Book Reviews

Foundations of Modern Biochemistry. Volume 4. More Landmarks in Biochemistry. Edited by Margery G. Ord and Lloyd A. Stocken (University of Oxford). Jai Press: Stamford, CT and London. 1998. x + 280 pp. $128.50. ISBN 0-7623-0351-4.

More Landmarks in Biochemistry, the fourth volume in this multivolume series, contains seven chapters describing novel developments in the understanding of biochemical processes, ranging from the genetic basis of antibody diversity to plant hormones, nitrogen fixation, and ion pumps. As with previous volumes in this series, this reviewer was fascinated to examine the thought processes and imaginations of our scientific predecessors who lacked the sophisticated equipment and computer analyses taken for granted by experimental biologists today. For more senior scientists, reading some of these chapters will resemble glancing through a photo album of one's childhood and adolescence. For current biochemists and life scientists, however, a reminder of the intellectual leaps and conclusions made by these pioneers is, indeed, humbling.

The first and longest chapter, *Antibody Specificity and Diversity, Part II: The Genes*, by Lisa A. Steiner, continues the history of research on antibody diversity from the previous volume, focused on the development of the concept that antibody proteins contained both constant and variable regions. In this chapter, the experimental approaches of the past 20 years, describing the genetic basis for this diversity, are summarized in detail. The development of the concept that gene rearrangement accounted for the diversity and specificity of antibodies is explored in depth, as is the molecular mechanism of recombination. In general, progress in this complicated field has been amazing.

The second chapter, entitled *From Transplant to Transcript*, describes the outstanding progress in embryology from the original discovery of the "organizer" in the 1930s to the current status of the genetic basis of development. The studies of limb development in the frog and chicken embryo using transplantation are discussed because the experiments eventually resulted in the identification of the signal molecules 20 years later. More recent experiments that resulted in the correlation of the *hedgehog* gene in vertebrates including zebrafish, mice and chicks to the Drosophila gene demonstrated the universality of the genetic basis of development. Even more fascinating is the observation that studies of frog transplants and fly transcripts have led to important correlations between experimental embryology and clinical genetics in humans.

In a subsequent chapter, the history of research on DNA repair mechanisms is traced from the original observation, by Muller, that X-rays lead to mutations in Drosophila and to cancer in humans to the current research on enzymatic mechanisms of repair. The experimental approaches to repair mechanisms including excision, mismatch, recombination, and SOS repair are summarized. Similarly, the chapter entitled *Evolution in an RNA World* traces the study of RNA as a catalyst from the original discovery in the 1980s, by Cech and Altman, that RNA cleavage could be catalyzed by an RNA molecule, the ribozyme. These scientists demonstrated that protein was *not* involved in either the self-splicing of Group I introns or the cleavage of precursor tRNAs by RNase P. These observations have led to the suggestion that RNA was the original biomolecule, as RNA is capable of both storing retrievable information and catalysis.

Two chapters summarize the experimental progress in the fields of nitrogen fixation and plant hormones. Since ancient times, humans have observed the restorative properties of legumes and the wisdom of crop rotation. Agricultural scientists and chemists in the early 19th century defined the elements in manure necessary for good crop growth and concluded that there was a need for nitrogen; however, the source of nitrogen was elusive. The slow progress in understanding the basic biochemistry of nitrogen fixation, difficult to study experimentally, was spurred by the oil crisis of the 1970s, which increased the cost of fertilizer and eventually led to the identification of the proteins and genes involved in the process. The other chapter devoted to plants traces the history of plant hormones from the initial discovery of auxin in 1928, although the role of auxin to enhance the rate of growth and extensibility in immature cells was not elucidated until the mid-1940s. The challenges and serendipitous discovery of other plant hormones, such as ethylene, gibberellin, and the cytokinins, are also covered in depth. More recent attempts to elucidate the mechanism of action of these hormones, especially to find their receptors, and the use of *Arbidopsis* as a genetic model conclude the discussion.

The final chapter, *Pumps, Channels, and Carriers: From "Active Patches" to Membrane Transport Proteins*, by Richard Boyd, explores the different mechanisms for the transport of solutes across cell membranes, as indicated in the chapter title. The chapter begins with a discussion of the original concept, published by Davson and Danielli in 1943, that solute permeability was not a general property of the plasma membrane but instead resided in "active patches" on the membrane. The experimental evidence by which these early studies led to the concept of facilitated diffusion catalyzed by carriers is summarized. The importance of the observation that the kinetics of transport is similar to enzyme kinetics is indicated. Other experimental approaches using excitable cells led to the discovery of ion channels, in which selective transport of K^+ and Na^+ ions was observed. The discovery of ionophores and the development of the patch clamp technique were essential to the further characterization of transport through channels. Current knowledge of the primary amino acid sequence of these channels has provided a breakthrough in the field of ion transport and should result in rapid progress in understanding the mechanism. Similar studies with nerve cells by Hodgkin and Keynes in the 1950s led to the concept of the sodium pump to explain the different distribution of ions across cell membranes. Subsequent application of these principles to nonexcitable cells as well as the notion of secondary active transport were key developments in the transport field.

This brief survey of the articles in this book will, I hope, provide examples to indicate that tracing the development of important concepts in biochemistry makes fascinating reading.

Diana S. Beattie, *West Virginia University School of Medicine*

JA9857864

10.1021/ja9857864

Protective Groups in Organic Synthesis. 3rd Edition. By Theodora W. Greene (The Rowland Institute for Science) and Peter G. M. Wuts (Pharmacia and Upjohn Company). John Wiley and Sons, Inc.: New York. 1999. xxi + 747 pp. $84.95. ISBN 0-471-16019-9.

The first and second editions of *Protective Groups in Organic Synthesis* have become an indispensable reference tool for a great many organic chemists. The third edition builds on the success of the previous editions by the inclusion of many new protecting groups (over 348 since the second edition) and two new sections on protection of alkyne C−H and phosphates. In total, 1050 protecting groups are covered, with 5350 references.

Topics covered include the protection of hydroxyls (including 1,2 and 1,3 diols), carboxyls, phenols, catchecols, carbonyls, amines (including imidazoles, pyrroles and indoles), thiols, alkyne C−H, and phosphates. Each class of protecting group is introduced by an overview of advantages and disadvantages. Coverage then extends to individual protecting groups, with a comprehensive index of conditions for formation and cleavage. It is here that the great usefulness of this book becomes apparent, as many very specific and unusual methods are included alongside the more general methods. Commentary is given on the stability of the protecting group to acid/base and other reagents where appropriate. The stabilities of some of the more widely used protecting groups to 108 common reagents are also presented in tabular form in the final chapter.

This book is an excellent reference tool and, as such, should find its way into many chemists' personal collections, as well as any library concerned with organic synthesis.

Robert A. Stockman, *University of East Anglia*

JA995719P

10.1021/ja997519p