Preface

The authors and publishers are pleased to present the thirty-third edition of *Harper's Illustrated Biochemistry*. Now in its 86th year, the first edition of what was then titled *Review of Physiological Chemistry*, was published in 1939 with Jack Frame as sole author. Several years later, in 1944, a new edition appeared authored by Dr. John Lange. The third edition marked the beginning of Dr. Harold Harper's as author, succeeding Frame and Lange. Harper fulfilled this role through to the 17th edition, which was published in 1977. 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, including Victor W. Rodwell, who passed away in fall of 2022.

Cover Illustration for the Thirty-Third Edition

The cover illustration recognizes a major advance in biomedicine that took place in response to the global COVID-19 pandemic, the advent of RNA-based vaccines, which activate the patient's immune response via the endogenous expression of genetically encoded antigens, rather than the physical injection of a non-infectious antigen. The image at the upper left depicts one of injected nanoparticles used to deliver copies of nonreplicating mRNA to the host cells in which antigen synthesis takes place. The RNA molecules, shown in magenta, are each encapsulated within a lipid vesicle whose monolayer membrane consists primarily of phospholipids (Blue), ionizable lipids (Pale Yellow), with a few molecules of cholesterol (Greenish-yellow). Several of these vesicles are nested inside a second, larger vesicle whose lipid monolayer contains neutral lipids (Green) and lipid-conjugated polyethylene glycol moieties (Lavender) in addition to phospholipids and ionizable lipids. The lower portion of the illustration depicts in schematic form the major steps in the overall process, starting with the viral spike protein and ending up with the production of immunizing antibodies.

Changes in the Thirty-Third 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. In addition to incorporating new knowledge and techniques, a major goal of the 33rd edition was to respond to student requests for more tools to aid them in their studies. As a consequence, the number of questions has been increased to nearly double that of the 32nd edition, while each chapter will now feature new Key Point Summaries at the end. Our second major goal was to reduce the potential impact of these new additions by reducing the book's overall length. This was achieved in part by eliminating or combining redundant tables and figures, careful editing, and elimination of several of five chapters devoted to special topics that had appeared in previous edition. In so doing, our overriding objective was to maintain *Harper's* historic focus on foundational knowledge and fundamental principles of biochemistry and molecular biology that underly the functioning of the human body in both health and disease.

Organization of the Book

All 53 chapters of the thirty-third edition place major emphasis on the medical relevance of biochemistry. Topics are organized under 10 major headings. In order to assist study and to facilitate retention of the contained information, Questions follow each section. An Answer Bank follows Chapter 53.

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

Section II begins with a chapter on hemoglobin. The next four chapters address the mechanism of action, kinetics, 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 in this section considers the biochemistry of the porphyrins and bile pigments.

Section VII first outlines the structure and function of nucleotides and nucleic acids, and 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.

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

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.

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