewpoint or another.[1-3] These have been a welcome addition to the literature as they have given substance to the older matrix manipulation treatments of tensorial operators.[4,5] However, all these books have dealt with systems of spherical symmetry solely, and thus the adoption by molecular quantum mechanicians of the elegant mathematical techniques advocated by these texts has been delayed. Griffith's book should remove this delay with its excellent transcription and exposition of the method of irreducible tensorial sets for non-spherical geometries. It is to be cautioned though that his book is definitely not for beginners: it is addressed to the advanced worker in the field of quantum chemical physics and should be read in conjunction with his fine book on the theory of transition metal ions[6] for greatest gain.

It is a pity that Griffith did not expand his brief treatment of the irreducible tensor method for molecular symmetry groups. Because of its brevity, the book is extremely difficult to follow in a number of places. A more detailed and extensive list of applications is also sorely missed. On the brighter side of things, there are given a number of delightfully elegant derivations of familiar quantities which should please most readers (*e.g.*, the derivation of the spin Hamiltonian for paramagnetic systems) and the organization of the book is wondrous. (The publishers are to be warmly congratulated for the attractive appearance of the book. Their forethought as to its paginal pattern makes the book easy on the eye and a ready reference text. The book's price is a little steep, though.) All in all, J. S. Griffith's book is well worth buying and reading.

(1) M. E. Rose, "Multipole Fields," John Wiley & Sons, Inc., New York, N. Y., 1955; "Elementary Theory of Angular Momentum," John Wiley & Sons, Inc., New York, N. Y., 1957.

(2) A. R. Edmonds, "Angular Momentum in Quantum Mechanics," Princeton University Press, Princeton, N. J., 1957.

(3) U. Fano and G. Racah, "Irreducible Tensorial Sets," Academic Press, Inc., New York, N. Y., 1959.

(4) E. U. Condon and G. H. Shortley, "The Theory of Atomic Spectra," Cambridge University Press, Cambridge, Eng., 1953.

(5) E. Feenberg and G. E. Pake, "Notes on the Quantum Theory of Angular Momentum," Addison-Wesley, Cambridge, Mass., 1953.

(6) J. S. Griffith, "The Theory of Transition-Metal Ions," Cambridge University Press, Cambridge, Eng., 1961.

THEORETICAL CHEMISTRY
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**Experimental Cryophysics.** Edited by F. E. HOARE, Reader in Physics, University of Leeds; L. C. JACKSON, Professor of Physics, Royal Military College, Kingston, Ontario, Canada; and N. KURTI, Reader in Physics, University of Oxford, Senior Research Fellow, Brasenose College, Oxford. Butterworth Inc., 7235 Wisconsin Avenue, Washington 14, D. C. 1961. xv + 388 pp. 16 × 25 cm. Price, $14.00.

In three hundred and seventy-four pages this coöperative treatise contains an excellent summary of low temperature techniques including the liquefaction of air, hydrogen and helium. It is therefore, natural that there should have been some omissions. Notable among these is the absence of *any* discussion of the theory of the liquid air fractionating column although there is a brief description of fractionating columns for liquid air including the Linde double column (without discussions of tray design or packing materials).

There is no special section on cryostats which this reviewer thinks regrettable, although several types of cryostats are discussed in the different chapters.

The ten chapters along with their authors are listed below: (1) Low Temperature Laboratories and (2) The Mathematics of Gas Liquefaction and Liquefier Design, both by F. E. Hoare; (3) Liquid Air Production and (4) The Production of Liquid Hydrogen and Helium, both by D. H. Parkinson; (5) Ancillary Equipment for the Production of Liquid Hydrogen and Liquid Helium (the dictionary reveals that the leading adjective means subordinate, subservient, auxilliary) and (6) Materials and Methods for the Construction of Low Temperature Apparatus, A. J. Croft; (7) Storage and Transfer of Liquefied Gases by the late A. Wexler; (8) Magnetic Cooling by E. Mendoza; (9) Low Temperature Thermometry by R. P. Hudson; (10) Cryogenic Techniques and Miscellaneous Applications by E. R. Dobbs, L. W. Alvarez, R. W. Hill T. H. Blewitt, R. R. Coltman, Darrell W. Osborne, L. C. Jackson, D. M. S. Bagguley, J. Given, L. Couture, K. V. Osborne, R. Berman, E. R. Dobbs, H. M. Rosenberg.

There are twenty-five appendices including data on thermal conductivities, densities, viscosities, enthalpies and entropies of oxygen, nitrogen, hydrogen and helium as well as a table of Debye heat capacities and energies and some heat capacities of selected elements. That the appendix includes the 1958 Helium (vapor pressure) Temperature Scale (seven pages) will recommend the book to many. In addition there are vapor pressure–temperature tables for helium 3 ($^3$He), hydrogen (normal and equilibrium, liquid and solid), nitrogen and oxygen.

The chapters by F. E. Hoare (liquefier design), the late A. Wexler (storage and transfer), R. P. Hudson (thermometry) and E. Mendoza (magnetic cooling) are outstanding. There is an interesting section on the use of $^3$He (Darrell W. Osborne) and useful information on construction and silvering of dewars and on vacuum tight seals, etc., by Croft, who wrong lyimplies that the Schriver electrolytic cells for hydrogen require a low voltage. These cells are of the filter press type in series so that they operate on 120 volts.

The editors of this volume are to be congratulated on the results of their efforts to produce an integrated and modern treatise.

LOW TEMPERATURE LABORATORY
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**Mechanism of Action of Steroid Hormones. Proceedings of the Conference held at Endicott House, Dedham, Massachusetts.** Edited by CLAUDE A. VILLEE and LEWIS L. ENGEL, Harvard Medical School, Boston, Massachusetts. Pergamon Press Ltd., Headington Hill Hall, Oxford, England. 1961. xi + 263 pp. 16 × 23.5 cm. Price, $10.00.

Presently, there is a great deal of interest among biologists and biochemists in the problem of the regulation and integration of biochemical processes. Originally, ideas about biological regulation came from physiological studies on higher organisms which indicated the necessity for the maintenance of a constant internal environment. More recently, the behavior of microörganisms has provided relatively simpler systems for the study of the molecular basis of such regulatory phenomena. At the present time, however, even in bacteria, the mechanism of the most basic of such processes, enzyme induction, is barely understood.

The steroid hormones are a diverse group of molecules that influence a number of biological processes in higher organisms. It is, therefore, not surprising that the molecular bases for their actions are at the moment almost totally mysterious.

The readers of the volume reviewed herewith will therefore find only how a number of experienced investigators are attempting to deal with the problem, rather than, as suggested by the title, a final answer.

The two introductory chapters, the first by Engel and the second by Villee, discuss some general problems involved in studying hormone action. Each author indicated that steroids may be thought of as interacting with protein molecules, or as altering the physical state of cell membranes or intercellular boundaries or in a combination of such ways. Villee also adds the possiblity that steroids act by regulating rates of protein synthesis.

In the article by Topper on the effects of progesterone on the enzymic oxidation of galactose, there are several very interesting points. For example, it is shown that the *inhibition* of a particular enzyme (an aldehyde dehydrogenase) results in *stimulation* of another metabolic process, galactose oxidation, because a product of the former reaction inhibits the latter. Studies on the aldehyde dehydrogenase itself indicate that certain hormones stimulate the enzyme while others inhibit its action which illustrates a kind of specificity not previously demonstrated in *in vitro* systems.

The article by Csapo on *in vivo* and *in vitro* effects of estrogen and progesterone on the myometrium clearly illustrates the difficulties in trying to explain physiological phenomena in terms of the effects of hormones on isolated enzymes. In his presentation, the author compares the actions of steroids on uterine contractility when the hormones are applied locally and when they are injected into the animals prior to removal of the organ. That there are significant differences depending on how the hormones are administered indicates very well how the final total action of a hormone must, in fact, reflect its distribution and metabolism as well as its specific local effect.

The paper by Dorfman on androgen action reviews a number of cases where steroid hormones have acted as enzyme inducers and the author proposes that hormones may operate at the level of enzyme induction or repression. These generalizations are documented in the report by Fishman, who discusses the increase in renal $\beta$-glucuronidase concentration after administration of testosterone to animals.

In the paper by Hagerman and Villee entitled "A Mechanism of Action for Estrogenic Steroid Hormones," the authors outline their well known work on the stimulation of pyridine nucleotide transhydrogenase by estrogens. Although the mechanism of the stimulation is unknown, Hagerman and Villee suggest that activation of transhydrogenase in the uterus is sufficient to account for the increase in metabolic activity of the uterus following estrogen administration. Unfortunately, there is no critical comparison of their results with those of Talalay, which differ in certain important respects from the Hagerman–Villee interpretation.

Following this paper, there are some interesting remarks by Mueller on the role of protein synthesis in estrogen action. He reports that pretreatment of animals with puromycin, an inhibitor of protein synthesis, prevents any response to estrogen administration and, therefore, suggests that stimulation of protein synthesis is the primary event in estrogen action. Whether this viewpoint is in conflict with that of Hagerman and Villee is not clear at the moment. However, the approach seems both interesting and fruitful.

The chapter entitled "Structure and Chemical Reactivity in the Steroids" by Turner reviews certain recent developments in steroid chemistry which he feels are not sufficiently known to investigators interested in biochemical or clinical subjects; such as the control by stereoelectronic or kinetic factors of the course of a given transformation. He also reviews some of the recent work of Barton indicating that minor structural alterations at sites on the steroid nucleus apparently remote from a given site of reaction can be transmitted through the fused ring system of the nucleus and can thus influence the course of the reaction. For the moment this discussion does not appear to be strictly relevent to the problem of the biological action of the steroids, but, of course, this judgment is subject to revision at any moment. Almost the same thing could be said of the discussion by Ringold concerning the effects of chemical modifications of the steroid molecule on biological activity of the hormones. Since many factors probably go into the biological activity of a given steroid, it is difficult to say which chemical alterations affect its local activity and which, for example, change its localization and distribution.

In his concluding remarks, Stetten calls attention to this difficulty in the interpretation of structure–function relations.

Perhaps because more fundamental problems of biological regulation are not yet solved, the actions of steroids, a special class of regulators, cannot be considered in a completely satisfactory way. Despite this, this book seems quite worthwhile as indicating the approaches that are being taken.

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**Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Chrom. Teil A-Lieferung 1. Geschichtliches. Vorkommer. Technologie. Element bis Physikalische Eigenschaften. System-Nummer 52.** Herausgegeben vom Gmelin-Institut. Begonnen von R. J. MEYER. Fortgeführt von E. ERICH PIETSCH. Stellvertretender Hauptredakteur, Alfons Kotowski. Verlag Chemie, G.m.b.H., Pappelallee 3, Weinheim/Bergstr., Germany. 1962. xx + 418 pp. 18 × 25.5 cm. Price, DM. 316.–.

Anyone who has attempted to make a complete literature survey on even a small chemical topic knows what a difficult, time-consuming and frustrating experience it can be, and can well imagine the enormity of the task which confronts the editorial staff of Gmelins Handbuch in their attempt to make a complete survey of the literature of inorganic chemistry. It is no wonder that the volumes in this series are expensive, and that, even though this book bears a 1962 imprint, the literature references in it are complete only through 1949. It is true that some references of later date (even up to 1961) are included, but they are a small minority, and for the most part are in the lists of general references with which each main section begins. The few specific references of recent date do not seem to follow a pattern—one gets the impression that the editors included those which they found during their search for earlier references. Even though the list of recent publications is incomplete, it will be of considerable value.

This volume is not a revision or a supplement to an earlier volume on chromium, for the previous edition of Gmelin did not include a description of that element. The work described here, therefore, includes the very earliest references to chromium. It covers the history and occurrence of chromium, the technology and toxicity of the element and its inorganic compounds, and the physical properties of the metal. The section on occurrence fills nearly one-half the book and that on physical properties, almost one-third. Very little mention is made of the solution chemistry of chromium compounds except that which is involved in metallurgical processes or in the chemistry of such technically important materials as pigments, leather tanning agents, and plating baths. The more "academic" chemistry of chromium compounds will, of course, be discussed in Part B.

An interesting and convenient (but hardly necessary) innovation in the recent volumes of Gmelin is the inclusion of marginal headings and a table of contents in English.

This volume represents a valuable addition to the literature of inorganic chemistry, and joins the rest of the Gmelin series as an essential part of every chemical library.

DEPARTMENT OF CHEMISTRY
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**An Introduction to the Biochemistry of the Cancer Cell.** By HARRIS BUSCH, College of Medicine, Baylor University, Houston, Texas. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1962. xiv + 424 pp. 15.5 × 23.5 cm. Price, $13.50.

The last comprehensive treatment of the biochemistry of cancer is the monograph by Greenstein published in 1953. The tremendous advances in biochemistry and the upsurge in the volume and scope of cancer research during the past decade make a book on the biochemistry of cancer not only timely but necessary. For these very reasons, however, prospective authors have shied away from the formidable task of updating Greenstein, an undertaking probably now beyond the capability of a single author. Busch wisely has not attempted this, but instead has written a relatively small volume of 424 pages in which he has chosen for review only those areas of major interest. To this reviewer, the selection of material has been excellent and admirably fulfills the author's aim of introducing his readers to those areas of biochemical research that offer particular promise and interest to most workers in the field.

The choice of topics clearly reveals the many changes that are occurring in the direction of the thoughts and ideas of researchers in the biochemistry of cancer. In the second edition of Greenstein's "Biochemistry of Cancer," nucleic acids were hardly mentioned. Today, with the general acceptance of the concept of cancer as a mutation, the problems of DNA and RNA structure and their role in protein synthesis are in the forefront of the cancer problem. In keeping with contemporary trends, over half of this book is devoted to these and related topics. In Part I, "The Genotype of Neoplastic Cells," the author first develops the currently accepted view of the neoplastic transformation as an alteration in the hereditary apparatus, and follows with a general description of the significance of DNA as the master substance in the transmission of genetic formation. In subsequent chapters the chemical structure, synthesis, breakdown and the various transformations of DNA and RNA are broadly covered, and the immediate relevance of these processes to the chemical treatment of cancer is delineated in a brief chapter on the inhibition of nucleic acid synthesis as an approach to cancer therapy. The final chapter of this section covers possible mechanisms of chemical and viral carcinogenesis. It is here that the excitement of imminent discovery makes itself felt, through the conception that some common transformations of DNA may underly the action of the three known classes of carcinogens, namely, viruses, radiation and chemicals.

The second section, termed "Some Aspects of the Phenotype of Cancer Cells" covers the more traditional ground of the cancer biochemist. Here he covers those familiar problems with which biochemists have been grappling unsuccessfully for many years. The first chapter describes the long-standing, peculiar observation that the activity of the enzyme catalase is depressed in the liver of tumor-bearing animals, and describes the possible role in this phenomenon of a mysterious entity known as "toxohormone," which is presumed to be produced by cancer cells. In subsequent chapters there are discussed the elaboration of abnormal proteins by neoplastic plasma cells; the formation of mucoproteins and their occurrence in abnormal quantities in the blood of cancer patients; and a brief discussion on neoplastic cell antigens and related immunologic problems. The remainder of this section is devoted to one of the traditionally controversial areas of cancer biochemistry, namely the significance of the high glycolysis of tumor cells, and related problems of carbohydrate metabolism.

Throughout the book, the author's own studies are given prominence. One of these which is particularly interesting is the discovery of a nuclear protein, RP2-L, claimed to be unique to cancer tissues.

Despite its small size this volume contains a wealth of interesting information, logically and lucidly presented with the aid of numerous charts, graphs and illustrations. An up-to-date bibliography at the end of each chapter enhances its value for reference purposes.

The book will be of particular value as a reference work to biochemists actively engaged in cancer research, and it would