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book reviews

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Perspectives in structural biology. Edited by M. Vijayan, N. Yathindra & A. S. Kolaskar. Hyderabad: Universities Press (India) Ltd, 2000. Pp. xv + 746. ISBN 81 7371 254 9.

This volume celebrates the scientific career of Professor G. N. Ramachandran, a world leader in studies of structural biology. He is remembered with respect by each author who presents a Ramachandran plot to referees for Section D of *Acta Crystallographica* because, as the editors note in their preface, 'the Ramachandran plot remains the simplest and most commonly used descriptor and tool for validation of protein structures'. The trio of editors have produced an excellent volume in Ramachandran's honor and I recommended it highly to all our readers.

Articles are presented on subjects that reflect the diverse interests of this distinguished scientist. Some of these, and Ramachandran's approach to them, are identified by Dr N. Kumar, President of the Indian Academy of Sciences, in a foreward: Ramachandran's 'penchant for enunciating general principles, leaving details to be filled in later by others, is discernible in his outstanding contributions to crystallography, conformational analyses and image reconstruction'. To these topics may be added his interests in and contributions to the study of structure and function, and pattern recognition.

Professor G. N. Ramachandran, born in 1922, was educated in Kerala, South India and, after obtaining a BSc in physics, did graduate work with Sir C. V. Raman at the Indian Institute of Science in Bangalore. He then worked in Cambridge, England with Sir Lawrence Bragg and obtained a second doctorate with Professor W. A. Wooster in 1949. He then returned to India, going first to Madras where he established a physics department and then in 1970 to Bangalore, where he set up the Molecular Biophysics Unit at the Indian Institute of Science.

This volume illustrates the present breadth and depth of structural biology and the role that G. N. Ramachandran played in making this possible. It begins, to my great joy, with an article on the stereochemical mechanism of cooperative effects in hemoglobin, an up-to-date analysis of the mechanism with Max Perutz as first author (reprinted with permission from the *Annual Review of Biophysics and Biomolecular Structure*, 1998). It is stated that 'almost every feature of this mechanism has been disputed, but evidence that has come to light more than 25 years later now shows it to have been substantially correct'. Then follows an article by John Kuriyan on the cell-signaling Src-family tyrosine kinases and their SH2 and SH3 regulatory domains that are involved in cellular recognition. He describes how the SH3 domain binds to peptide segments that adopt a left-handed helical configuration known as a polyproline type II helix; this helix is similar but not identical to individual strands of the triple helix of collagen for which Ramachandran and Kartha proposed a model in 1955. Structural details of some SH2 and SH3 interactions are provided in colored diagrams of various types (an excellent feature of this volume).

There are several other articles on molecular recognition including one on molecular mimicry (structural homology) and its implications for the immune response. For example, parasites can evolve antigens that mimic essential host molecules, thereby leading to autoimmune disorders in the host. Some interesting cases and their consequences are provided. Another medically relevant article covers the effects of phenols on the assembly and stability of insulin. Phenol is generally used in insulin preparations as an antibacterial preservative and it is shown to stabilize the R6 insulin hexamer. The interactions of mutant monomeric insulins with hexamer-stabilizing phenol are described by way of crystal structure analyses. A wide variety of other protein structures are described including examples of acetate ligand binding to proteins (again beautifully illustrated) and crystal structures of several mutant enzymes, loop conformations, a snake neutrotoxin, ribosome-inactivating proteins and aminoacyl-tRNA synthetases.

A section then follows containing two articles on collagen structure: one on the Ramachandran triple helix (1955) revisited and the other on water mediation of hydrogen bonds in collagen. In the collagen structure 'each of the three polypeptide chains with an approximate threefold symmetry' folds into 'left-handed helices' and each one of these undergoes 'further coiling in a right-handed fashion about a common axis to form a coiled coil'. Some conformational flexibility in this triple helix is now evident, but all of the structures examined confirm the original model of Ramachandran and Kartha.

The conformational stability of proteins and nucleic acids is described and the significance and variability in the regions in the Ramachandran plot are analyzed. This brings us to an article on the molten globule, including that of apomyoglobin, and then to an article on *de novo* protein design. There are also notable chapters on light-harvesting complexes of purple bacteria and on the biophysical properties of calcium channels. Virus structure is exemplified by articles on physalis mottle tymovirus and is augmented by descriptions of structural work on RNA (including mismatches), DNA and the hammerhead ribozyme. Methods of improving the solution of the phase problem and of using neutron diffraction in protein structure provide icing on the cake. This volume is highly recommended and is a bargain for students, teachers and researchers alike. The editors are to be congratulated on seeking to keep its cost to an affordable level. It can serve to inspire many young would-be crystallographers, demonstrating what a diverse scientific discipline they are entering or are part of.

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