

Preface

The authors and publishers are pleased to present the thirtieth 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 75th year.

Cover Illustration for the Thirtieth Edition

The illustration on the cover depicts the proteasome and the initial proteolytic degradation of an ubiquitinated intracellular protein. The proteasome consists of a macromolecular complex of 14 α and 14 β subunits (shown green and yellow, respectively) arranged as four stacked $\alpha, \beta, \beta, \alpha$ rings. These form a hollow, tube-like chamber that contains immobilized proteases. A polypeptide tagged for degradation (shown red) enters the proteasome (top left) and is hydrolyzed into peptide fragments by internal proteases of the proteasome. Following their exit from the proteasome (bottom, right), extracellular proteases degrade these peptide fragments to amino acids.

The timely and controlled degradation of intracellular proteins is critical to such fundamental biological processes as cell differentiation and division. The ability to recognize and dispose of denatured or damaged proteins is essential to health, since the accumulation of protein aggregates contributes significantly to the etiology of a variety of human diseases, including numerous neurological disorders. For the discovery of ubiquitin-mediated protein degradation, Aaron Ciechanover and Avram Herskko of Israel and Irwin Rose of the United States were awarded the 2004 Nobel Prize in Chemistry.

Changes in the Thirtieth Edition

The 30th Anniversary edition of *Harper's Illustrated Biochemistry* continues its timely, integrated updating of biochemical knowledge, with repeated emphasis on its relationship to genetic diseases, clinical information, and the practice of medicine. This edition includes new full-color illustrations and tables, and numerous medically-relevant examples that present a clear and succinct review of those fundamentals of

biochemistry that a student needs to understand for success in medical school. In addition to timely updating of content, the order of presentation of concepts has undergone major revision. The present 58 chapters are organized under an expanded list of eleven Sections. Chapters and topics in these sections emphasize integrated coverage of biochemical disease and clinical information. A major change has been that following the retirement of Dr. Murray, authorship and revision of his thirteen chapters have been assumed by Drs. Bender, Botham, Kennelly and Rodwell. For example, Section X contains a new chapter on white blood cells, and Section XI features nine entirely new, open-ended clinical case problems that emphasize clinical relevance and test both knowledge and understanding. To facilitate a student's grasp of each group of concepts, Question Sets now appear after each of the eleven new Sections. Many new questions have been added, and an Answer Bank follows the last chapter. New to this edition is the Answer Bank's inclusion of comprehensive explanations of many answers.

Organization of the Book

All 58 chapters of the thirtieth edition place major emphasis on the medical relevance of biochemistry. Topics are organized under eleven major headings. To facilitate retention of the contained information, Questions follow each Section and an Answer Bank follows the Appendix.

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

Section II begins with a chapter on hemoglobin, three chapters address the kinetics, mechanism of action, and metabolic regulation of enzymes. A chapter on Bioinformatics and Computational Biology reflects the ever-increasing importance of these topics in modern biochemistry, biology, and medicine.

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, and the biochemistry of aging.

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