Glories of protein structure

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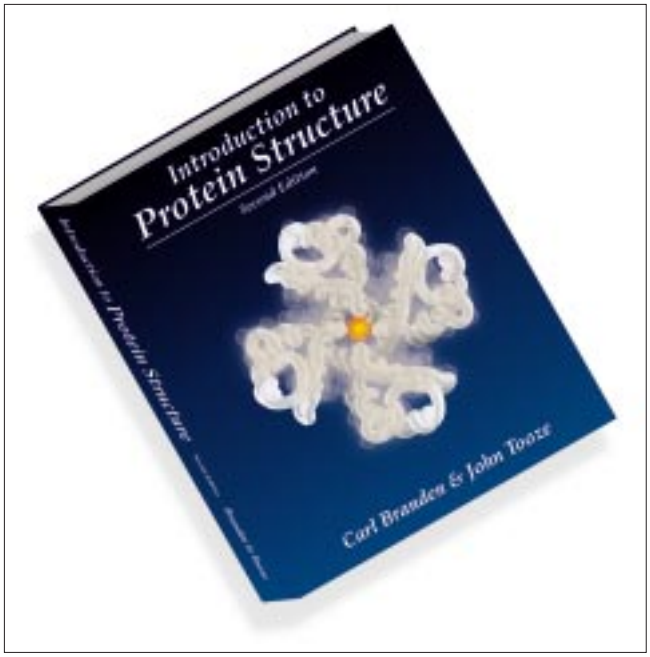
Introduction to Protein Structure (2nd edition) by Carl Branden and John Tooze, Garland Publishing, New York, 1999, 410 pp. £29.95, $47.95 ISBN 0-8153-2305-0 (paperback); £55.00, $72.95 ISBN 0-8153-2304-2 (hard cover).



When the history of 20th century science is written, surely the chapter on determining the structure of molecules by X-ray crystallography, NMR, and electron microscopy will be one of the most prominent, with the structures of proteins and viruses being the culminating glory. No current book illustrates and explains these glories more effectively and concisely than Branden and Tooze's second edition of their fine text.

The second edition has the look, feel, and thickness of the first, even though it has a third more pages. Four new chapters have been added, and two old ones deleted. The first third of the book is again on basic principles of structure, and retains its clarity in describing these basic concepts. This unit contains a new chapter on folding and flexibility, offering discussions of kinetics and energetics of folding, chaperone-assisted folding, and allostery — subjects short-changed in the first edition. The old chapter Antiparallel Beta Structures has been generalized to Beta Structures by adding drawings and discussion of the the beautiful β helices, first seen in Frances Jurnak's lab. This unit on principles, and the final chapter on methods of structure determination, make this text suitable in the USA for an undergraduate course on proteins, or as a supplement in a course for first year graduate students.

In the main part of the book on Structure, Function, and Engineering, the description of DNA-binding proteins and transcription factors has been greatly expanded, with the addition of a third chapter to cover all of the main families of transcription factors. Membrane proteins now get twice the attention they received in the first edition, with more detail on the mechanism of bacteriorhodopsin and engaging diagrams of porins, the potassium channel, and light-harvesting proteins.

Signal transduction now earns a full chapter. G proteins are given their due, and there is a well-illustrated segment on the receptors for human growth hormone. SH2 and SH3 domains and their ligands are used to illustrate concepts of signal transduction.

Also promoted to a full chapter are the fibrous proteins. Coiled coils are of course featured here, as is collagen and the components of muscle for which we now have the breathtakingly complex structures of actin from Kabsch, Holmes and Schutt and of myosin from Rayment. This chapter concludes, as do several others, with a physiological example. In this case it is on ATP in muscular contraction and the parallels to GTP in G-protein activation.

A slightly expanded chapter on Prediction, Engineering and Design of Protein Structures gives a balanced view of the role of computational and energetic approaches to protein structure and function. Up to date topics are included, such as fold assignment, phage display, and conversion of an α structure to a β structure by Lynne Regan.

What is missing from this clear, comprehensive and lavishly illustrated introduction? To me there is over-reliance on the arrows-and-cylinders representation of proteins, popularized by the pioneering work of Jane Richardson. True, these diagrams display the path of the protein backbone in a way that is not easy to see in other modes of display, and they also encode the pattern of mainchain hydrogen bonds. Here they are again rendered in the unintimidating faux-colored-pencil style of the earlier edition. But they are in such preponderance in this book that a student is apt to forget that proteins are packed

solid with atoms, whose interactions determine the stability and function of the molecules. To some extent, the paucity of atomic-level representations is compensated by the availability of the Kinemage Supplement on CD by Jane and David Richardson.

Furthermore, although the text is outstanding in its presentation of the beauty and significance of protein structures, the biophysical underpinnings do not come through. Given that the only equation of the text is Bragg's law, the beauty and power of the methods must evade its student readers. Clearly the authors have decided that their mission is to recruit the next generation of cell biologists, not biophysicists.

Despite these minor complaints, I have ordered Branden and Tooze for my course. I look forward to using it, and think that my students will be lucky to read this concise introduction to the glorious structural science of proteins.