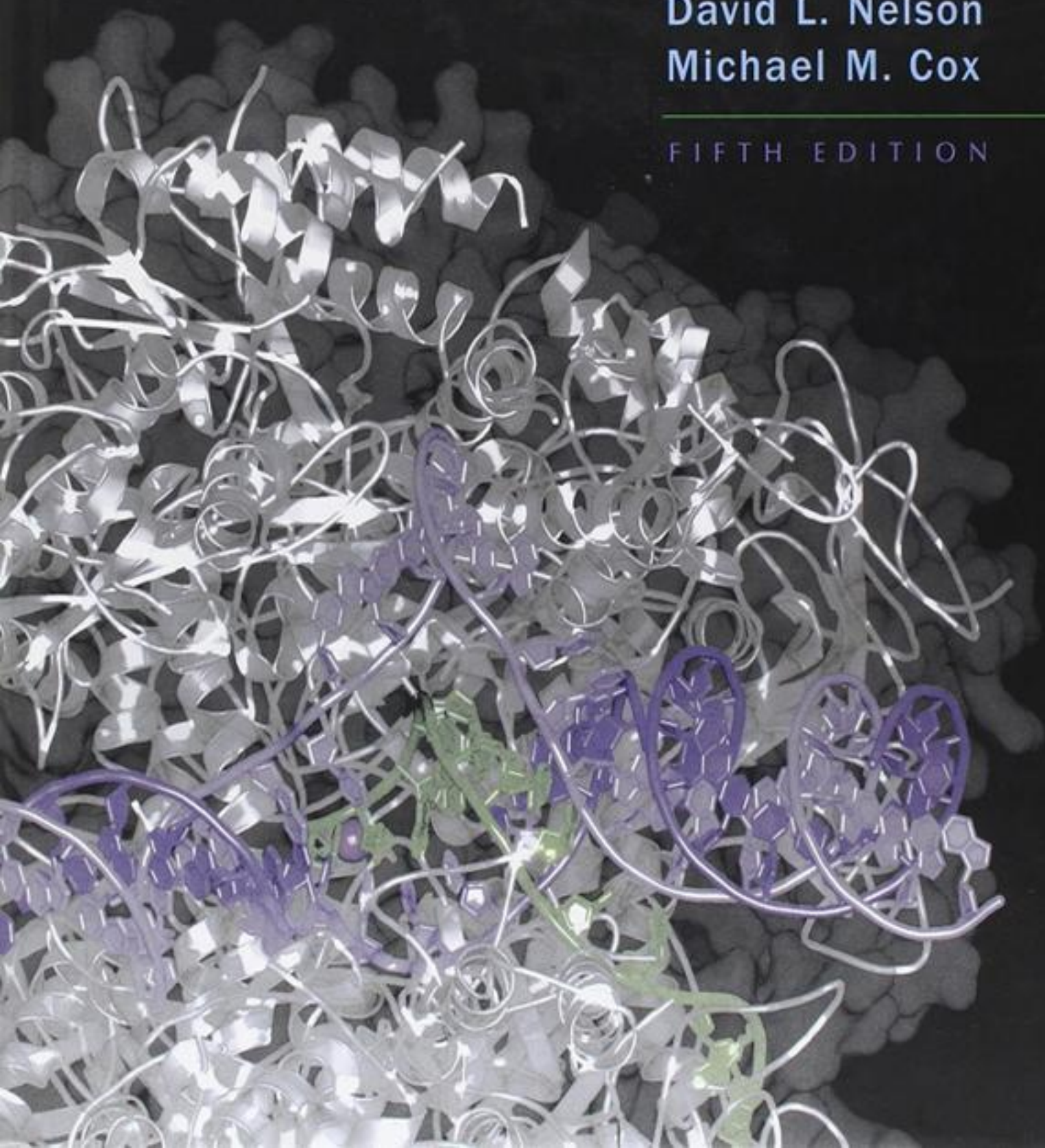


LEHNINGER

PRINCIPLES OF BIOCHEMISTRY

David L. Nelson
Michael M. Cox

FIFTH EDITION



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Sample Chapters and Art for **Lehninger Principles of Biochemistry**, Fourth Edition

The classic introduction to biochemistry.

*****Sample Chapters: Note: The sample chapters here are uncorrected page proofs. Chapters are being reviewed a final time before publication.*****

PART I. STRUCTURE AND CATALYSIS

Chapter 1: **The Foundations of Biochemistry**

Distilled and reorganized from Chapters 1 to 3 of the previous edition, this overview provides a refresher on the cellular, chemical, physical, genetic, and evolutionary background to biochemistry, while orienting students toward what is unique about biochemistry.

Chapter 2: **Water**

Includes new coverage of the concept of protein-bound water, illustrated with molecular graphics.

Chapter 3: **Amino Acids, Peptides, and Proteins**

Adds important new material on genomics and proteomics and their implications for the study of protein structure, function, and evolution.

Chapter 4: **The Three-Dimensional Structure of Proteins**

Adds a new box on scurvy.

Chapter 5: **Protein Function**

Adds a new box on carbon monoxide poisoning.

Chapter 6: **Enzymes**

Offers a revised presentation of the mechanism of chymotrypsin (the first reaction mechanism in the book), featuring a two-page figure that takes students through this particular mechanism, while serving as a step-by-step guide to interpreting any reaction mechanism. Features new coverage of the mechanism for lysozyme including the controversial aspects of the mechanism and currently favored resolution based on work published in 2001.

Chapter 7: **Carbohydrates and Glycobiology**

Includes new section on polysaccharide conformations. A striking new discussion of the "sugar code" looks at polysaccharides as informational molecules, with detailed discussions of lectins, selectins, and oligosaccharide-bearing hormones. Features new material on structural heteropolysaccharides and proteoglycans. Covers recent techniques for carbohydrate analysis.

Chapter 8: **Nucleotides and Nucleic Acids**

Chapter 9: **DNA-Based Information Technologies**

Introduces the human genome. Biochemical insights derived from the human genome are integrated throughout the text. Tracking the emergence of genomics and proteomics, this chapter establishes DNA technology as a core topic and a path to understanding metabolism, signaling, and other topics covered in the middle chapters of this edition. Includes up-to-date coverage of microarrays, protein chips, comparative genomics, and techniques in cloning and analysis.

Chapter 10: **Lipids**

Integrates new topics specific to chloroplasts and archaebacteria. Adds material on lipids as signal molecules.

Chapter 11: **Biological Membranes and Transport**

Includes a description of membrane rafts and microdomains within membranes, and a new box on the use of atomic force microscopy to visualize them. Looks at the role of caveolins in the formation of membrane caveolae. Covers the investigation of hop diffusion of membrane lipids using FRAP (fluorescence recovery after photobleaching). Adds new details to the discussion of the mechanism of Ca²⁺-ATPase (SERCA pump), revealed by the recently available high-resolution view of its structure. Explores new facets of the mechanisms of the K⁺ selectivity filter, brought to light by recent high-resolution structures of the K⁺ channel. Illuminates the structure, role, and mechanism of aquaporins with important new details. Describes ABC transporters, with particular attention to the multidrug

transporter (MDR1). Includes the newly solved structure of the lactose transporter of *E. coli*.

Chapter 12: **Biosignaling**

Updates the previous edition's groundbreaking chapter to chart the continuing rapid development of signaling research. Includes discussion on general mechanisms for activation of protein kinases in cascades. Now covers the roles of membrane rafts and caveolae in signaling pathways, including the activities of AKAPs (A Kinase Anchoring Proteins) and other scaffold proteins. Examines the nature and conservation of families of multivalent protein binding modules, which combine to create many discrete signaling pathways. Adds a new discussion of signaling in plants and bacteria, with comparison to mammalian signaling pathways. Features a new box on visualizing biochemistry with fluorescence resonance energy transfer (FRET) with green fluorescent protein (GFP).

PART II: BIOENERGETICS AND METABOLISM

Chapter 13: **Principles of Bioenergetics**

Chapter 14: Glycolysis, Gluconeogenesis, and the Pentose Phosphate Pathway
Now covers gluconeogenesis immediately after glycolysis, discussing their relatedness, differences, and coordination and setting up the completely new chapter on metabolic regulation that follows. Adds coverage of the mechanisms of phosphohexose isomerase and aldolase. Revises the presentation of the mechanism of glyceraldehyde 3-phosphate dehydrogenase.

New Chapter!

Chapter 15: **Principles of Metabolic Regulation, Illustrated with Glucose and Glycogen Metabolism**

Brings together the concepts and principles of metabolic regulation in one chapter. Concludes with the latest conceptual approaches to the regulation of metabolism, including metabolic control analysis and contemporary methods for studying and predicting the flux through metabolic pathways.

Chapter 16: **The Citric Acid Cycle**

Expands and updates the presentation of the mechanism for pyruvate carboxylase. Adds coverage of the mechanisms of isocitrate dehydrogenase and citrate synthase.

Chapter 17: **Fatty Acid Catabolism**

Updates coverage of trifunctional protein. New section on the role of perilipin phosphorylation in the control of fat mobilization. New discussion of the role of acetyl-CoA in the integration of fatty acid oxidation and synthesis. Updates coverage of the medical consequences of genetic defects in fatty acyl CoA dehydrogenases. Takes a fresh look at medical issues related to peroxisomes.

Chapter 18: **Amino Acid Oxidation and the Production of Urea**

Integrates the latest on regulation of reactions throughout the chapter, with new material on genetic defects in urea cycle enzymes, and updated information on the regulatory function of N-acetylglutamate synthase. Reorganizes coverage of amino acid degradation to focus on the big picture. Adds new material on the relative importance of several degradative pathways. Includes a new description of the interplay of the pyridoxal phosphate and tetrahydrofolate cofactors in serine and glycine metabolism.

Chapter 19: **Oxidative Phosphorylation and Photophosphorylation**

Adds a prominent new section on the roles of mitochondria in apoptosis and oxidative stress. Now covers the role of IF1 in the inhibition of ATP synthase during ischemia. Includes revelatory details on the light-dependent pathways of electron transfer in photosynthesis, based on newly available molecular structures.

Chapter 20: **Carbohydrate Biosynthesis in Plants and Bacteria**

Reorganizes the coverage of photosynthesis and the C4 and CAM pathways. Adds a major new section on the synthesis of cellulose and bacterial peptidoglycan.

Chapter 21: **Lipid Biosynthesis**

Features an important new section on glyceroneogenesis and the triacylglycerol cycle between adipose tissue and liver, including their roles in fatty acid metabolism (especially during starvation) and the

emergence of thiazolidinediones as regulators of glyceroneogenesis in the treatment of type II diabetes. Includes a timely new discussion on the regulation of cholesterol metabolism at the genetic level, with consideration of sterol regulatory element-binding proteins (SREBPs).

Chapter 22: **Biosynthesis of Amino Acids, Nucleotides, and Related Molecules**
Adds material on the regulation of nitrogen metabolism at the level of transcription. Significantly expands coverage of synthesis and degradation of heme.

Chapter 23: **Integration and Hormonal Regulation of Mammalian Metabolism**
Reorganized presentation leads students through the complex interactions of integrated metabolism step by step. Features extensively revised coverage of insulin and glucagon metabolism that includes the integration of carbohydrate and fat metabolism. New discussion of the role of AMP-dependent protein kinase in metabolic integration. Updates coverage of the fast-moving field of obesity, regulation of body mass, and the leptin and adiponectin regulatory systems. Adds a discussion of Ghrelin and PYY3-36 as regulators of short-term eating behavior. Covers the effects of diet on the regulation of gene expression, considering the role of peroxisome proliferator-activated receptors (PPARs)

PART III. INFORMATION PATHWAYS

Chapter 24: **Genes and Chromosomes**

Integrates important new material on the structure of chromosomes, including the roles of SMC proteins and cohesins, the features of chromosomal DNA, and the organization of genes in DNA.

Chapter 25: **DNA Metabolism**

Adds a section on the "replication factories" of bacterial DNA. Includes latest perspectives on DNA recombination and repair.

Chapter 26: **RNA Metabolism**

Updates coverage on mechanisms of mRNA processing. Adds a subsection on the 5' cap of eukaryotic mRNAs. Adds important new information about the structure of bacterial RNA polymerase and its mechanism of action.

Chapter 27: **Protein Metabolism**

Includes a presentation and analysis of the long-awaited structure of the ribosome--one of the most important updates in this new edition. Adds a new box on the evolutionary significance of ribozyme-catalyzed peptide synthesis.

Chapter 28: **Regulation of Gene Expression**

Adds a new section on RNA interference (RNAi), including the medical potential of gene silencing.