BOOK REVIEWS

Proceedings of the Rehovoth Conference on Nuclear Structure held at the Weizmann Institute of Science, Rehovoth. September 8–14, 1957. Under the Auspices of the International Union of Pure and Applied Physics (IUPAP). Edited by H. J. LIPKIN. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1958. xvi + 614 pp. 16 × 23 cm. Price, $12.50.

This book contains an essentially complete account of the formal sessions of an international conference on nuclear structure held in Rehovoth, Israel. The main emphasis of the conference was on two fast-moving areas of low energy nuclear physics—nuclear models and parity. In addition to the coverage of these subjects, a fair amount of material concerned with experimental methods related to nuclear structure appears in the proceedings. The main part of the book consists of the texts of the lectures and short contributions presented by the various speakers. In addition, the recorded discussions which followed many of the papers are included; these lend an air of completeness to the book and give the reader an important means for placing many of the papers in their proper perspective.

The papers are arranged according to the nine conference sessions. Each session generally consisted of three or four long lectures of a general nature and several (sometimes ten or more) shorter papers on specific topics relating to the session theme. Since most of the short presentations have since appeared in various journals, the most important contribution of the book stems definitely from the texts of the longer talks, many of which were of a review nature. The outstanding features of the various sessions are as follows:

1. Shell Model Evidence in Nuclei. This session was mainly devoted to considerations of refinements to the simple shell model and the results of various calculations involving these refinements. Outstanding papers are on the foundations of the shell model (R. J. Eden), prediction of nuclear energies by the shell model (I. Talmi), intermediate coupling (D. Kurath), and γ-ray de-excitation in light nuclei (D. A. Bromley).

2. The Unified Model. Features and applications of the collective model are covered in this session. The papers on the description of nuclear spectra in terms of the collective model (B. Mottelson), nuclear spectroscopy in the heavy element region (I. Perlman and F. Asaro), collective effects in light nuclei (D. A. Bromley), unified model applied to fission (L. Wilets), and the foundations of the collective model (R. E. Peierls) are the highlights of this group.

3. Group-Theoretical Methods in Nuclear Spectroscopy. Two very good papers in this session are those by G. Racah and B. H. Flowers. Racah does a superb job of unveiling the meaning of the seniority quantum number and its application to nuclear structure. Flowers presents the results of some attempts to explain collective effects in terms of the shell model.

4. Electromagnetic Transitions and Heavy Nuclei. The important features of this group are papers surveying the data on electromagnetic transitions in light nuclei (D. H. Wilkinson), on the effects of configuration mixing on γ-ray transition probabilities (A. De-Shalit), and on nuclear energy level systematics in the lead region (I. Bergstrom).

5. Effects of the Finite Size of the Nucleus. This is mainly a session on the fine points of the internal-conversion process. There are good reviews of both the theoretical aspects (M. E. Rose) and the experimental problems (A. H. Wapstra).

6. Parity Non-Conservation and β-Decay. This is undoubtedly the most significant section of the book. The papers in this session review the recent parity experiments and reflect on their meaning. This is probably the first time that such a comprehensive survey of this area has appeared in print. The outstanding papers are on the theoretical implications of parity non-conservation (T. D. Lee), the experimental evidence for parity non-conservation (C. S. Wu), the effects of the recent developments on the interpretation of old β-decay data (E. J. Konopinski), the application of angular correlation measurements to this general area (R. M. Steffen), and the experimental problems in measuring beta spectra (L. M. Langer). Of interest to experimenters in this area is the wealth of information on specific experiments contained in many of the shorter contributions. The editor has also added a timely supplement of post-conference developments in this field which puts the section almost up to date.

7. Extra-Nuclear Effects on Angular Correlation. Papers by A. Abragam and by H. Frauenfelder adequately review this field.

8. Instruments of Nuclear Spectroscopy. This session deals mostly with the latest developments in instrumentation. Outstanding are the reviews of developments in magnetic spectrometers and coincidence circuits (T. R. Gerholm) and the bent crystal spectrometer (J. DuMond).

9. The Measurement of Very Short Nuclear Life-Times. The emphasis here is on the newer non-conventional techniques. The highlights are a general review of these techniques (S. Devons), a review of recent developments in nuclear resonance fluorescence (F. R. Metzger), and a paper on the experimental application of recoil shifts to life-time measurements (S. G. Cohen).

There are several reasons why this book will be exceedingly valuable to people with active experimental or theoretical interests in nuclear structure. By eliminating the post-conference editing of the papers, the time-lag inherent in the publication of conference proceedings has been kept to a minimum. This has had the effect of keeping the book fairly well up to date. The papers are generally quite detailed, and they are presented at an advanced level. Although there has been no attempt to summarize the important results of the conference, this shortcoming will be important only to the casual reader of material on nuclear structure.

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING
UNIVERSITY OF ILLINOIS JOHN P. HUMMEL
URBANA, ILLINOIS

Emulsions. Theory and Practice. ACS Monograph No. 135. By PAUL BECHER, Research Chemist, Atlas Powder Co. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1957. ix + 382 pp. 16 × 23.5 cm. Price, $12.50.

In the 382 pages of this ACS Monograph, Becher has done an excellent job of extracting and concentrating the essence of both the theoretical and the technological aspects of the field of emulsions. Obviously the author has demonstrated a penetrating insight into the multiplicity of subjects treated, from the classical definition of emulsions and underlying theory to the chemistry of emulsifying agents and discussion of present day equipment for manufacturing commercial emulsions.

At the outset the author recognizes the difficulty of arriving at even a clear-cut definition of an emulsion as the term is used today, in contrast to the classical one of a dispersion of one immiscible liquid in another, *i.e.*, a disperse system in which both phases are liquid. A rigid adherence to this definition would rule out many commercial formulations such as a paraffin wax emulsion, which at the temperature of formation is a liquid–liquid dispersion but at lower temperatures is a dispersion of a solid in a liquid. In many instances he has suggested changes in definition and nomenclature to bring order to a subject that appears to defy an all-encompassing theory to explain the myriad of facts uncovered from antiquity to the flood of developments from intensive research in the last three decades.

While the author in his preface modestly states that the book is essentially a self-contained discussion of modern emulsion theory and practice and that older work has for the most part been only superficially mentioned, it appears that enough of the older art has been interestingly presented to form a background against which the tremendous developments of the past three decades have been skillfully portrayed. A perusal of the bibliographics following the

several chapters reveals the vast amount of literature covering the past and present art and theory from which the author critically selected the material for this book. In Appendix B are listed approximately a thousand commercially available emulsifying agents—yet an admittedly incomplete list. Contrast this with the two papers in "Industrial and Engineering Chemistry" in 1931 describing two emulsifying agents, ammonium linoleate and triethanol amine stearate, that first made possible the commercial production of stable paraffin wax emulsions. The earlier emulsifying agents were primarily limited to a few soaps and the naturally occurring products of animal and plant origin used in pharmaceutical preparations and cosmetics. Coincidental with the modern industrial development in emulsions came the host of fundamental researches on surface chemistry by Adam, Bartell, Hardy, Harkins, Langmuir, McBain, and many others that form the basis for present day theories of emulsion chemistry, ably discussed by the author.

The monograph is divided into nine chapters and two appendices: (1) Introduction; (2) Surface Activity; (3) Physical Properties of Emulsions; (4) Theory of Emulsions: Stability; (5) Theory of Emulsions: Creaming, Inversion, and Demulsification; (6) The Chemistry of Emulsifying Agents; (7) Techniques of Emulsification; (8) Emulsion Applications; (9) Demulsification; Appendix A, Testing of Emulsion Properties; and Appendix B, Commercially Available Emulsifying Agents. After each chapter is an adequate list of cited references that should enable students and newcomers in the field to get off to a good start in the exploration of the different areas of the subject of emulsions, theory and practice. While this book is a monograph and not a compendium, the various chapters, nevertheless, deal with a considerable number of subjects and it would have been helpful to the reader and researcher if, in the table of contents, subheadings had been included so that more direct approach to topics of especial interest would be afforded.

The format of the book is excellent and in keeping with the standards for the American Chemical Society Monograph Series. The book will appeal to the teacher, student and industrial worker alike.

DEPARTMENT OF AGRICULTURAL CHEMISTRY
MICHIGAN STATE UNIVERSITY ELROY J. MILLER
EAST LANSING, MICHIGAN

The Chemistry of the Actinide Elements. By JOSEPH J. KATZ, Argonne National Laboratory, and GLENN T. SEABORG, University of California, Berkeley. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. xv + 508 pp. 16 × 24 cm. Price, $14.00.

This book follows by only four years, "The Actinide Elements" edited by the same authors, and reviewed in THIS JOURNAL, **76**, 5262 (1954). The commendations of the former review would apply equally to the present volume. It is pertinent to ask what requires a new work now.

Some advances have been notable and well advertised. Three new elements have been reported, though some reports are that the real discovery of element 102 will have to be credited to the California monopoly. It would be reassuring to have more diverse confirmation of discoveries since, to quote pp. 433–434 on the discovery of element 101, "it was possible to make the first chemical identification with amounts of the element as small as one atom, on the average, per experiment." This one atom had to behave correctly in elution from a column. These are heroic experiments and require heroic faith.

Perhaps equally propitious are the long-lived isotopes of previously reported transuranic elements. For example, in only four years the most stable known isotope of plutonium has increased from Pu^{239}, half-life 2.4 × 10^4 yr., to Pu^{244}, half-life 7.6 × 10^7 yr., and of Californium from days to Cf^{251}, half-life 660 years.

Still fragmentary is the information from outside the U.S.A., and no really unusual developments have been recorded in chemical or other properties. The authors have redigested the known information in the field, and have presented it in an up-to-date, more concise, better organized package. The authors, of course, write with authority on the chemistry, isolation, detection and proof of identity of new elements. No two authors could be authorities in all the chemical and physical fields covered; the review of magnetic, spectral and crystallographic properties and their bearing on atomic structure, and *f*-orbital bonding is useful but not always critical and definitive. In these respects, in spite of being older, the edited volume has some special merits.

After treating chemical and physical aspects of each element in turn, Chapter XI presents a summary in which the thesis is defended that the elements, thorium through 103, are actinides in the same sense that cerium through lutetium are lanthanides. Here seems to be the purpose behind the new volume. "The Actinide Elements" contained a clear, well-documented challenge to this thesis in a chapter by Zachariasen. This dissent is eliminated from the new volume, but, unfortunately, Zachariasen's arguments are essentially left unanswered. Since the authors seem to have chosen a lawyers brief to defend their thesis one can only recommend the reading of Zachariasen's chapter in the older work.

Since makers of periodic tables are accepting the actinide thesis, chemists should study the evidence *now* and decide for themselves or find acceptance an accomplished fact. After reviewing the matter I have a tentative opinion which I set forth in the hope that it may at least cause some further discussion before the actinide terminology is either accepted or rejected:

The elements after thorium without doubt form a transition series within which the 5f-subshell is filled. The start is not abrupt as in the lanthanide series; though at the end of the group the +3 oxidation state is dominant there is no reason for calling thorium an actinide, and probably no advantage for elements at least through plutonium. Zachariasen's suggestion that in oxidation state +3 the elements are actinides, in +4 thorides, in +5 protactinides, in +6 uranides, has some merit.

The end of the series will probably not be abrupt. Elements 104, 105 and 106 will probably resemble Hf, Ta and W, but this also means they will probably resemble Th, Pa and U within the series.

There are advantages in keeping thorium in group IV, protactinium in V, uranium in VI. The elements 93 through 106 (not 103) could then be listed as a series (actiuranide?) since, in truth, the majority of the group have oxidation states and chemistry not like actinium, but like members of this *range* of elements. This would allow one and only one position in the periodic table per element and would not over-emphasize the 3-valent state.

If one book in the field is to be bought "The Chemistry of the Actinide Elements" will no doubt be the choice. "The Actinide Elements" still has its points.

DEPARTMENT OF CHEMISTRY
IOWA STATE COLLEGE R. E. RUNDLE
AMES, IOWA

Isotopic Tracers in Biology. An Introduction to Tracer Methodology. Third Edition, Revised, Enlarged and Reset. By MARTIN D. KAMEN, Associate Professor of Radiochemistry, Edward Mallinckrodt Institute of Radiology, Washington University Medical School, St. Louis, Missouri. **Organic and Biological Chemistry. A Series of Monographs.** Edited by LOUIS F. FIESER and MARY FIESER, Harvard University, Cambridge, Massachusetts. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xii + 474 pp. 16 × 23.5 cm. Price, $9.50.

This book is a revision of "Radioactive Tracers in Biology" with the more inclusive new title justified perhaps by the addition of relatively brief sections on the stable isotopes H^2, C^{13}, N^{15} and O^{18}. The Table of Contents is extensively reorganized; however, much of the book is literally unchanged, excepting for the rearrangement of various sections.

The discussions of the assay methods for and the applications of the stable isotopes to problems in biochemistry suffice to demonstrate the principles involved. A chapter designated "Practical Interlude" consists chiefly of generalities which are of little practical value to the beginner.