

Physical Chemistry with Applications to Biological Systems

by R. Chang
Collier MacMillan; 1977
538 pages. £6.75 (paperback). £11.25 (hardback)

The difficulties of teaching physical principles to students of biological sciences are first their abhorrence of even quite elementary mathematics and secondly that application to interesting 'revelant' example requires fairly advanced treatment. This does not mean that experience with numerical solutions to quite elementary problems is not useful. We have all come across students who have an enormous amount of factual information at their disposal but are quite incapable of calculating by what factor a sample of ^{32}P -labelled material has decay in 24 h, or to convert absorbance into concentration. Teaching of physical principles has the additional duty to provide plenty of experience to solve numerical problems. There is no doubt that the volume under review provides good worked numerical examples and plenty of numerical questions with answers at the back.

Next it needs to be said that the book provides a lucid treatment of elementary physical chemistry with a few examples taken from the biochemical literature. It does not treat biochemical problems to a level which should be considered adequate for an honours or graduate course in biochemistry. I would say that the level covered is adequate as a foundation for a subsequent course.

To some extent it is difficult to know what role

this book would play in a complete curriculum. One would hope that students who take a one-year chemistry course will have covered all but the occasional references to biochemical examples. If there are students of biology who do not take first year chemistry they would certainly benefit from Dr. Chang's gentle guidance.

Most book reviews itemise the topics covered. This is obviously superfluous for the bulk of the present volume. A few comments are in place on the biochemical topics treated. Chapter 8 deals with intermolecular forces. Non-covalent interactions and the effects of environment on them, are most important aspects of physical chemistry in biology. However, the treatment given would not enable the student to solve many interesting problems. The treatment of enzyme kinetics and the behaviour of proteins and nucleic acids, as well as of ligand binding, gives no more of the physicochemical basis than would be expected of a good biochemical text, perhaps rather less.

To sum up I would suggest that this is a good book for the student who has missed an adequate education in physical chemistry and would like to prepare himself for the study of biochemical problems presented elsewhere.

H. Gutfreund

NMR in Biology

Edited by R. A. Dwek, I. D. Campbell, R. E. Richards and R. J. P. Williams
Academic Press; London, 1977
xvi + 381 pages. £9.00

There was a time not so long ago when the title 'NMR in Biology' would have suggested a conference

devoted primarily to ^1H NMR studies on the interaction of enzymes and in some cases nucleic acids,

with small ligands together with possibly one or two presentations devoted to high resolution protein NMR investigations of small proteins, focusing primarily on those regions of the spectrum which lie outside the main envelope. It is a measure of the extent of progress in this field that studies of this type played a relatively more minor role in the 1977 Spring meeting of the British Biophysical Society, the proceedings of which are reported here. Instead one finds in this volume for example the extensive use of nuclei other than protons and the application of NMR technology to the examination of membrane structure and of intact tissues. The primary reason underlying these rapid developments has been the very rapid improvements in the instrumentation which have opened the way to applications inconceivable 10 years ago, together with the increasing and very fruitful collaboration between physicists, chemists and biochemists. Nowhere is this better illustrated than in the activities of the Oxford Enzyme Group whose contributions to the field are well documented here.

The articles included can then be divided into two main categories following the introductory chapters on X-ray crystallography of trypsin (Huber and Bode) and NMR studies of protein structure (Campbell):

1. The first category concerns high resolution NMR studies of purified macromolecules and illustrates in several instances the very productive interaction between the NMR and X-ray crystallographic analyses in elucidating the conformational parameters of proteins in solution, cf. for example in the article on lysozyme by Dobson. Although this relationship at present in most cases operates with the bulk of the information coming from the X-ray data, solution of the problems of residue assignment in the NMR spectrum which appears increasingly feasible should allow useful conclusions from high resolution protein NMR studies in the absence of knowledge of the tertiary or quaternary structure. Indeed the article on tropomyosin (Edwards and Sykes) goes some way in this direction although the analysis here is still con-

finied to the aromatic residues of the protein.

The utility of a multinuclear approach and of isotopic substitution in the protein to be studied is well illustrated by the accounts of the data obtained for dihydrofolate reductase (Roberts, Feeny et al.) and gene-5 protein (Coleman and Armitage) although one does wonder to what extent the biosynthetic isotopic substitution method will be generally applicable.

2. The second category of articles which come primarily from the Oxford Enzyme Group concerns the use of NMR to investigate intact organelles, tissues and in some cases organisms using ^1H and ^{31}P NMR. These studies are of particular interest to those interested in metabolism and metabolic control since they have the potential to examine these processes without the need for destructive analyses. At present the time and concentration resolution of the NMR analyses is not adequate to provide much information of interest but the potential clearly exists given appropriate advances in instrumentation. Even at this stage the NMR studies have provided evidence for the presence of unknown intermediates at relatively high concentration and in this way has stimulated further work on the metabolism of the tissues concerned.

In the context of both categories it is useful to have abstracts deriving from the poster presentations at the meeting which give a further idea of the range of systems to which NMR can usefully be applied, while in the Preface the Editors provide a useful summary of the meeting of the sort of questions which they hope may be answered by these techniques in the next decade. As a non-specialist but one who has a passing familiarity with NMR in biological systems I found this book of much interest and hope it will be widely available to both students and research workers.

M. C. Scrutton

Physical Chemistry and Its Biological Applications presents the basic principles of physical chemistry and shows how the methods of physical chemistry are being applied to increase understanding of living systems. Chapters 1 and 2 of the book discuss states of matter and solutions of nonelectrolytes. Chapters 3 to 5 examine laws in thermodynamics and solutions of electrolytes. This book is useful to biological scientists for self-study and reference. With modest additions of mathematical material by the teacher, the book should also be suitable for a full-year major's course in physical chemistry. Table of Contents. 1/States of Matter.