Book Reviews

Hydrophobic Interactions. By A. Ben-Naim (Hebrew University of Jerusalem). Plenum Press, New York. 1980. xiii + 311 pp. $32.50.

Any attempt to prepare a definitive monograph for a rapidly evolving field such as water and its solutions is doomed from the start. Ben-Naim, realizing this, has produced a "selected topics" snapshot of the field in motion which is generally useful but more so for theoretically-oriented people seeking an introduction to water than for the nontheoretically oriented who seek a molecular explanation for hydrophobic hydration and the hydrophobic effect. The author makes it clear that he has not found this explanation and the title could well have been "A Search for the Basis of Hydrophobic Interactions".

The theoretical discussions are less comprehensive and there is somewhat more experimental information than in Ben-Naim's "Water and Aqueous Solutions". The resulting shorter version may well have been constructed with the experimental biochemist and chemist in mind but the theoretical level is still too high for most people who fall into this category. The data and many of the discussions will be useful to them but the text probably will be of most value to the theoretically trained person wishing to enter the field. It is not a bad study guide for the learner but probably no better than its predecessor.

The first four chapters progress smoothly from simpler systems and models to more complex models with almost complete emphasis on free energy. There is a relative overemphasis on some of the theoretical models Ben-Naim has developed. This is not surprising, but not all of these may stand the test of time and insofar as their extensive discussion limits coverage, it is unfortunate. A significant number of people in the field do not agree with all the theoretical developments and conclusions the author presents which makes it unwise to depend entirely on this volume. For example, there is good reason to believe that Kauzmann's famous analysis of hydrophobic hydration as due to the unfavorable entropy of transfer from a "normal" organic solvent greatly oversimplifies the situation, but little of the evidence supporting this important possibility is presented and none discussed in this connection.

Since the abnormalities of water are due to its extreme fluctuational behavior in turn due to a large degree of cooperativity and since free energy measures fluctuations at best only weakly, the emphasis on free energy is something of a virture. That is, the continuing absence of an understanding of both thermodynamic and molecular aspects of water behavior is due primarily to an inability to make sense out of the first and second derivatives of the free energy which are powerful measures of fluctuation behavior. A more comprehensive review of the various ways they have been interpreted might be of some help to the reader but such discussions already exist. Only the last chapter is devoted to the derivatives, and this limitation was a wise one although it will disappoint readers who have come to believe that there has been more progress in the field than is in fact the case. On the other hand, many highly associated liquids demonstrate free-energy behavior in the solvation of hydrophobic molecules and in the hydrophobic effect quantitatively similar to water, and probably due to similar molecular behavior. Hence the first four chapters have considerable generality even though the fifth chapter, the only specifically "water chapter", does not.

Progress in the study of water and water solutions appears to have undergone rapid acceleration in recent years. The final goals may not yet be in sight but this monograph is partial preparation for those who wish to join in the increasing excitement of the journey toward those goals.

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Handbook of Liquid Crystals. By Hans Kelker and Rolf Hatz. Verlag Chemie, Deerfield Beach, Florida. 1980. xvii + 917 pp. $262.50.

Kelker and Hatz have given themselves the formidable task of providing a comprehensive survey of the field of liquid crystals up to 1976 including most of the 1977 publications. References are listed per chapter and reach a total of at least 8219 covering the final 265 pages of the book. Thus even after allowing for some duplication of references between related chapters, the "Handbook of Liquid Crystals" is indeed unique in providing the first comprehensive guide to literature in the field.

There are altogether 15 chapters. The first two chapters are devoted to an introduction of basic concepts and physical properties of liquid crystals. However, these early sections lack illustrative structural discussions of the basic types of liquid crystals whose inclusion is standard in treatises of liquid crystals. Further, the field of liquid crystals is so rich in nomenclature that the inclusion of a glossary of terms and their common usage would have added value to the handbook.

A chapter provides an overview of the theories of liquid crystals. The style of coverage adopted, as is true in many other chapters, departs from that of a typical handbook in that the authors show important steps leading to a theoretical result. However, the reviewer failed to find where the quantity $Q(\xi_1,\xi_2)$ in eq (3.2) and (3.3) is defined. Behavior of liquid crystals in magnetic and electric fields and their spectroscopic studies occupy a substantial portion of the handbook in four chapters. Two chapters treat the thermodynamic properties of single and multicomponent liquid-crystal systems with the latter chapter specializing in situations in which a liquid crystal is the solvent in analytical gas chromatography, and in synthetic reactions. The single chapter by Ch. Schumann mainly provides tables itemizing the NMR and ESR studies on thermotropic and lyotropic mesophases. Two chapters discuss a miscellany of related issues: the phenomena of lyotropic mesomorphism, mesomorphic polymer solutions, and liquid crystals in living systems. The phenomenon of liquid crystalline order in synthetic high polymers and the important issue of technical applications of liquid crystals have each been given full chapters. The final chapter provides a literature guide to reviews, books, and the most important symposia proceedings in the field.

The handbook is particularly remarkable in describing experimental facts, in providing an historical documentation, and as a reference guide. The rather detailed summary of theoretical development will certainly prove useful to both experimentalists and theoreticians in the field. At the stated price the handbook should find a popular place only in the reference section of research libraries.

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Advances in Photochemistry. Volume 12. Edited by James N. Pitts, Jr., G. S. Hammond, Klaus Gollnick and Daniel Grosjean. John Wiley and Sons, New York. 1980. xiii + 358 pp. $42.50.

The latest in this esteemed series, and the last to be produced under the editorship of Professor Pitts, who has been with the series since its inauguration in 1963, consists of four assays: Photochemistry of Simple Aldehydes and Ketones in the Gas Phase by E. K. C. Lee and R. S. Lewis; The Photochemistry of Rhodopsins by M. Ottolenghi; Organic Photochemical Refractive-Index Image Recording Systems by W. J. Tomlinson and E. A. Chandross; and Theory and Applications of Chemically Induced Magnetic Polarization in Photochemistry by J. K. S. Wan. In each case, the reviews have been written by authors who are expert active investigators in the respective fields of photochemical research. One should therefore expect essays of high technical quality, and the authors do not disappoint. The literature coverage varies slightly in each case with references through early 1978 to early 1979, but in all instances the listings are quite extensive. The article on rhodopsins, with 447 literature citations, is the most comprehensive review on the chemistry associated with vision known to me and is required reading for anyone working in this area. The article by Lee and Lewis describing primary processes in the gas-phase photochemistry of simple carbonyl compounds is the first extensive review of work in this classical area in over 10 years. In this case, the authors have wisely chosen not to describe everything that has been done in this field in the last 10 years, but rather to concentrate on molecules of current interest, with special emphasis on formaldehyde as the prototypical carbonyl compound. The other two articles deal with subjects where research has developed only in the last few years, and hence are more limited in scope, but not in timeliness. The production job in this volume is of high quality, and the cost seems reasonable for a book of this size in comparison with prices noted recently for comparably sized volumes. Most photochemists will surely want to have this volume in their personal collections for ready reference.

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