for graduate students and researchers in molecular biology and related fields.

Volume 1 begins with a rather perfunctory discussion of the genetic code and the synthesis of polypeptide chains. This is followed by two excellent chapters on structure-function relationships in the ribosome and transfer RNA. By this time the reader has gained an understanding of our present knowledge of protein synthesis and is prepared for the next section, on control.

In this section the initiation, elongation, and termination of RNA synthesis as deduced from transcription studies on phage genomes are presented. The section also contains discussions of the control mechanisms operating in the lactose, L-arabinose, galactose, and arginine systems in *Escherichia coli*. This reviewer questions the inclusion of all this material in a section on transcription because there had not been a rigorous demonstration of control at the transcriptional level in *ara* and *arg* when the book went to press. A good feature of this section is an excellent general discussion of positive and negative control in both inducible and repressible systems.

The final part of volume 1 describes the reproduction of DNA. Included are chapters on replication, modification, repair, recombination, and the cell division cycle.

Volume 2 is divided into two sections dealing respectively with the structure of the eukaryotic genetic apparatus and with the expression of eukaryotic genes. The first chapter reviews the evidence for the continuity and semiconservative replication of DNA in the chromosome. The organization of chromatin fibers is discussed in terms of the folded-fiber model. The molecular events associated with the cell division cycle are related to the classical descriptions of these events. Two chapters are devoted to the protein components of the chromosome and sequences of DNA. The large amount of work on sequence analysis and modification of histone proteins is reviewed. A final section discusses the structure of chromatin. The chapter on DNA sequences contains a fine summary of hybridization studies, analyzing important procedures and pointing out the pitfalls and limitations of this type of work. A section on the organization of heterochromatin discusses possible mechanisms of band formation.

The complexity of the eukaryotic genetic apparatus is evident from the material presented in the second part of the volume. A chapter on transcription and processing of RNA begins with a detailed analysis of the methods used to characterize RNA sequences. The processing of heterogeneous nuclear RNA and 45*S* precursor RNA is discussed. A chapter on control of transcription describes eukaryotic RNA polymerases and presents some of the models for control of gene expression. The final chapter discusses nuclei transplantation experiments and somatic cell hybridization studies. The use of cell fusion for studies of nuclear gene expression and genetic mapping is illustrated.

In general the author is careful to define terms and to qualify statements on matters that may still be controversial. An excellent selection of photographs is an added feature of this volume.

GARY WILCOX
Department of Bacteriology, University of California, Los Angeles

Carbon-13 Spectroscopy

Topics in Carbon-13 NMR Spectroscopy. Vol. 1. GEORGE C. LEVY, Ed. Wiley-Interscience, New York, 1974. xii, 292 pp., illus. $17.50.

The authors of each of the six chapters in this book present solid introductions illustrated with examples drawn largely from their own work. For the first volume in a series on carbon-13 NMR (nuclear magnetic resonance) spectroscopy, chemical shifts and relaxation are obvious topics. Theoretical calculations of shifts are treated by R. Ditchfield and P. D. Ellis, and an empirical approach to them is presented by G. Maciel. For the chemist who wants to utilize carbon-13 as a structural tool, Maciel's ideas will prove valuable. Ditchfield and Ellis, taking a more rigorous approach, succeed in both presenting several theoretical treatments and in delineating the experimental facts, which they have treated most satisfactorily.

Spin relaxation is presented by J. R. Lyerla and G. C. Levy. The theory of mechanisms is covered extensively and illustrated with numerous examples. For the beginner in carbon-13 research this chapter can serve as a thorough introduction to experimental problems. It also serves as an introduction to the more specialized chapters of the book. From Jacob Schaefer's chapter it is clear that both shifts and spin relaxation parameters are valuable in the study of polymers. F. A. L. Anet relies heavily on the spin relaxation chapter in his discussion of high field systems. The organic chemist who will use carbon-13 as an analytical tool will find J. Stothers's chapter most valuable. Stothers has extended a section of his earlier monograph and presents examples of both carbon-13 and deuterium tracer studies.

The authors have succeeded in their objective, which is to sell carbon-13 NMR spectroscopy as a technique. Some of the chapter introductions are similar to those found in other collections on magnetic resonance. Where this occurs, however, direct applications to carbon-13 are also presented, and it is convenient to have the introductory material at hand. All six chapters present enough experimental data to make the significance of their topics obvious. The book is significantly different from other monographs on this subject. For those who are already experienced in proton magnetic resonance applications, this volume can aid in gaining an understanding of carbon-13 spectroscopy.

JAMES A. MAGNUSON
Program in Biochemistry and Biophysics, Washington State University, Pullman

Disordered Materials

Amorphous and Liquid Semiconductors. J. TAUC, Ed. Plenum, New York, 1974. x, 442 pp., illus. $28.

By now, most scientists are aware that the electronic properties of disordered materials are at least as diverse as those of crystalline solids and that amorphous solids and liquids can be insulators, semiconductors, or metals. Nevertheless, there has been little effort to rewrite the texts and modify the courses in solid state theory to avoid misleading students and novices about the importance of periodicity. It is even difficult to find specialized texts that adequately cover amorphous and liquid materials; apart from the book by Mott and Davis, currently being revised, there are only several recent conference proceedings and one monograph. One reason for this lack is the rapid progress that has taken place over the past decade, spurred

by the theoretical work of Nevill Mott and the applied work of Stanford Ovshinsky.

Until something better comes along, this collection of seven articles edited by Tauc will remain a standard. Most of the chapters are well written and informative, although they are not of uniform caliber. Some stand on their own, others require extensive use of supplementary references. The introductory article by Bagley on the nature of the amorphous state is quite good, although it demands some previous knowledge of the field; a self-contained version of this material would require a book in itself. The chapter has several weaknesses, particularly in its treatment of the free-volume model of the liquid state, where some important concepts, such as excess volume and nucleation, are poorly defined, and the equations presented would not be useful to anyone unfamiliar with the theory. No explanation of the recent specific-heat data is offered despite their implications for the structure and entropy of amorphous solids. The classification of these materials as relaxation semiconductors is accepted without experimental confirmation or further explanation. However, the important subject of phase separation is handled well. Less successful is the chapter by Grigorovici on structure, which, although it contains a great deal of information on the recent experimental diffraction studies of a large class of materials, will be comprehensible primarily to those who are already somewhat familiar with the field.

The theoretical chapter by Economou *et al.* leaves much to be desired. The presentation is not completely logical, and few quantitative results are presented. The chapter is primarily a summary of the work of the authors, which, although in the forefront of the field, is not representative of all the recent advances. This chapter is also the most out of date; only two references as recent as 1972 appear. No mention is made of the contributions of Joannopoulis, Weaire, Yonezawa, Brenig, Kramer, Alben, Thorpe, Emin, or Taylor, or the recent work of Anderson or Thouless. The chapter on optical properties by Tauc is an excellent review of the subject. My only disappointment is that it does not point out the absorption-edge problem in amorphous silicon and germanium, where the optical gap is still undetermined to within a factor of 2!

In my opinion, the two chapters by Fritzsche, on electronic properties and on switching, are the best in the book. They are the least out of date, a considerable achievement in an area in which the literature is still growing exponentially. But, more important, both chapters are real contributions of a sort not available elsewhere. Finally, Enderby's chapter on liquid semiconductors appears to be present only to avoid the necessity of changing the title of the book. The beginning of the chapter is overly mathematical and not very informative to nonexperts. The end does put the field in perspective and makes the chapter worthwhile, but a much longer work would be necessary to do justice to the entire subject.

The editing appears to have been minimal; the chapters are not very well integrated either in style or by cross-referencing, and no author index has been provided.

The major defect of this collection of papers stems from the fact that the field is simply too young and growing too fast to be encompassed in a book, given present-day publication speeds. It is hoped that another such book is in preparation. For the time being, this one is the best starting point for a novice in the field. But more recent publications must be checked out before anyone can feel really knowledgeable.

DAVID ADLER
Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge

Toward a Theory of Water

Water and Aqueous Solutions. Introduction to a Molecular Theory. ARIEH BEN-NAIM. Plenum, New York, 1974. xvi, 474 pp., illus. $29.50.

The development of a molecular theory of liquids has trailed far behind that of theories for gases and solids. Whereas physical chemists can compute many properties of a gas or solid from the properties of the molecules that compose it, they have had scant success in computing properties of liquids. Similarly, though they can extract many molecular properties from measurements on solids or gases, they derive little information about molecules from observations on liquids.

The reason for this lag is that the molecules in a liquid interact strongly with each other, but have no long-range order. A gas is simpler for the theorist to treat because the molecules may, at low pressures, be regarded as exerting no forces on one another. A crystalline solid is simpler because of its near-perfect spatial regularity. But a liquid presents the most difficult situation: an irregular arrangement of strongly interacting particles. Water and aqueous solutions offer an especially difficult challenge because the forces, in addition to being strong, are highly asymmetric. The hydrogen bonds that endow water with its fitness for sustaining life are the source of difficulty to the liquid theorist.

Ben-Naim's book summarizes the progress of theorists during the last decade in forging a molecular theory of aqueous systems. Its scope is restricted to thermodynamic properties and to the radial distributions of molecules determined by x-ray and neutron scattering. There is no discussion of nonequilibrium properties (such as viscosity, ionic conductivity, or the various types of relaxation phenomena), which are far harder for the theorist to treat. Nor is there discussion of spectroscopic or electrical properties (such as nuclear magnetic resonance or dielectric constant).

The book is addressed to readers who are familiar with the material of a typical graduate-level course in statistical thermodynamics. An initial chapter reviews the rudiments of statistical mechanics. The concepts are discussed concisely and with great clarity, and the notation to be used in the rest of the book is introduced. The next four chapters are also introductory, in that they develop concepts of molecular distribution functions, statistical thermodynamics, and the statistical theory of solutions. The meat of the book is found in the final three chapters: one on liquid water, one on water containing a single dilute solute, and one on the hydrophobic interaction.

The chapter on water develops the statistical mechanical basis of mixture and interstitial models for this liquid. Here the author shows considerable cleverness in devising mathematical descriptions of such traditionally qualitative concepts as "water structure" and "two state liquid." In addition, it describes the recent computer simulations of water carried out by Rahman, Stillinger, and others. These simulation studies show that numerous equilibrium properties of water can be computed by assuming little more than a potential energy function for the interaction of