

BOOK REVIEWS

Principles of Protein Structure

by G. E. Schulz and R. H. Schirmer

Springer-Verlag; Berlin, Heidelberg, New York, 1979

x + 314 pages. DM 54.00, \$29.70

Sperm whale myoglobin was the first crystalline protein for which a high resolution structure was obtained by X-ray analysis. This work by Kendrew and colleagues, published in 1960 and 1961 (*Nature* 185 (1960) 422 and 190 (1961) 665) was a landmark in our study of proteins and, indeed, of Biochemistry. It showed that, given an ability to crystallize in a suitable form, the structure of any protein could, in principle, be determined. It also showed that, as a reward for their labours, protein crystallographers might expect that knowledge of protein structure could provide insight into how proteins function biologically. Now, some twenty years and over seventy protein structures later, it seems a suitable moment to take stock and see what generalisations can be made about the structures we now know and to what extent such generalisations may have predictive value for those that we do not (especially for those which may never be crystallized).

Drs. Schulz and Schirmer have carried out this stock-taking to admirable effect. This is a wide-ranging, readable, yet scholarly work, backed up with an excellent collection of over 800 references. It can be read or dipped into. Each chapter is divided into sections and sub-sections, headed in bold type, and carries a summary at the end. Although, as the authors indicate in their preface, chapters can be read in any order, they follow a reasonably logical sequence. Starting with amino acids and their side chain properties, the book continues with the peptide bond, non-covalent forces, patterns of folding and association of polypeptide chains and the prediction of secondary structure. These chapters are far from being purely descriptive. As the title of the book implies, the authors probe deeper, attempting to provide answers to questions such as why α -amino acids are used in proteins and not β -, why aromatic groups are always attached to the main chain through a methylene group, why peptides normally have the *trans* configuration, why β -pleated sheet structures usually have a left-handed twist (when viewed along the sheet perpendicular to the strands) and the $\beta\zeta\beta$ unit is usually right-handed, why polypeptide chains in proteins contain no knots, but often fold in repeating structures or domains, to what extent sequence information can lead to successful prediction of secondary structure. A wealth of background material is provided to show how answers to these and many other questions may be reached.

After these first 6 chapters, chapter 7 on *Models, Displays and the Documentation of Protein Structures* may

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seem a digression. In this the relative merits of different types of structural representation (three-dimensional models, computer graphics, stereo pictures, cartoons) are discussed. Chapter 8 covers the thermodynamics and kinetics of chain folding, a process which must be understood if useful structural predictions from amino acid sequences are to be made. Protein evolution, an underlying theme in much of the books, also receives a separate chapter. This chapter deals with criteria for establishing phylogenetic trees relating proteins of similar function in different organisms (speciation), the diversification of function of homologous proteins (differentiation) and convergence to similar function or topology of different proteins. Several examples are given of probable evolutionary relationships based on comparisons of sequence and chain fold, perhaps the most interesting of which is the Ig-domain of immunoglobulins and HL-A antigens (which show sequence homology) and a similar fold found in cytosolic superoxide dismutase (which does not). In the final chapters protein-ligand interactions, exemplified by haem proteins and nucleotide binding proteins, and protein function are dis-

cussed. Again both specific examples and generalisations are given: mechanisms of chymotrypsin, papain and glyceraldehyde-3 phosphate-dehydrogenase are compared and factors contributing to rate acceleration in enzymic reactions are assessed. Finally the point is made that functions of individual proteins must ultimately be related to the performance of biological systems as a whole and muscle is given as an example.

This book will be invaluable to anyone working in, or even just interested in, the field of protein structure and function in the widest sense, including established research workers, postgraduates and undergraduates. Although it does not deal with specific proteins in great detail (that is not its purpose), the references are there. It is well, if not superbly illustrated, but this keeps the price down to a figure, which though high, is perhaps manageable. Those who do buy it, will find it not just an adornment for their shelves, but a book to use.

Pauline M. Harrison

The Nature of Enzymology

by R. L. Foster

Croom Helm; London, 1979

xii + 384 pages. £19.95 (hardback), £9.95 (paperback)

The author of this book set out to produce a work that might be regarded as 'all things to all those interested in enzymes'. This implies an enormous coverage in approx. 400 pages, a most daunting task. The range of subject matter does indeed cover almost all that could conceivably have been included. The only serious omission that is apparent is the absence of discussion of coenzyme mechanisms, in particular those which involve pyridoxal and thiamine.

The book is divided into two halves: the first half covers what might be described as 'classical' enzymology, including chapters which cover such topics as chemical catalysis, protein structure, enzyme kinetics and detailed enzyme mechanisms; the second half of the book is distinctly more original in content and has

chapters on enzyme physiology and technology as well as medical enzymology. The chapters on enzyme technology and medical enzymology are both welcome and well-presented. These topics are not usually covered in textbooks of enzymology and serve to distinguish this book from most others. The chapter on enzyme physiology contains much information that can be found in the standard textbooks of biochemistry and represents rather an amorphous collection of facts.

On rather numerous occasions the author has provided somewhat inadequate cover of important topics. Everything is mentioned but often in such a brief fashion as to render its value doubtful. Little attention is paid to practical aspects and often difficulties