

---

# Contents

List of Topics ix  
Preface to the Third Edition xxv  
Preface to the Second Edition xxix  
Preface to the First Edition xxxi

---

## PART I MOLECULAR DESIGN OF LIFE 1

---

CHAPTER 1. Prelude 3  
2. Protein Structure and Function 15  
3. Exploring Proteins 43  
4. DNA and RNA: Molecules of Heredity 71  
5. Flow of Genetic Information 91  
6. Exploring Genes: Analyzing, Constructing, and Cloning  
DNA 117

---

## PART II PROTEIN CONFORMATION, DYNAMICS, AND FUNCTION 141

---

CHAPTER 7. Oxygen-transporting Proteins: Myoglobin and  
Hemoglobin 143  
8. Introduction to Enzymes 177  
9. Mechanisms of Enzyme Action 201  
10. Control of Enzymatic Activity 233  
11. Connective-Tissue Proteins 261  
12. Introduction to Biological Membranes 283

---

**PART III GENERATION AND STORAGE OF METABOLIC ENERGY 313**

---

CHAPTER 13. Metabolism: Basic Concepts and Design 315  
14. Carbohydrates 331  
15. Glycolysis 349  
16. Citric Acid Cycle 373  
17. Oxidative Phosphorylation 397  
18. Pentose Phosphate Pathway and Gluconeogenesis 427  
19. Glycogen Metabolism 449  
20. Fatty Acid Metabolism 469  
21. Amino Acid Degradation and the Urea Cycle 495  
22. Photosynthesis 517

---

**PART IV BIOSYNTHESIS OF MACROMOLECULAR PRECURSORS 545**

---

CHAPTER 23. Biosynthesis of Membrane Lipids and Steroid Hormones 547  
24. Biosynthesis of Amino Acids and Heme 575  
25. Biosynthesis of Nucleotides 601  
26. Integration of Metabolism 627

---

**PART V GENETIC INFORMATION: storage, transmission, and expression 647**

---

CHAPTER 27. DNA Structure, Replication, and Repair 649  
28. Gene Rearrangements: Recombination and Transposition 687  
29. RNA Synthesis and Splicing 703  
30. Protein Synthesis 733  
31. Protein Targeting 767  
32. Control of Gene Expression in Prokaryotes 799  
33. Eukaryotic Chromosomes and Gene Expression 823  
34. Viruses and Oncogenes 851

---

**PART VI MOLECULAR PHYSIOLOGY: interaction of information, conformation, and metabolism in physiological processes 887**

---

CHAPTER 35. Molecular Immunology 889  
36. Muscle Contraction and Cell Motility 921  
37. Membrane Transport 949  
38. Hormone Action 975  
39. Excitable Membranes and Sensory Systems 1005  
Appendices 1044  
Answers to Problems 1049  
Index 1065