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-

cellent for describing some intriguing problems in biological adhesion.

Except in rare cases, however, the specialist will find his topic handled in an abbreviated and dated fashion. A. C. Taylor's article, for example, omits much progress on the measurement of cell adhesiveness that has been made since the symposium was held, despite the editor's stated invitation to the participants to update their contributions. R. E. Baier's chapter is an interesting and informative account of the relationships between wettability and adhesion. It contains a fascinating discussion of some data which suggest that the degree of cell spreading may be partially dependent on the critical surface tension of the substrate. Another chapter depicts, all too briefly, the attachment of marine bacteria to slides immersed in aquaria. Four chapters are concerned with the morphology, histology, and biochemistry of barnacle and mussel attachment to moist surfaces. The remaining nine chapters are devoted to a description of existing and potential artificial adhesives for soft and hard tissues.

For readers seriously interested in biological adhesion the greatest shortcoming of the book is its failure to include any summary of the biochemistry of intercellular adhesion. Weiss's introductory article concentrates insistently on the theoretical, biophysical level of adhesion and does little to alleviate this shortcoming. It is, after all, biological adhesion that one would like to be able to duplicate in preparing clinical adhesives. Although the molecular mechanisms are unknown, cell-to-cell adhesions are specific, nontoxic, and tenacious in the presence of water. It would seem, therefore, that when the mechanisms are understood, artificial adhesives will utilize them. For these reasons, omission of work on natural biological adhesions is a major flaw and one that could have been rectified easily at the expense of one or two of the nine chapters devoted to excessive description of synthetic adhesives.

All things considered, this volume contains much information about adhesion research in biology, but the experimental embryologist, pathologist, and student interested in the possible relationship between the contents of this book and cellular adhesion in vivo will be disappointed.

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Diseases of Plants

Plant Virology. R. E. F. MATTHEWS. Academic Press, New York, 1970. xviii, 784 pp., illus. $29.50.

The preface to this weighty book states that it "was written primarily for graduate students in plant pathology, plant virology, general virology and microbiology and for teachers and research workers in these fields," and that the author hopes "it will also prove useful as a reference book for those in disciplines related to plant virology—molecular biologists, biochemists, plant physiologists and entomologists." In attempting to serve so many purposes and to deal with all aspects of such a wide-ranging subject, the author set himself a formidable task, but to a large extent he has achieved his intentions. Not all chapters are of equal quality, and those on subjects in which the author has worked read more consecutively than the others; all summarize a great deal of information, however, with many references to work published in 1969 and 1970. The text is shorter than the number of pages suggests, because the book is profusely illustrated and the bibliography and index occupy more than 100 pages. The half-tone illustrations are well chosen and reproduced, but if the color plates add anything it is only to the price. Perhaps the greatest compliment the book can be paid is to say that every graduate student should have a copy, but probably few outside North America will be able to afford one.

Reading the book brings home how uneven has been development in knowledge about plant viruses and virus diseases. While almost every feature except the sequence of nucleotides has been discovered about the composition and architecture of strains of tobacco mosaic virus, there is still no inkling of an explanation for the fact that strains differ in host range and in the type of symptoms they cause. Also, although a multitude of phenomena has been discovered that shows how greatly changes in the environment of plants affect their susceptibility to infection, the extent to which viruses multiply in them, or the kind of symptoms produced, the phenomena all still await explanation. The viruses with particles most amenable to study in the laboratory are obviously proving most attractive to workers, although they are not necessarily the most important ones or the ones for which there has been most success in developing control measures. Indeed, although it would be an exaggeration to say that the more that is known about the composition and architecture of a virus the less probable it is that a method has been developed for controlling the diseases it causes, there is more than a grain of truth in the statement; certainly epidemiological work has led to methods of controlling some viruses before anything was known about their shape, size, or constitution. Others, including some whose particles have been much studied, still spread almost unrestricted, and will do so until workers turn from taxonomy to epidemiology and pathology. It may seem ridiculous to cavil at a book for students because it deals largely with what is known, especially when there is so much information to summarize, but a little more emphasis on the large gaps in our knowledge would have been valuable, and might have attracted people to work in subjects that would fill the most important ones.

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