

Preface

The authors and publishers are pleased to present the thirty-first edition of *Harper's Illustrated Biochemistry*. The first edition, entitled *Harper's Biochemistry*, was published in 1939 under the sole authorship of Dr Harold Harper at the University of California School of Medicine, San Francisco, California. Presently entitled *Harper's Illustrated Biochemistry*, the book continues, as originally intended, to provide a concise survey of aspects of biochemistry most relevant to the study of medicine. Various authors have contributed to subsequent editions of this medically oriented biochemistry text, which is now observing its 79th year.

Cover Illustration for the Thirty-first Edition

The illustration on the cover of the thirty-first edition, the structure of Zika virus protein determined at 3.8 Å resolution, was generously prepared and provided by Lei Sun. The supporting data appeared in: Sirohi D, Chen Z, Sun L, Klose T, Pierson TC, Rossmann MG, Kuhn RJ: "The 3.8 Å resolution cryo-EM structure of Zika virus protein", *Science* 2016;352:497-470. Together with the Zika virus, first recovered in the Zika valley of Uganda, the viruses responsible for yellow fever, West Nile fever, and dengue fever are members of the *Flaviviridae* family of positive-strand DNA viruses. The cover illustration indicates the resolving power of cryo-electron microscopy (cryo-EM). More importantly, it recognizes the medical significance of infection by the Zika virus, which in pregnant women can result in a significant risk of congenital microcephaly and associated severe mental impairment. While Zika virus typically is transmitted by the bite of an infected mosquito, emerging evidence suggests that under certain conditions the Zika virus may also be transmitted between human subjects.

Changes in the Thirty-first Edition

As always, *Harper's Illustrated Biochemistry* continues to emphasize the close relationship of biochemistry to the understanding of diseases, their pathology and the practice of medicine. The contents of most chapters have been updated and provide to the reader the most current and pertinent information. Toward that end, we have replaced Chapter 10 "Bioinformatics and Computational Biology," most of whose programs and topics (for example protein and nucleotide sequence comparisons and *in silico* approaches in drug design) are available on line or are now common knowledge. Its replacement, new Chapter 10 "Biochemistry of Transition Metals," incorporates material from several chapters, notably

those of blood cells and plasma, which contained extensive content on metal ion adsorption and trafficking, especially of iron and copper. Since approximately a third of all proteins are metalloproteins, new Chapter 10 explicitly addresses the importance and overall pervasiveness of transition metals. Given the overlap with the topics of protein structure and of enzyme reaction mechanisms, new Chapter 10 now follows the three chapters on enzymes as the final chapter in Section II, now renamed Enzymes: Kinetics, Mechanism, Regulation, & Role of Transition Metals.

Organization of the Book

All 58 chapters of the thirty-first edition place major emphasis on the medical relevance of biochemistry. Topics are organized under eleven major headings. Both to assist study and to facilitate retention of the contained information, Questions follow each Section. An Answer Bank follows the Appendix.

Section I includes a brief history of biochemistry, and emphasizes the interrelationships between biochemistry and medicine. Water, the importance of homeostasis of intracellular pH are reviewed, and the various orders of protein structure are addressed.

Section II begins with a chapter on hemoglobin. Four chapters next address the kinetics, mechanism of action, and metabolic regulation of enzymes, and the role of metal ions in multiple aspects of intermediary metabolism.

Section III addresses bioenergetics and the role of high energy phosphates in energy capture and transfer, the oxidation-reduction reactions involved in biologic oxidation, and metabolic details of energy capture via the respiratory chain and oxidative phosphorylation.

Section IV considers the metabolism of carbohydrates via glycolysis, the citric acid cycle, the pentose phosphate pathway, glycogen metabolism, gluconeogenesis, and the control of blood glucose.

Section V outlines the nature of simple and complex lipids, lipid transport and storage, the biosynthesis and degradation of fatty acids and more complex lipids, and the reactions and metabolic regulation of cholesterol biosynthesis and transport in human subjects.

Section VI discusses protein catabolism, urea biosynthesis, and the catabolism of amino acids and stresses the medically significant metabolic disorders associated with their incomplete catabolism. The final chapter considers the biochemistry of the porphyrins and bile pigments.

Section VII first outlines the structure and function of nucleotides and nucleic acids, then details DNA replication and repair, RNA synthesis and modification, protein synthesis, the principles of recombinant DNA technology, and the regulation of gene expression.

Section VIII considers aspects of extracellular and intracellular communication. Specific topics include membrane structure and function, the molecular bases of the actions of hormones, and signal transduction.

Sections IX, X, & XI address fourteen topics of significant medical importance.

Section IX discusses nutrition, digestion, and absorption, micronutrients including vitamins free radicals and antioxidants, glycoproteins, the metabolism of xenobiotics, and clinical biochemistry.

Section X addresses intracellular traffic and the sorting of proteins, the extracellular matrix, muscle and the cytoskeleton, plasma proteins and immunoglobulins, and the biochemistry of red cells and of white cells.

Section XI includes hemostasis and thrombosis, an overview of cancer, the biochemistry of aging, and a selection of case histories.

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Victor W. Rodwell

David A. Bender

Kathleen M. Botham

Peter J. Kennelly

P. Anthony Weil