thesis, and the stereochemical consequences of the symmetry rules so profound, that one really cannot criticize their selection. We can safely assume that other books taking up omitted topics will soon be available.

The present book is very well written, using a deliberately nonmathematical approach. The illustrations are particularly well done and show the arguments and the conclusions quite clearly. The authors have presented in a convenient and attractive way their pioneering contributions to an important new area of chemistry.

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Actinide Element

The Chemistry of Plutonium. J. M. CLEVELAND. Gordon and Breach, New York, 1970. xxiv, 654 pp., illus. $19.50; to institutions, $39.50.

Some 30 years have passed since the discovery of plutonium. From less-than-microgram to many-ton amounts has been the history of production; the volume of literature has kept pace, and we find that the element is indeed well studied, certainly better than many other more common elements. Since plutonium has been and is of prime importance in weapons work and will most assuredly become extremely important for electrical generation in the next generation of nuclear breeder reactors, it is not surprising that a great deal of both basic and applied research has been carried out over this 30-year period.

The author has attempted to include all of the known chemistry of plutonium in one volume with the unfortunate, in my opinion, exception of the chemistry of the metal itself. I believe that the author has indeed collected essentially all the rest of the unclassified chemical knowledge of plutonium and has reported it in a comprehensive and lucid fashion. The book jacket states that the coverage of the many topics is so thorough that the original literature in most cases need not be consulted. To depend on this book rather than upon the original articles is, of course, a rather optimistic and probably foolhardy procedure. However, the discussions are sufficiently complete that the researcher can decide which articles to consult and can then find those of the 1100 references he desires conveniently listed.

The Chemistry of Plutonium is divided into four sections. The first is a very brief introductory discussion. The next section, on solution chemistry, is several hundred pages long and discusses topics such as oxidation states and reactions, hydrolysis, complex formation, ion exchange, solvent extraction, and nonaqueous solution chemistry. The third section is also long and discusses the compounds of plutonium in a comprehensive way, giving such physical properties as crystal structure, melting point, and vapor pressure, along with preparative methods. The final section, on chemical processing, is more engineering in nature and discusses reactor fuel treatment, conversion of other compounds to the tetrafluoride, metal preparation, and, finally, recovery and waste disposal.

Although there are few who can use all of the varied information given, almost anybody interested in actinide chemistry will find this book to be a very useful collection of the known facts on the element plutonium.

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The Distorted Wave Method

Direct Nuclear Reaction Theories. NORMAN AUSTERN. Wiley-Interscience, New York, 1970. x, 390 pp., illus. $19.95. Interscience Monographs and Texts in Physics and Astronomy, vol. 25.

Austern has written a textbook intended for advanced graduate students and research workers in the field of direct nuclear reactions. But he has achieved much more. Acting in the capacity of a super referee he has brought together over 600 articles for digestion, dissection, rejection, and reconstitution. The final product is presented to the reader as one of those marvelous multicolored candy balls known to English children as "gob stoppers." It delights the eye as well as the palate as it so easily dissolves in the mouth. The aftertaste is tart (some might say bitter); the overall effect is refreshing.

The main theme of the book is the distorted wave method and its application to nuclear processes. The discussion of this is preceded by introductory chapters on scattering theory. A wave packet approach is employed, but in a manner which is shown to be relevant rather than pedantic. This leads naturally into a discussion of delay times and the difference between a compound nucleus and direct reaction. Antisymmetrization is discussed in configuration space, not in a second quantized formulation. Students will undoubtedly find this easier, but it will not help them in reading outside this book.

Detailed and easily readable examples of the method are then given in a huge chapter on applications. Experimentalists especially will find this the most useful part of the book. The presentation is both complete and clear, and there can be few reactions that are not discussed in detail. The results are illustrated throughout by such an overwhelming number of accurate fits to experiment that one is convinced that all is solved and there is nothing more to learn. But we are only halfway through the book. There follow quieter chapters to which perhaps fewer readers will penetrate but which I found equally absorbing. Those finer points so essential to the real specialist, so important in dragging up that last vestige of information from the data, are worked over. Coupled channels, L-space models, recoil effects, and many other topics are included, with a last chapter on unified theories and dispersion theory.

All the time I was reading this book, though, a specter kept tugging at my mind. His name is Fadeev. I would really have been interested to hear what Austern has to say about non-Fredholm kernels, dangerous diagrams, and divergence of the Born series. Does Fadeev's work show that there is a tragic flaw in the whole fabric of our understanding of many-particle interactions, or is it just an irrelevant mathematical detail which in the final analysis affects nothing? If Austern knows the answer to this question he is not telling us here.

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Stereochemistry

Polymer Conformation and Configuration. FRANK A. BOVEY. Academic Press, New York, 1969. x, 182 pp., illus. $9.50. Current Chemical Concepts.

This volume is based on a series of lectures presented by the author at the Polytechnic Institute of Brooklyn. Bovey surveys areas of polymer stereochemistry, including the use of such

techniques as nuclear magnetic resonance, circular dichroism, and other spectral tools.

In the first three chapters, Bovey considers the configuration of vinyl polymer chains, the deduced statistics and mechanisms of polymerizations that derive from configurational analysis, and the use of model compounds. In the last two chapters we are treated to an examination of conformational analysis of polypeptides. Bovey develops his approach by discussing the foundations of the spectral techniques from which stereochemical assignments are made. In the last chapter he applies these to systems with which he and his associates have worked.

This book contains much useful information. It is possible to ascertain from this volume how the stereochemical analysis of polystyrene, polyvinylchloride, polyacrylates, polymethacrylates, and polypropylene was developed. The use of model compounds for stereoregular placements in a vinyl polymer chain is clearly discussed and interpreted. In like manner, Bovey uses model compounds, spectroscopy, and stereoviews to explain the structure of polypeptides.

This book is a personal expression of the author's research interests and as such represents a living and developing document. In these days when so many books are editors' compilations, I find it refreshing to see an author tie the various aspects of his own research interests together so well.

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Cells and Molecules

Handbook of Molecular Cytology. A. LIMA-DE-FARIA, Ed. North-Holland, Amsterdam, and Interscience (Wiley), New York, 1969. xvi, 1508 pp., illus. $78. Frontiers of Biology, vol. 15.

"By having in one book most of the information available on the evolution of DNA, the ultrastructure and biochemistry of chromosomes, and the ultrastructure and biochemistry of cytoplasmic organelles, the reader may be in a better position to get a general picture of the molecular interactions within the cell, to see the areas which are least developed, and to find out where new and significant trends in research lie," writes the editor of this volume. The editor is not unmindful that "in a number of cytological fields our knowledge has not yet reached the molecular level."

The book is really a collection of review articles (53 in all) that deal either with molecular biology or with the ultrastructure of the cell, but virtually none of these articles comes to grips with the molecular biology of ultrastructure. Those in the first category hardly deal with ultrastructure; those in the second category hardly deal with molecular events. The hybridization of molecular biology and cytology thus takes the form of mixing articles from the two fields within the same volume. But this mixing has the virtue of pointing up the molecular phenomena that have to be rationalized by the ultrastructural events and the ultrastructural phenomena that have to be rationalized in molecular terms.

The quality of the reviews is generally high. The reviewer found the chapters of the following authors eminently readable and informative: S. A. Henderson (on chromosomal pairing, chiasmata, and crossing-over), J. H. Subak-Sharpe (the doublet pattern of virus nucleic acid), H. D. Berendes and W. Beermann (biochemical activity of interphase chromosomes), A. Forer (chromosome movements), B. J. Stevens and J. André (the nuclear envelope), H. Swift and D. R. Wolstenholme (genetics of mitochondria and chloroplasts), P. Favard (Golgi apparatus), R. Wattiaux (lysosomes), P. Baudhuin (peroxisomes), B. A. Afzelius (ultrastructure of cilia and flagella), and J. D. Robertson (biological membranes).

As one surveys in this volume the ultrastructural account of the structures and phenomena that underlie the hereditary process (chromosomes, meiosis, mitosis, spindle, nucleolus, the nuclear envelope) it comes as a shock that this vital area of biology is *still* a no-man's-land. The molecular logic of the structures of the hereditary apparatus and the operational principles of the hereditary process are almost completely unknown. The structures and the interpretation of the events are largely inferences from what we already know from molecular biology and genetics.

The only examples we have of a successful transition from the ultrastructural to the molecular level are those in which the ultrastructural components can be isolated, purified, and characterized biochemically. Then significant correlational studies can be carried out, as in the elucidation of the mechanism of muscular contraction by H. Huxley.

As long as ultrastructure is examined largely or exclusively in a descriptive way, by electron microscopy alone, the transition to the molecular level is virtually excluded. Electron microscopists have examined the cell membrane for 20 years and speculated on its molecular structure. But the solution of the structure in terms of the protein crystal model of G. Vanderkooi came by way of membrane models and the fitting of biochemical and physical data to the models. The point to be made is that those who are to succeed in rationalizing ultrastructure in molecular terms will have to be practitioners of several disciplines—of biochemistry and molecular biology in addition to electron microscopy. The integration of approaches will have to be internal, not external.

The *Handbook of Molecular Cytology* is a compilation of the thousands of pieces of information that eventually will have to be fitted into a grand molecular design. For those who are intrigued with this undertaking, the *Handbook* is a treasure of information, highly to be recommended.

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Attachment

Adhesion in Biological Systems. RICHARD S. MANLY. Academic Press, New York, 1970. xvi, 302 pp., illus. $15.50.

This book, which stems from an AAAS symposium held in 1967, concerns itself almost entirely with the nature of adhesions between biological and nonbiological compounds in the presence of moisture. A more accurate title might therefore have been "Adhesion in Semibiological Systems." The 17 chapters, each by different authors, cover a broad area ranging from the adhesion of gingival epithelium to teeth, and of barnacles to polytetrafluorethylene, all the way to cyanoacrylates as hemostatic agents in surgery and the effects of repeated application and removal of surgical tapes on human skin. This diversity, rather than detracting from the book, is its greatest strength. Investigators in other areas and interested students will find the volume ex-