

PREFACE

In writing this seventh edition of *Biochemistry*, we have balanced the desire to present up-to-the minute advances with the need to make biochemistry as clear and engaging as possible for the student approaching the subject for the first time. Instructors and students have long relied on *Biochemistry* for:

- **Clear writing** The language of biochemistry is made as accessible as possible. A straightforward and logical organization leads the reader through processes and helps navigate complex pathways and mechanisms.
- **Single-concept illustrations** Illustrations in this book address one point at a time so that each illustration clearly tells the story of a mechanism, pathway, or process without the distraction of excess detail.
- **Physiological relevance** Biochemistry is the study of life on the smallest scale, and it has always been our goal to help students connect biochemistry to their own lives. Pathways and processes are presented in a physiological context so that the reader can see how biochemistry works in different parts of the body and under different environmental and hormonal conditions.
- **Clinical insights** Wherever appropriate, pathways and mechanisms are applied to health and disease. These applications show students how biochemistry is relevant to them while reinforcing the concepts that they have just learned. (For a full list, see p. xi.)
- **Evolutionary perspective** Evolution is evident in the structures and pathways of biochemistry and is woven into the narrative of the textbook. (For a full list, see p. x.)

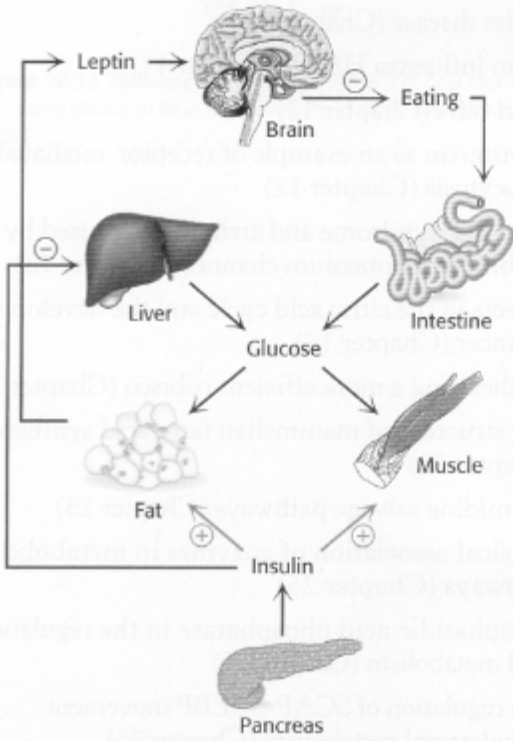
New to This Edition

Researchers are making new discoveries in biochemistry every day. The seventh edition takes into account the discoveries that have changed how we think about the fundamental concepts in biochemistry and human health. New aspects of the book include:

- **Metabolism integrated in a new context** New information about the role of leptins in hunger and satiety has greatly influenced how we think about obesity and the growing epidemic of diabetes. In this edition, we cover the integration of metabolism in the context of diet and obesity.
- **New chapters on gene regulation** To relate to the rapidly growing understanding of the biochemical aspect of eukaryotic gene regulation,

we have greatly expanded our discussion of regulation and have split the chapter in the preceding editions into two: Chapter 31, “The Control of Gene Expression in Prokaryotes,” and Chapter 32, “The Control of Gene Expression in Eukaryotes.” These chapters address recent discoveries such as quorum sensing in prokaryotes, induced pluripotent stem cells, and the role of microRNAs in regulating gene expression.

- **Experimental techniques updated and clarified** We have revised Chapters 3 (“Exploring Proteins and Proteomes”), 5 (“Exploring Genes and Genomes”), and 6 (“Exploring Evolution and Bioinformatics”) to give students a practical understanding of the benefits and limitations of the techniques that they will be using in the laboratory. We have expanded explanations of mass spectrometry and x-ray crystallography, for instance, and made them even clearer for the first-time student. We explain new techniques such as next-generation sequencing and real-time PCR in the context of their importance to modern research in biochemistry. (For a full list, see p. xii.)



Chapter 27 A schematic representation illustrates a few of the many metabolic pathways that must be coordinated to meet the demands of living.

Recent Advances

Some of the exciting advances and new topics that we present in the seventh edition include:

- Osteogenesis imperfecta, or brittle bone disease (Chapter 2)
- Intrinsically unstructured proteins and metamorphic proteins (Chapter 2)
- Recent updates in protein-misfolding diseases (Chapter 2)
- The use of recombinant DNA technology in protein purification (Chapter 3)
- Expanded discussion of mass spectrometry and x-ray crystallography (Chapter 3)
- Next-generation sequencing methods (Chapter 5)
- Real-time PCR (Chapter 5)
- DNA microarrays (Chapter 5)
- Carbon monoxide poisoning (Chapter 7)
- Single-molecule studies of enzyme kinetics (Chapter 8)
- Myosins as a model of a catalytic strategy for ATP hydrolysis (Chapter 9)
- Glycobiology and glycomics (Chapter 11)
- Hurler disease (Chapter 11)
- Avian influenza H5N1 (Chapter 11)
- Lipid rafts (Chapter 12)
- Transferrin as an example of receptor-mediated endocytosis (Chapter 12)
- Long QT syndrome and arrhythmia caused by the inhibition of potassium channels (Chapter 13)
- Defects in the citric acid cycle and the development of cancer (Chapter 17)
- Synthesizing a more efficient rubisco (Chapter 20)
- The structure of mammalian fatty acid synthetase (Chapter 22)
- Pyrimidine salvage pathways (Chapter 25)
- Physical association of enzymes in metabolic pathways (Chapter 25)
- Phosphatidic acid phosphatase in the regulation of lipid metabolism (Chapter 26)
- The regulation of SCAP-SREBP movement in cholesterol metabolism (Chapter 26)
- Mutations in the LDL receptor (Chapter 26)
- The role of HDL in protecting against arteriosclerosis (Chapter 26)

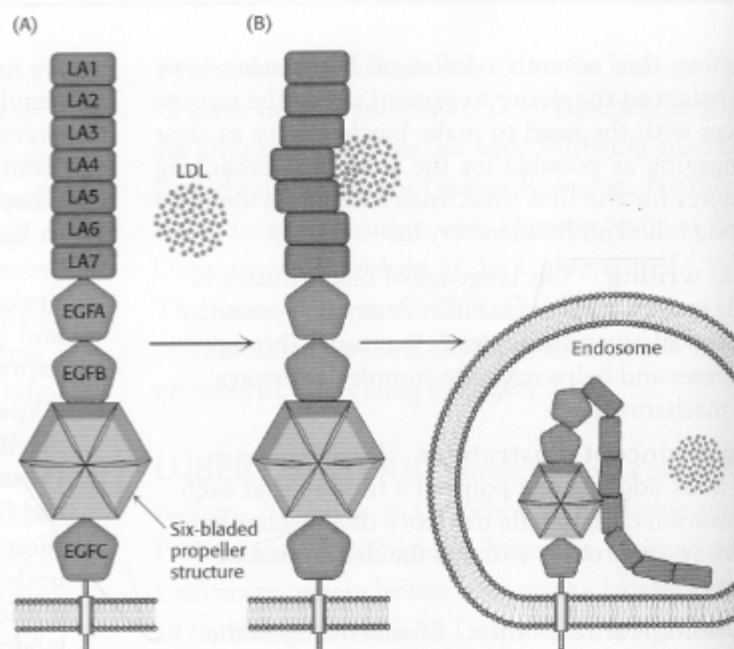


Figure 26.24 LDL receptor releases LDL in the endosomes. [After I. D. C. *Biochem. Soc. Trans.* 31:1107–1114, 2003, Fig 1A.]

- Aromatase inhibitors in the treatment of breast ovarian cancer (Chapter 26)
- The role of leptin in long-term caloric homeostasis (Chapter 27)
- Obesity and diabetes (Chapter 27)
- Exercise and its effects on cellular biochemistry (Chapter 27)
- Updated detailed mechanism of helicase's action (Chapter 28)
- Updated detailed mechanism of topoisomerase action (Chapter 28)
- Riboswitches (Chapter 29)
- The production of small regulatory RNAs (Chapter 30)
- Vanishing white matter disease (Chapter 30)
- Quorum sensing (Chapter 31)
- Biofilms (Chapter 31)
- Induced pluripotent stem cells (Chapter 32)
- The role of microRNAs in gene regulation (Chapter 32)
- How vaccines work (Chapter 34)
- The structure of myosin head domains (Chapter 34)

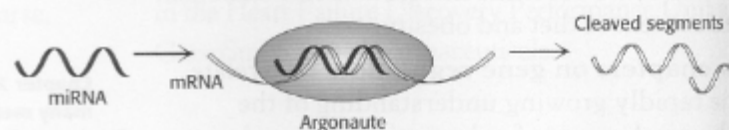


Figure 32.27 MicroRNA action.

New End-of-Chapter Problems

Biochemistry is best learned by practicing it. In addition to many traditional problems that test biochemical knowledge and the ability to use this knowledge, we have three categories of problems to address specific problem-solving skills.

- **Mechanism problems** ask students to suggest or elaborate a chemical mechanism.
- **Data interpretation problems** ask questions about a set of data provided in tabulated or graphic form. These problems give students a sense of how scientific conclusions are reached.
- **Chapter integration problems** require students to use information from several chapters to reach a solution. These problems reinforce a student's awareness of the interconnectedness of the different aspects of biochemistry.

Brief answers to these problems are presented at the end of the book; expanded solutions are available in the accompanying *Student Companion*.

Visualizing Molecular Structure

All molecular structures have been selected and rendered by Jeremy Berg and Gregory Gatto. To help students read and understand these structures, we include the following tools:

- A **molecular-model “primer”** explains the different types of protein models and examines their strengths and weaknesses (see appendices to Chapters 1 and 2).
- **Figure legends** direct students explicitly to the key features of a model.

- A **great variety of types of molecular structures** are represented, including clearer renderings of membrane proteins.
- For most molecular models, the **PDB number** at the end of the figure legend gives the reader easy access to the file used in generating the structure from the Protein Data Bank Web site (www.pdb.org). At this site, a variety of tools for visualizing and analyzing the structure are available.
- **Living figures** for most molecular structures now appear on the Web site in Jmol to allow students to **rotate three-dimensional molecules** and view alternative renderings online.

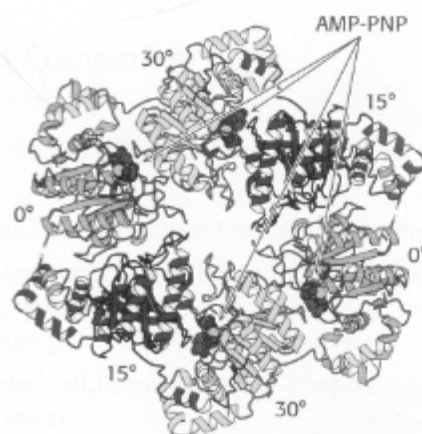


Figure 28.12 Helicase asymmetry. Notice that only four of the subunits, those shown in blue and yellow, bind AMP-PNP. [Drawn from 1EOK.pdb.]