Book Reviews

Applications of a Technique

Mössbauer Spectroscopy. N. N. GREENWOOD and T. C. GIBB. Chapman and Hall, London, 1972 (U.S. distributor, Barnes and Noble, New York). xii, 660 pp., illus. $38.50.

A sample of lunar material as detected by a Mössbauer spectrometer provides the pattern for the dust jacket of this book, and with it also gives us a rather striking indication of how far this research area has extended since its inception with Rudolph Mössbauer's discovery of the phenomenon of recoil-free resonance fluorescence 15 years ago. Only infrequently is one privileged to observe a particular discovery in one field of study lead to proliferating developments in various quite different areas, but these interesting interdisciplinary crossings-over and growth phenomena have been relatively easy to follow in the case of the Mössbauer effect. This phenomenon, originally in the province of the low-energy nuclear physicist, has provided the basis of the now burgeoning field of Mössbauer spectroscopy (or nuclear gamma resonance spectroscopy), the subject of this new comprehensive volume.

It should be stated at the outset that, the title notwithstanding, this is not strictly speaking a general book on Mössbauer spectroscopy; rather, the orientation is toward applications in chemistry. The fundamentals of Mössbauer spectroscopy are reviewed in a thorough, useful, and readable fashion in the first three chapters, which provide an introduction to the Mössbauer effect, outline experimental techniques, and discuss hyperfine interactions. The following chapter contains discussion of applications in various other fields including relativity, nuclear physics, and solid state physics. The remainder of the book, which is by far the major portion, summarizes the wealth of experimental and theoretical results that have been obtained by the use of Mössbauer spectroscopy during the last decade. As might be expected by workers in the field, this portion of the book is organized with respect to the elements or specific nuclides exhibiting resonances, and further according to the types of chemical compounds examined. To the tremendous extent and detailed coverage undertaken by the authors may be ascribed at least in part the fact that in some cases the topical discussions are summarized largely from the original publications, without as thorough a critical review and updating as might be desired.

The authors express in the preface their hope that this book will serve both as an introductory text for those wishing to become familiar with the technique and as a detailed source book of references and ideas for those actively working in the field. The latter objective is met admirably, but only the first several chapters of this rather comprehensive book provide reasonably condensed textbook-type material, and in my opinion the cost of the book practically precludes its use as a formal text.

The book is well produced, attractively printed, and the illustrations, which are taken mainly from the original literature, are of good quality. The book incorporates references providing extensive coverage of the primary literature up to and including some 1970 publications. As the literature in this field is so widely dispersed through a vast number of domestic and foreign journals as well as many hardback volumes, the fact that this new book is so well referenced contributes to making it a valuable addition to the specialist's library.

Greenwood and Gibb's *Mössbauer Spectroscopy* will certainly become a standard work on the subject, and it is a volume which most scientists with a serious interest in Mössbauer spectroscopy will want to own.

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The Excluded-Volume Effect

Modern Theory of Polymer Solutions. HIROMI YAMAKAWA. Harper and Row, New York, 1971. xvi, 420 pp., illus. $19.95. Harper's Chemistry Series.

Polymeric systems have afforded the statistical mechanician one of his richest fields of study, and the mixture of sophisticated theory and confrontation with experiment that characterizes this field is amply demonstrated in Yamakawa's monograph.

Against the vast panorama of current interest in polymer theory, the work must be described as of fairly limited but frankly declared scope. The dimensional, thermodynamic, and transport properties of chain polymer molecules in dilute solution mark the field of interest. And in that field the excluded-volume effect is the most prominent topic.

The excluded-volume effect on many dilute-solution properties may be made to vanish with a proper choice of solvent (the "theta" solvent), since the short-range repulsion between polymer segments that gives rise to excluded-volume effects may be compensated by a net attraction at slightly longer range. The theory of polymer dimensions in this situation is a prerequisite to the study of more complicated ones, and Yamakawa provides a valuable review. Although on the whole this area is not treated nearly so extensively as in the books by Volkenstein and Flory, some aspects (such as the worm model) are treated more extensively, and in a wider context of application.

Yamakawa attempts a comparative review of the major theoretical approaches to the excluded-volume effect and succeeds remarkably well. But even in the simplest aspect of the problem, the excluded-volume effect on equilibrium dimensions, the vast variety of attacks offered by the theoretical community, and the still-unsettled nature of this tantalizing problem, mark the work as an interim report rather than a eulogy. Nevertheless, if the standard of a rigorous and analytic approach is put aside, a fairly satisfactory semiquantitative understanding is available.

The compounding of excluded-volume and realistic backbone potentials with hydrodynamic interactions in the theory of relaxation and transport properties leads to an extremely complex theory in which not all the effects have been reliably sorted out. Highly flexible chains in a theta solvent, with a poten-

tial reasonably approximated by a quadratic form, are accounted for rather well by the theory associated with the names of Kirkwood, Rouse, Bueche, and Zimm, and this theory is lucidly reviewed by Yamakawa. The incorporation of more realistic potentials has led to a variety of approaches, such as the use of rigid arrays of segments, modification of dimensional averages required in the theory, or modification of the force constants in the quadratic form. The difficulties, shortcomings, and successes are more or less briefly explained.

The industrial and biological significance of macromolecules, and perhaps even more importantly the variety of problems, and their suitability to statistical mechanical and experimental investigation, have generated an explosion of interest in macromolecular theory. The experienced theorist who cares to know what has been accomplished in dilute-solution theory, or of methods and models that find much wider applicability, and the student with a good introduction to statistical mechanics behind him will find Yamakawa's book an invaluable guide. There is nothing else remotely like it.

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Spermine, Spermidine, Etc.

Introduction to the Polyamines. SEYMOUR S. COHEN. Prentice-Hall, Englewood Cliffs, N.J., 1971. xii, 180 pp., illus. $7.95.

Until a few years ago studying the biochemistry and physiology of the naturally occurring polyamines putrescine, spermidine, and spermine was almost exclusively the province of a small number of research groups whose prime interest was in these polyamines. Recently a change has occurred so that a number of workers who have been interested primarily in the control of RNA synthesis, the effects of hormones on nucleic acid synthesis, and processes associated with the cell cycle are now either interested in or working on polyamine biochemistry.

A number of factors account for this change in status of polyamine biochemistry; among the most important are (i) the establishment of a correlation between polyamine metabolism and RNA metabolism in a wide variety of procaryotic and eucaryotic cells, (ii) the demonstration that ornithine decarboxylase activity correlates well with the growth rate of many tissues, that its turnover in regenerating liver is remarkably fast, and that its activity in many tissues is increased by the administration of appropriate hormones, (iii) the development of rapid electrophoretic and thin layer chromatographic methods for the sensitive assay of polyamines, and (iv) the isolation of mutants of *Escherichia coli* defective in certain of the enzymes necessary for polyamine biosynthesis.

It is thus timely that Seymour Cohen should write the first book devoted exclusively to naturally occurring polyamines. It is the most extensive review of polyamines since that of Hugh and Celia Tabor in 1964 (*Pharmacol. Rev.* **16**, 245). The book comprises four chapters, the first of which opens with an interesting account of the history of polyamines since 1674 including snippets of the biographies of the men involved. The second and third chapters are devoted to polyamines in eucaryotic and procaryotic cells, respectively, and the final chapter is entitled "Organic cations in the structure and function of nucleic acids."

From reading the book it becomes very clear that there is now an abundance of evidence showing a correlation between polyamines and RNA synthesis, but also that we know very little about the nature of this correlation. Cohen presents a number of novel and speculative suggestions as to how polyamines might act. He also analyzes why many molecular biologists shrug their shoulders after posing the question, "Won't magnesium ions do the job equally well?"

The book, which is based on four lectures which Cohen gave to the Collège de France in 1970, could be better organized. The development of the themes is sometimes illogical and the subheadings are often uninformative and bear little relation to one another. For example, the biosynthesis of spermidine is dealt with under three separate headings in three separate chapters; it could surely be dealt with more logically in a single section. The book has a good index and bibliography and in spite of shortcomings should prove stimulating reading for potential workers in the field and a useful reference work for those already in the field.

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Viral Oncology

Growth Control in Cell Cultures. A Ciba Foundation symposium, Oct. 1970. G. E. W. WOLSTENHOLME and JULIE KNIGHT, Eds. Churchill Livingstone, Edinburgh, 1971 (U.S. distributor, Williams and Wilkins, Baltimore). x, 276 pp. + plates. $11.75.

This symposium is concerned with the mechanism of growth restriction in crowded cell cultures. The discovery that oncogenic viral transformation relieves this restriction has stimulated renewed interest in the problem. Some investigators have assumed that this density-dependent inhibition of growth is the consequence of cell-to-cell contact, whereas others have argued that it is due to decreased accessibility to serum growth factors. Papers presented at the symposium support both points of view. Indeed, as evidenced by the spirited discussion following each paper, there was little agreement on the relation between the respective roles of plasma membrane and components of the culture medium. This difficulty is easy to understand in view of the multiplicity of growth factors, inhibitors, and surface phenomena studied. It is certainly compounded by the fact that different cell systems and a variety of assay techniques have been employed.

Among the more promising approaches to the problem of the relation between cell surface structure and growth control is that of Max Burger and associates. Burger found a difference in the molecular surface structure of normal cells and their counterparts after transformation by oncogenic viruses. This difference is expressed in the exposure of wheat germ agglutinin receptor sites in the transformed cells. These sites are present in masked form in normal cells, where they can be demonstrated transiently after brief treatment with a proteolytic enzyme and during normal mitosis. A correlation between the degree of exposure of agglutinin sites and loss of density-dependent inhibition of growth was also found.

The use of genetic methods to analyze the relationship between topoinhibition (contact inhibition of growth), surface changes, and stimulation of cellular DNA synthesis was a lively topic of discussion. The results of studies with temperature-sensitive mutants of polyoma virus were interpreted by Dulbecco to show that low topoinhibition and high wheat-germ agglutinating ac-