in the equations of the earlier work, effects an esthetic improvement by favoring neither component of a binary mixture in applying corresponding states; his reference substance is a defined equimolal hybrid of the two pure components, so that the resulting equations are both simpler and completely symmetrical. From the final confrontation of theory with experiment, one sees clearly why more experimental data on mixtures of the simplest molecules are imperative and now actively being obtained, and also that the old ignorance about forces between unlike molecules is still very much with us.

As might be guessed, the thermodynamic symbols used are U, H, F, G. By now we have no trouble in reading that language, but it is much harder to get used to the inflationary though legitimate joule as the energy unit. The reader will find that Rowlinson has adopted yet another definition of "regular solution," a harmless pastime which can be expected to infuriate certain of his predecessors. He will also find the inevitable boner in a footnote on page 6, but he will perhaps be surprised to find almost nothing about volume fractions as concentration units, for the author argues that they are rarely worth the trouble. The reader may also feel that inordinate amounts of history and priority have been ignored.

This book could well be used in a graduate course, although one would skip over some of the compilatory sections. As a reference work, it is highly recommended to both research scientists and engineers whose basic thermodynamics and statistical mechanics have been previously acquired and not allowed to rust very long. In no other single volume can they find such an authoritative and well-balanced account of the present experimental and theoretical state of this perpetual part of chemistry.

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X-Ray Metallography. By A. TAYLOR, Advisory Physicist, Westinghouse Research Laboratories, Pittsburgh, Pennsylvania. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1961. vii + 993 pp. 16 × 23 cm. Price, $27.00.

If anyone has the slightest doubt of the spectacular growth of X-ray science in all branches, and of X-ray metallography in particular, he has only to compare Taylor's 1961 version (written in Pittsburgh) with his introductory text (written in England) published about 15 years ago. Both were written with the same objectives of providing the metallurgist an appreciation of X-ray methods as they apply to his particular field of work, in a book which "can be studied without prior knowledge of the subject, and particularly directed to the student reading for a degree and to research workers in university and industrial laboratories."

It is a tribute to this eminent authority that so much material is contained in about a thousand pages which might well have required several volumes. With a characteristically clear, conversational style, even the novice will find reading of descriptive matter surprisingly effortless, interesting and genuinely rewarding. There are, of course, some chapters presenting rigorous mathematical derivations, essential to the X-ray diffraction process, which will be tough going and discouraging for those "without prior knowledge of the subject" for whom the book is intended; but at least an incentive is provided for intensive further study. Instead of compromising by "writing down" to his readers, the author indeed sets a high standard for them. If they are to become able research X-ray metallographers, not just technicians, they see here clearly what mastery of the science entails.

The order of topics, upon which there might be a considerable divergence of opinion by readers and by experts, depending upon their specific backgrounds and interests, is briefly as follows: scope and history of X-ray metallography; generation and absorption of X-rays; radiography, microradiography and X-ray microscopy in general; external and internal symmetry of crystals; diffraction of X-rays by a simple primitive lattice; experimental diffraction methods; X-ray tubes; intensities of X-ray reflections; crystal structures of elements; thermal equilibrium (phase-rule) diagrams; crystal chemistry of alloys; precipitation hardening, complex alloys and steels; orientation textures; size and perfection of grains; internal stresses in metals and alloys; chemical analysis by X-ray procedures; applications to refractory materials, oxides and corrosion products. A hundred-page appendix presents in condensed form useful tables and information on techniques, and there are many tables closely related to the text throughout the volume.

What, then, are the distinctive qualities of this contribution? In the unreserved opinion of this reviewer, after 40 years of experience in the general field, this is the most complete coverage of X-ray science, in fundamental aspects as well as in metallurgical, chemical, physical and engineering applications, ever accomplished in a single volume by a single author. A check on 1959–1960 developments (such as the Lang diffraction-microradiograph technique, p. 766; the Land-Polaroid instantly-developed X-ray film; new findings in neutron radiography, etc.) reveals that the author has kept abreast of progress. Beyond any doubt this is the most completely documented manuscript ever published in this field, for the Bibliography at the end of each chapter is truly complete and accurate. While inevitably some topics are more adequately treated than others, perhaps because of space limitations, the admiration of the reviewer grew page by page during reading of long familiar subject matter. Especially masterly in treatment were such items as the powder diffraction method in general (of course of principal interest in metallurgy), the design (by the author) of high-intensity rotating-target X-ray diffraction tubes, order-disorder phenomena in alloys, dislocations, analysis of ternary and more complex alloys, the martensite phase in steels, evaluation of texture by pole figures, grain sizes and internal stresses. Oversights or omissions in such a wealth of material are surprisingly few. There is no mention of the rad, the unit of dosage which is largely displacing the older roentgen; or the Buerger precession goniometer. Though briefly mentioned in several places there is a feeling that the concept and usefulness of the reciprocal lattice are slighted while some other features, especially mathematical, are overweighted.

The book is well printed with only 4 minor errors noted, and the 416 figures are clear and useful. The 27-dollar price, almost prohibitive for the "student reading for a degree," makes one wonder when will these spiraling costs of books level off. Suffice it to say, however, to the author—well done and a genuine service to science. Chemists who read this evaluation will find this book just as applicable and useful and challenging as will the metallographers.

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Cahiers de Synthèse Organique. Méthodes et Tableaux d'Application. Volume VI. Rearrangement et Migration. By JEAN MATHIEU and ANDRÉ ALLAIS. Published under the direction of Lèon Velluz. Masson et Cie., 120 Boulevard Saint-Germain, Paris 6, France. 1960. 417 pp. 15.5 × 22 cm. Price, 120 NF.

Of the 417 pages in this volume, 276 are devoted to an up-to-1959 review of contributions related to rearrangements and isomerizations. The selection is largely from the area of synthetic organic chemistry and appears reasonably comprehensive from the point of view of reaction types. References to transformations in the field of natural products are only incidental.

In the manner of the earlier volumes in this series, an attempt is made to codify the various reaction types. Considerable success was achieved judging from a few tests made by the reviewer to locate references to reactions. The review should prove useful to those with only a very rudimentary knowledge of the French language since throughout extensive use in made of the universal language of structural formulas.

The organization of each of the four chapters involves first a synopsis of the coding system with reference to page numbers. This is followed by undocumented sections on principles, mechanisms and application. Thereafter, the above-mentioned reviews are presented. The sections relating to principles are merely brief explanations of the

reaction types outlined in the synopsis, presumably to illustrate further the various types of rearrangements under consideration and serve little purpose. The sections on mechanisms are essentially sterile since with few exceptions no consideration is made of the driving force for the reaction. For example, on page 29, the pinacol rearrangement is formulated to proceed by way of two discrete carbonium ions with no indication of the role played by the oxygen in charge delocalization. The discussion is largely one of "arrowisms" and this with only partial regard for the convention that curled arrows represent the direction of electron flow. That is, in this work, both dotted- and solid-line arrows are used simultaneously, the dotted-line arrows to represent movements of groups or atoms and the solid-line arrows to represent the movements of electrons. Not surprisingly, errors arise from the use of this cumbrous and pedantic mode of presentation (see, for example, the decomposition of the carbonium ion II in the above-mentioned pinacol rearrangement). A further serious deficiency is the basically erroneous approach to conformational analysis wherein the route of the reaction of a conformationally flexible compound is attributed to a conformational property of the compound in the ground state rather than to the relative electronic and conformational properties of the possible transition states involved (see, for example, page 37). This is particularly unfortunate in view of the lack of references to the literature and the didactic style of presentation. The sections on applications present, in a generalized form, lists of the various types of possible transformations without any consideration of either limiting or complicating factors.

Nevertheless, the book is of definite interest to an *advanced* student of organic chemistry who may wish to exercise simultaneously his knowledge of chemical French and of reaction mechanisms (the latter necessarily obtained from a more sophisticated source). The volume can also serve as a useful handbook for a practicing chemist who may wish to check on some of the previous experience related to the type of rearrangement or isomerization at hand. Certainly, the amount of recent chemical literature which has been compressed into this volume renders it a valuable contribution to the chemical literature.

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The Nucleic Acids. Volume III. Edited by ERWIN CHARGAFF, Department of Biochemistry, Columbia University, New York, N.Y., and J. N. DAVIDSON, Department of Biochemistry, University of Glasgow, Glasgow, Scotland. Academic Press Inc., 111 Fifth Avenue, New York 3, N.Y. 1960. xvi + 588 pp. 16 × 23.5 cm. Price, $18.00.

Although knowledge of the chemistry and biological importance of the nucleic acids has made rapid advances since 1955, when the first two volumes of this series were published, the editors have felt that a new edition is not yet justified. They have therefore decided to provide a "diagonal supplement," made up of a selection of chapters which would cut across the systematic arrangement observed in the preceding volumes. The topics chosen for Volume III were those that had not received sufficient emphasis before, or that had acquired particular importance since the publication of Volumes I and II.

The first six chapters, 29 to 34, discuss topics related to Volume I, which dealt with the physical and chemical properties of nucleic acids. Sadron critically reviews the literature on deoxyribonucleic acids as macromolecules, with emphasis on the uncertainties involved in interpreting light scattering, sedimentation and viscosity measurements. Shugar provides a comprehensive discussion of the photochemistry of nucleic acids, and includes a list of reviews on photochemistry and radiation biology. Khorana first deals with the nomenclature of polynucleotides, and then provides excellent discussions of the chemical and enzymic syntheses of ribo- and deoxyribopolynucleotides. The review of the chemistry of the nucleic acids of microörganisms, by Belozersky and Spirin, summarizes an extensive literature, but fails to mention soluble ribonucleic acid. Sinsheimer gives an excellent review of the nucleic acids of the bacterial viruses, discussing unsolved problems as well as present progress. He suggests that "the study of the processes of bacterial virus infection offers a particularly favorable route to analysis of the most basic problems of cellular and genetic biochemistry." An equally fine discussion of viral ribonucleic acids is provided by Schuster, who emphasizes the need for caution in regard to the effects of ribonuclease.

Chapters 35 to 40 are related to Volume II, which dealt with the metabolism, cytology and biological roles of nucleic acids. The biosynthesis of purine nucleotides is reviewed by Buchanan, and that of pyrimidine nucleotides by Crosbie. Two chapters are devoted to protein synthesis. Its relationship to nucleic acid, as revealed by studies in cell-free systems, is critically reviewed by Hoagland, with a much-needed warning, that, in studies of the *in vitro* incorporation of amino acids, "the failure to demonstrate the requirement for an intermediate does not establish its inessentiality." The following chapter, in which Gros discusses the biosynthesis of proteins in intact bacterial cells, is in general agreement with the preceding one; such differences as do appear may be merely differences in rate. Handschumacher and Welch provide a detailed and critical review of chemical agents which influence nucleic acid metabolism, with emphasis on antimetabolites; they stress the need for further study of the physicochemical properties of analogs and their corresponding metabolites, and particularly of the active centers of the enzymes involved. In discussing the effect of radiations on nucleic acid metabolism Lajtha focusses attention on intranuclear triphosphorylation as a highly radiosensitive function, and one on which deoxyribonucleic acid synthesis depends.

In general, these reviews are of high quality. It is difficult to judge their completeness without knowing the dates when they were finished; some authors include 1960 literature, while others have very few references later than 1958. In a field that is changing as rapidly as nucleic acid chemistry, mention of the closing date for each chapter would have added considerably to the value of this fine book.

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Röntgenographische Chemie. Möglichkeiten und Ergebnisse von Unterschungen mit Röntgen- und Elektroneninterferenzen in der Chemie. Zweite, erweiterte Auflage. By DR. E. BRANDENBERGER, Professor an der Eidg. Techn. Hochschule und Direktor der Eidg. Materialprüfungs- und Versuchsanstalt, and DR. W. EPPRECHT, Professor an der Eidg. Techn. Hochschule, Mitarbeiter am Institut für technische Physik. Birkhäuser Verlag, Basel, Switzerland. 1960. 272 pp. 17 × 24.5 cm. Price, sFr. 32.—.

This book, the first edition of which appeared 14 years ago, is not a textbook. Therefore no attempt was made by the authors to explain in detail how to make X-ray, electron or neutron beam interference experiments, or how to evaluate or measure the patterns obtained. The purpose of the book is to show what chemical problems can be solved using the above-mentioned radiations, especially X-rays. According to the authors, the book can also be used in biological research. Examples taken from the wide field of solid state chemistry and physics (including metallurgy and ceramics) are numerous.

The book starts with a very brief description of properties of crystals, and then powder, rotating crystal and Laue-patterns are discussed. Application of electron and neutron rays is mentioned and the advantages of each radiation are emphasized. Pictures of some equipment and of some patterns are shown. The next chapters 3, 4 and 5 deal with amorphous and crystallized substances, transition phenomena, analyses of phases and of mixed crystals, and isotope effects, all in the light of X-rays. The ASTM cards are mentioned. The long chapter 6 (p. 96–159) is devoted to the description of the relation between the shape of the X-ray lines or spots and the interior structure of the crystalline material. Thus, various defects, surface properties, refraction, grain size, preferred orientation, stresses, small angle scattering, stacking faults, determination of crystal shape, the appearance of superlattice lines, orientation effects, line broadening, asterism and structures of crystalline surfaces are discussed in this connection. All material is presented in a qualitative manner, without mentioning a