history in peat technology.

In a book which deals largely with the subject from an industrial viewpoint, it is surprising to find that the longest section (Chapter 12) is devoted to a review of the occurrence and structural chemistry of humic acids and lignin. By contrast, Chapters 13–15 provide a most valuable account of the theory and practice of peat carbonization, specifications for coke and related products, and the production and utilization of distillates and gases from peat pyrolysis.

Chapter 16 on chemical methods of peat analysis is perhaps the weakest in the entire book. In a work containing such an extensive and well-documented bibliography up to, and including, 1978, it is surprising to be presented with many analytical methods which are out of date. Thus much stress is placed on the use of paper chromatography for the estimation of components of hydrolysates, disregarding modern liquid and gas chromatographic techniques for the analysis of waxes, steroids, terpenes, phenols, sugars and amino acids. Automated flow analysis methods are not mentioned. The concluding three chapters deal with the scale of peat processing operations, economic and social implications, environmental impact and pollution control.

Overall, Charles Fuchsman's book fills an important gap in existing literature and will be widely welcomed not only by specialists in the field concerned but by all those engaged in peat research and development. □

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Art of the insoluble

R. H. Pain

Hydrophobic Interactions. By A. Ben-Naim. Pp.311. (Plenum: 1980.) $32.50, £20.48.

MEDAWAR has reminded us that the pursuit of science is the art of the soluble. This book is about the art of the insoluble.

To judge by the number of monographs recently published on the subject, interest in the hydrophobic effect and its involvement in the stabilization of biological structures is at a high point.

Kauzmann in 1959 (*Adv. Protein Chem.* **14**, 1) drew attention to the fact that the association of non-polar groups in an aqueous medium exhibits thermodynamic properties which can only be explained in terms of changes in the entropy of the solvent. Such groups, which are present on many biological molecules, come together not so much due to mutual attraction as to a mutual distaste for water. These concepts have been developed by several groups to provide a valuable tool with which biochemists can rationalize a wide range of interactions. What may be called the thermodynamic approach to hydrophobic interactions is widely accepted and remains useful because of the still limited understanding of the structure of water. The beauty of thermodynamics in such a situation lies in its ability to handle phenomena quantitatively without having to make any assumptions as to mechanism, and some of the workers in this field have vigorously eschewed any attempt to taint the purity of the approach by considering molecular mechanisms. The frustration which this kind of treatment apparently induces in biochemists is well illustrated by widespread references in the literature to 'water structures' and 'icebergs', and indeed there is much that we want and need to know about the details of the hydrophobic interaction.

The monograph by Ben-Naim attempts to steer a course somewhere in between the thermodynamic and the molecular-structure approaches. It is not in any sense a review, as the limited and selective list of references indicates, but an account of the author's own attempts over a period of years to tackle the problem of hydrophobicity. The first impression is one of clarity in his treatment of the subject. He leads the reader patiently, if at times paternally, through the development of his argument in a way which is refreshing and helpful. The argument is clarified by a series of diagrams which enable the model-orientated reader to grasp the significance of the equations. Frequent "Comment" paragraphs provide summary, objective assessment of the previous sections. It is, surprisingly, these comments which first make for a sense of unease, for the general impression conveyed is that more experimental data are required to test the theory or that the theory being developed does not relate to real and highly complex macromolecular systems.

The author begins by drawing a useful distinction between the *direct* parts of the interaction between two particles in solution and the *indirect* part which comprises the hydrophobic interaction. His approach is based on that of statistical mechanics and he sets out to describe the interaction in terms of association rather than solubility. The contrasts with the thermodynamic approach are marked, in that the familiar description of the hydrophobic interaction in terms of characteristic changes in entropy and heat capacity is absent. In fact, consideration of these does not appear until three-quarters of the way through the book. The treatment progresses through discussion of the interaction between two simple particles to interaction between many solute particles, with particular emphasis on the non-additivity or cooperative aspects. The final chapter concerns the temperature and pressure dependence of hydrophobic interactions. Statistical mechanical derivations are assigned to appendices in order to make the text more readable. Various kinds of experiments are described, although some of these, such as those involving the association of carboxylic acids, are notoriously difficult to interpret in terms of the hydrophobic contribution.

This book is unlikely to be of value to the biochemist. Little light is shed on the four fundamental questions raised in the preface as to the nature and role of hydrophobic interactions — these are still best answered by intuitions and prejudices based largely on the thermodynamic approach. The book is a useful contribution for the hydrophobic buff, summarizing the application of the statistical mechanical approach. For my money, though, further understanding of the hydrophobic interaction will only come as we learn more about the behaviour of the solvent at the molecular level. □

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