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The World of the Cell

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The World of the Cell

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Preface

The World of the Cell is intended as a comprehensive introduction to cellular and molecular biology for students preparing for careers in biology, medicine, and related fields. Portions of this book began as lecture notes, problem sets, and exams in Biocore 303, a cell biology course at the University of Wisconsin-Madison. These materials were expanded into the first edition of this textbook, published in 1986. Heartened by the large number of users and by the responses of instructors and students alike, we have prepared this edition jointly, with each of us bringing to the venture about twenty years of teaching experience in cell biology, including both introductory and advanced courses.

Something Old and Something New

The book is neither exhaustive nor encyclopedic. Our goal has been to sketch in as lucid a manner as possible the essential principles and processes of cell biology. Recognizing the exceptionally rapid pace of discovery in cell biology during the past several years, we have sought to weave new knowledge and insight into the fabric of the text. In doing so, we have retained the features of the first edition that readers have described as “user-friendly,” while reorganizing and updating the material in ways that we hope will make the text even more useful for both students and instructors.

Features we have retained from the first edition include an organization of subject matter that is readily adaptable to a great variety of course syllabi, an illustration program that users of the first edition found very helpful, and a problem set at the end of each chapter. We have also paid careful attention to accuracy, consistency, and vocabulary, hoping thereby to maximize understanding and minimize confusion for the reader.

Additions and changes that we believe will further enhance the usefulness of the text include the following:

- Introductory unit restructured such that cell chemistry is now covered before cell structure.
- Units reorganized to cover membrane structure and function before energy flow, thereby ensuring that the reader understands membrane potential and transport before encountering mitochondrial and chloroplast function.
- Coverage of molecular biology updated and expanded, including a more extended consideration of eukaryotic gene regulation.
- Discussion of recombinant DNA technology expanded significantly and placed in an appendix for ready access from anywhere in the text.
- Coverage of the cytoskeleton expanded to an entire chapter, immediately preceding a chapter on motility and contractility that has also been updated significantly.
- Chapter on membrane receptors added to provide enhanced coverage of mechanisms of cell communication.
- Updated coverage of developmental biology, cancer biology, and immunology provided by contributors chosen for their expertise in these areas.
- Each micrograph identified in the figure legend as a light micrograph (LM), scanning electron micrograph (SEM), or transmission electron micrograph (TEM).
- Size bars used to indicate magnification of micrographs.

Techniques and Methods

Throughout the text, we have tried to explain not only *what* we know about cells but also *how* we know what we know. Toward that end, we have included descriptions of experimental techniques and findings throughout, almost always in the context of the questions they address and in anticipation of the answers they provide. For example, equilibrium density centrifugation is introduced not in a chapter concerned with how cells are studied, but in Chapter 9, where it becomes important to understand how lysosomes were originally distinguished from mitochondria and subsequently from per-

oxisomes as well. To help readers locate techniques out of context, an alphabetic **Guide to Techniques and Methods** follows the Acknowledgments, with page references to particular techniques.

The only exceptions to the principle of introducing techniques in context are the methodologies of microscopy and of recombinant DNA technology. Both of these topics are relevant to much of contemporary cell biology and both involve a variety of related techniques that can be logically considered as a self-contained unit. Accordingly, this edition has two appendices, **Appendix A: Principles and Techniques of Microscopy** and **Appendix B: Recombinant DNA Technology**, each fully illustrated. Both appendices are cross-referenced at numerous points in the text, to make their existence known to readers who, despite the fond hopes of the authors, are not likely to be careful readers of this Preface.

In-Text Learning Aids

To enhance the book's effectiveness as a learning tool, each chapter includes the following features:

- One or two **Boxed Essays** to help students better understand particularly important or intriguing aspects of cell biology. While some of the essays give interesting historical perspectives on how science is done (the discovery of the double helix as described in the boxed essay of Chapter 3, for example), others are intended to help students understand potentially difficult principles (the analogy of monkeys shelling peanuts to help explain enzyme kinetics, in Chapter 6). Still others provide further insights into contemporary techniques used by cell biologists (the scanning tunneling microscope, in Chapter 1) or into facets of cell biology with special medical relevance (the use of intermediate filament typing as a diagnostic tool, in Chapter 18).
- A list of **Key Terms** that includes the page number where each term first appears in boldface. Most of the key terms are included in the **Glossary** at the end of the book, which provides a definition of each term along with a reference to the chapter(s) in which that term appears most prominently.
- A **Suggested Reading** list, with an emphasis on review articles that motivated users are likely to find understandable. We have tried to avoid overwhelming readers with lengthy bibliographies of the original literature, but have referenced selected articles that are especially relevant to the topics of the chapter.
- A **Problem Set**, reflecting our conviction that we learn science not just by reading or hearing about it, but

by working with it. The problems are designed to emphasize understanding and applying the principles taught in the chapter, not just rote recall. Many of the problems have been carefully selected from class-tested exams. To give instructors flexibility in their use of the problem sets, answers for all of them appear in the **Solutions Manual** described below. At the discretion of the instructor, this manual can either be made available to students through the bookstore or used by the instructor as a resource for homework and exam questions.

Supplemental Learning Aids

Supplemental learning aids available with this text include:

- A **Solutions Manual** that contains detailed answers to all of the problems in the text. As a special feature new to this edition, this **Solutions Manual** also contains black-only versions of over 150 drawings from the text. Instructors can use these illustrations as masters in creating acetate transparencies for classroom use; students can then review and annotate the illustrations while they are being discussed in class. (ISBN 0-8053-0871-7)
- A separate set of 52 two-color acetate transparencies corresponding to selected figures from the text but with enlarged labels to enhance their usefulness in classroom lecture. (ISBN 0-8053-0872-5)
- The **Benjamin/Cummings Micrograph Transparencies for the Life Sciences**, a set of 50 micrographs that complement (but are not usually identical to) the micrographs reproduced in the text. This set includes both electron micrographs and full-color light micrographs, many with explanatory drawings. (ISBN 0-8053-1815-1)

Comments Welcome

The real test of any textbook is how effectively it helps instructors teach and students learn. We welcome feedback from readers; please send your comments and suggestions to either of us.

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The many reviewers listed below provided helpful criticisms and suggestions for revision at various stages of manuscript development. Their words of appraisal and counsel were gratefully received and greatly appreciated. Indeed, the extensive review process to which both this and the prior edition of this text have been exposed ought itself to be counted as a significant feature of its content. Nonetheless, the final responsibility for what you read here remains ours, and you may confidently attribute to us any errors of omission or commission you may encounter in these pages.

We are deeply indebted to the many people at The Benjamin/Cummings Publishing Company who made this venture a reality. Special recognition goes to Diane Bowen, Jamie Northway, Jane Reece, Brian Jones, and Cecilia Mills, whose consistent encouragement and careful attention to detail contributed much to the clarity of both the text and the art.

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Guide to Techniques and Methods

The following techniques are important to cell biologists. Each technique is described in the text at the indicated location, in the context of its actual use by researchers.

Cancer

Ames test for carcinogens, Chapter 23 (p. 724, Figure 23-8)

Cell Cycle

Cell fusion, Chapter 14 (p. 419, Figure 14-29)

Laser photobleaching, Chapter 14 (p. 426, Figure 14-32)

Cytoskeleton

Intermediate filament typing, Chapter 18 (p. 575)

Use of drugs and antibodies to study cytoskeletal function, Chapter 18 (p. 558)

Embryological Development

Fate mapping, Chapter 22 (p. 687)

Inductive interactions, Chapter 22 (p. 696)

Laser ablation, Chapter 22 (p. 708)

Nuclear transplantation, Chapter 22 (p. 691)

Pole plasm transfer, Chapter 22 (p. 686)

Zygote division, Chapter 22 (p. 691)

Enzymes

Determination of K_m (Michaelis constant) and V_{max} (maximum velocity), Chapter 6 (p. 149)

Inhibition analysis, Chapter 6 (Figure 6-17)

Genetics

Cis-trans test, Chapter 17 (p. 514)

Chromosome mapping, Chapter 15 (p. 448)

Cotransductional mapping, Chapter 15 (p. 449)

Restriction mapping, Appendix B (p. 804, Figure B-3)

Immunology

Immunochemical staining, Chapter 9 (p. 226)

Monoclonal antibody production (hybridoma technique), Chapter 24 (pp. 758-760)

Membranes

Dissociation and reconstitution of mitochondrial ATP synthase, Chapter 11 (p. 301, Figure 11-20)

Formation of inverted membrane vesicles, Chapter 8 (p. 217)

Membrane asymmetry, Chapter 7 (p. 174)

Membrane fluidity (laser photobleaching), Chapter 7 (p. 173, Figure 7-14)

Membrane fluidity (cell fusion), Chapter 7 (p. 173, Figure 7-15)

Membrane fluidity (patching and capping), Chapter 7 (p. 176, Figure 7-16)

Membrane permeability (liposomes), Chapter 8 (p. 195)

Patch clamping, Chapter 20 (p. 628, Figure 20-11)

Planar lipid membrane system (lipid bilayer), Chapter 20 (p. 621, Figure 20-6)

Microscopy

Atomic force microscopy, Appendix A (p. 797)

Autoradiography, Chapter 12 (p. 334), Chapter 14 (p. 336, Figure 14-8), Chapter 16 (p. 491, Figure 16-30), Appendix A (pp. 784, 791)

Cytochemical staining, Chapter 9 (Figure 9-16)

Deep-etching, Chapter 18 (Figure 18-10), Appendix A (p. 796)

Electron microscopy, Chapter 1 (p. 6), Appendix A (p. 785)

High-voltage electron microscopy, Chapter 1 (p. 8), Chapter 18 (p. 557, Figure 18-3), Appendix A (p. 789)

Scanning electron microscopy, Chapter 1 (p. 8), Appendix A (p. 788)

Scanning transmission electron microscopy, Appendix A (p. 789)

Transmission electron microscopy, Appendix A (p. 785)

Embedding, Appendix A (pp. 783, 790)

Fixation, Appendix A (pp. 783, 790)

Freeze-etching, Chapter 18 (p. 556, Figure 18-2), Appendix A (p. 795)

Freeze-fracturing, Chapter 7 (p. 168, Figure 7-13), Chapter 11 (Figure 11-5), Chapter 12 (Figure 12-10), Appendix A (p. 793)

Light microscopy, Chapter 1 (p. 5), Appendix A (p. 777)

Brightfield microscopy, Appendix A (p. 777)

Darkfield microscopy, Appendix A (p. 778)

Differential interference contrast microscopy, Appendix A (p. 782)

Fluorescence microscopy, Appendix A (p. 779)

Immunofluorescence microscopy, Chapter 4 (Figure 4-21), Chapter 7 (p. 173), Chapter 18 (pp. 556, 575, Figure 18-1)

Phase contrast microscopy, Appendix A (p. 778)

Polarization microscopy, Appendix A (p. 781)

Negative staining, Appendix A (p. 791)

Poststaining, Appendix A (p. 790)

Scanning tunneling microscopy, Chapter 1 (pp. 8, 11), Appendix A (p. 797)

Sectioning, Appendix A (pp. 783, 790)

Shadowing, Appendix A (p. 792)

Staining, Appendix A (p. 784)

Stereo electron microscopy, Appendix A (p. 796)

Video-enhanced differential interference microscopy, Chapter 18 (p. 565)

Nucleic Acids

Detection of DNase I sensitivity of active genes in chromatin, Chapter 17 (p. 537, Figure 17-23)

DNA sequencing (chemical method), Chapter 13 (pp. 363, 367, Figures 13-13, 13-14)

In vitro protein synthesis, Chapter 17 (p. 534)

Nuclear run-on transcription assay, Chapter 17 (p. 526, Figure 17-16)

Reverse transcription, Chapter 16 (p. 470)

RNA-DNA hybridization, Chapter 16 (p. 479)

Use of cDNA probes, Chapter 16 (p. 479), Chapter 17 (p. 534)

Proteins

Immunoblotting, Chapter 17 (p. 533)

Protein denaturation and renaturation, Chapter 2 (p. 32), Chapter 3 (p. 47)

SDS-polyacrylamide gel electrophoresis, Chapter 7 (p. 168, Figure 7-12)

Recombinant DNA

Cloning of genes, Chapter 13 (p. 367), Chapter 17 (p. 524), Appendix B (p. 806)

Colony hybridization, Appendix B (p. 808, Figure B-8)

DNA amplification using the polymerase chain reaction, Appendix B (p. 810)

Genetic engineering, Appendix B (p. 811)

Recombinant DNA, Appendix B (p. 805)

Separation of restriction fragments, Appendix B (p. 803, Figure B-2)

Separation

Agarose gel electrophoresis, Appendix B (p. 803, Figure B-2)

Differential centrifugation, Chapter 4 (pp. 90, 94), Chapter 9 (Figure 9-1)

Equilibrium density centrifugation, Chapter 9 (p. 242, Figure 9-20), Chapter 14 (pp. 393, 395, Figures 14-6, 14-7)

Paper chromatography, Chapter 12 (p. 334)

SDS-polyacrylamide gel electrophoresis, Chapter 7 (p. 168, Figure 7-12)

Thin layer chromatography, Chapter 7 (p. 167, Figure 7-11)

Ultracentrifugation, Chapter 1 (p. 10)

Brief Contents

PART ONE

Introduction 1

- 1 The World of the Cell: A Preview 2
- 2 The Chemistry of the Cell 16
- 3 The Macromolecules of the Cell 41

PART TWO

Cell Structure and Function 73

- 4 Cells and Organelles 74
- 5 Bioenergetics:
The Flow of Energy in the Cell 106
- 6 Enzymes: The Catalysts of Life 132
- 7 Membranes:
Their Structure and Chemistry 158
- 8 Transport Across Membranes:
Overcoming the Permeability Barrier 193
- 9 Intracellular Compartments 220

PART THREE

Energy Flow in Cells 251

- 10 Energy from Chemical Bonds:
The Anaerobic Mode 252
- 11 Energy from Chemical Bonds:
The Aerobic Mode 275
- 12 Energy from the Sun: Photosynthesis 314

PART FOUR

Information Flow in Cells 351

- 13 The Flow of Information: DNA, Chromosomes,
and the Nucleus 352
- 14 The Cell Cycle, DNA Replication, and
Mitosis 389
- 15 Sexual Reproduction, Meiosis, and Genetic
Variability 427
- 16 From Genes to Proteins: The Genetic Code and
Protein Synthesis 456
- 17 The Regulation of Gene Expression 508

PART FIVE

Specific Cell Functions 553

- 18 Cytoskeletal Structure and Function 554
- 19 Cellular Movement:
Motility and Contractility 581
- 20 Electrical Signals: Nerve Cell Function 616
- 21 Chemical Signals:
Hormones and Receptors 644

PART SIX

Special Topics in Cell Biology 669

- 22 Cellular Aspects of Embryonic
Development 670
- 23 Cellular Aspects of Cancer 718
- 24 Cellular Aspects of the Immune Response 741

Detailed Contents

Preface v

Acknowledgments vii

Guide to Techniques and Methods ix

PART ONE

Introduction 1

1 The World of the Cell: A Preview 2

The Cell Theory: A Brief History 2

Modern Cell Biology Emerges 3

The Cytological Strand 5

The Biochemical Strand 8

The Genetic Strand 10

Perspective 12

Key Terms for Self-Testing 13

Suggested Reading 13

Problem Set 14

Boxed Essay: Units of Measurements in Cell Biology 4

Boxed Essay: First Photograph Ever to Show Structure of DNA Molecule 11

2 The Chemistry of the Cell 16

The Importance of Carbon 16

Carbon-Containing Molecules Are Stable 18

Carbon-Containing Molecules Are Diverse 19

Carbon-Containing Molecules Can Form Stereoisomers 20

Importance of Water 21

Water Molecules Are Polar 21

Water Molecules Are Cohesive 22

Water Has a High Temperature-Stabilizing Capacity 22

Water Is an Excellent Solvent 23

The Importance of Selectively Permeable Membranes 24

The Membrane Bilayer 24

Movement Across the Membrane 26

The Importance of Synthesis by

Polymerization 26

The Importance of Macromolecules 27

Kinds of Macromolecules 27

The Synthesis of Macromolecules 30

The Importance of Self-Assembly 31

The Self-Assembly of Proteins 32

The Self-Assembly of Other Cellular Structures 34

Tobacco Mosaic Virus: A Case Study in Self-Assembly 34

The Limits of Self-Assembly 35

The Advantages of Hierarchical Assembly 36

Perspective 36

Key Terms for Self-Testing 38

Suggested Reading 38

Problem Set 39

Boxed Essay: Tempus Fugit and the Fine Art of Watchmaking 37

3 The Macromolecules of the Cell 41

Proteins 41

The Monomers Are Amino Acids 41

The Polymers Are Polypeptides and Proteins 42

Protein Structure Depends on Amino Acid Sequence and Interactions 44

Nucleic Acids 48

The Monomers Are Nucleotides 49

The Polymers Are DNA and RNA 50

A DNA Molecule Is a Double-Stranded Helix 53

Polysaccharides	55
<i>The Monomers Are Monosaccharides</i>	55
<i>The Polymers Are Storage and Structural Polysaccharides</i>	58
<i>Polysaccharide Structure Depends on the Kinds of Glycosidic Bonds Involved</i>	60
Lipids	62
<i>Triglycerides Are Storage Lipids</i>	62
<i>Phospholipids Are Important in Membrane Structure</i>	64
<i>Sphingolipids Are Also Found in Membranes</i>	66
<i>Steroids Are Lipids with a Variety of Functions</i>	67
Perspective	67
Key Terms for Self-Testing	68
Suggested Reading	69
Problem Set	69
Boxed Essay: On the Trail of the Double Helix	56

PART TWO

Cell Structure and Function 73

4	Cells and Organelles	74
	Properties and Strategies of Cells	74
	<i>Cell Sizes and Shapes</i>	74
	<i>Prokaryotes and Eukaryotes: An Organizational Dichotomy</i>	76
	<i>Cell Specialization: The Unity and Diversity of Biology</i>	80
	The Eukaryotic Cell in Overview: Pictures at an Exhibition	80
	<i>The Plasma Membrane</i>	83
	<i>The Nucleus</i>	84
	<i>Intracellular Membranes and Organelles</i>	85
	<i>The Cytoplasm and the Cytoskeleton</i>	95
	<i>Outside the Cell: Walls and Coats</i>	98
	Living or Not? The Enigma of the Viruses	99
	Perspective	101
	Key Terms for Self-Testing	102
	Suggested Reading	102
	Problem Set	103
	Boxed Essay: Discovering Organelles: The Importance of Centrifuges and Chance Observations	94

5

Bioenergetics:	
The Flow of Energy in the Cell	106
The Importance of Energy	106
<i>The Need for Energy</i>	107
<i>Using Energy: Chemotrophs and Phototrophs</i>	110
<i>The Flow of Energy in the Biosphere</i>	111
<i>The Flow of Matter in the Biosphere</i>	112
<i>On to Cellular Energetics</i>	113
Bioenergetics	113
<i>Energy, Systems, Heat, and Work</i>	113
<i>Conservation of Energy: The First Law of Thermodynamics</i>	115
<i>How to Know Which Way It Will Go: The Second Law of Thermodynamics</i>	116
Understanding ΔG	122
<i>The Equilibrium Constant as a Measure of Directionality</i>	122
<i>Calculation of ΔG</i>	123
<i>The Standard State and the Standard Free Energy Change</i>	124
<i>Summing Up: The Meaning of $\Delta G'$ and ΔG°</i>	125
<i>Free Energy Change: Sample Calculations</i>	126
Life and the Steady State	127
Perspective	128
Key Terms for Self-Testing	128
Suggested Reading	129
Problem Set	129
Boxed Essay: Jumping Beans and Free Energy	118
Boxed Essay: Energy and Entropy: The Greek Connection	122

6

Enzymes: The Catalysts of Life	132
Activation Energy and the Metastable State	132
<i>Activation Energy</i>	133
<i>The Metastable State</i>	133
<i>Overcoming the Activation Energy Barrier</i>	134
Enzymes as Biological Catalysts	135
<i>Enzymes as Proteins</i>	135
<i>Enzymes as Catalysts</i>	139
<i>The Mechanism of Enzyme Catalysis: An Example</i>	141
Enzyme Kinetics	144
<i>Michaelis-Menten Kinetics</i>	145
<i>The Meaning of V_{\max} and K_m</i>	145
<i>The Double-Reciprocal Plot</i>	148

<i>Determining K_m and V_{max}: An Example</i>	149
Enzyme Inhibition and Regulation	150
<i>Enzyme Inhibition</i>	151
<i>Allosteric Regulation</i>	151
Perspective	153
Key Terms for Self-Testing	154
Suggested Reading	154
Problem Set	155
Boxed Essay: Not All Enzymes Are Proteins	140
Boxed Essay: Monkeys and Peanuts	146

7

Membranes:	
Their Structure and Chemistry	158
Why Membranes?	158
<i>Definition and Compartmentation</i>	158
<i>Locus of Function</i>	158
<i>Regulation of Transport Functions</i>	159
<i>Detection and Recognition of Signals</i>	159
Membrane Structure: A Historical	
Perspective	159
<i>Overton and Langmuir: The Importance of Lipids</i>	160
<i>Gorter and Grendel: The Lipid Bilayer</i>	160
<i>Davson and Danielli: The Importance of Proteins</i>	161
<i>Robertson: The Unit Membrane</i>	162
<i>Singer and Nicolson: The Fluid Mosaic Model</i>	163
<i>Henderson and Unwin: Molecular Structure of Membrane Proteins</i>	164
Molecular Organization and Membrane Function	164
<i>Structure of the Red Blood Cell Membrane</i>	164
<i>Analysis of Membrane Components</i>	166
<i>Classes and Functions of Membrane Lipids</i>	168
<i>Classes of Membrane Proteins</i>	171
<i>Membrane Carbohydrates</i>	171
<i>Membrane Asymmetry</i>	172
<i>Membrane Fluidity</i>	173
<i>Regulation of Membrane Fluidity</i>	176
Cell Junctions	178
<i>Desmosomes</i>	178
<i>Tight Junctions</i>	180
<i>Gap Junctions</i>	180
The Cell Surface: Coats and Walls	180
<i>Coats and Fuzzy Layers</i>	182

<i>Cell Walls</i>	183
<i>Bacterial Cell Walls</i>	184
<i>Plant Cell Walls</i>	184
<i>Plasmodesmata: Bridging the Wall</i>	186
Perspective	188
Key Terms for Self-Testing	189
Suggested Reading	189
Problem Set	190
Boxed Essay: Red Blood Cells, Membranes, and Ingenuity	174

8

Transport Across Membranes:	
Overcoming the Permeability Barrier	193
Cells and Transport Processes	193
<i>Categories of Transport</i>	193
<i>Mechanisms of Membrane Transport</i>	194
Passive Transport	195
<i>Simple Diffusion and Membrane Permeability</i>	195
<i>Diffusion and Passive Transport</i>	197
<i>Facilitated Transport</i>	198
Active Transport: Energy and Gradients	202
<i>Directionality of Active Transport</i>	203
<i>Energetics of Active Transport</i>	203
Mechanisms of Active Transport	206
<i>Properties of Active Transport Mechanisms</i>	206
<i>A Look at Several Active Transport Mechanisms</i>	207
Perspective	215
Key Terms for Self-Testing	216
Suggested Reading	216
Problem Set	217
Boxed Essay: Ionophores and the Study of Membranes	200

9

Intracellular Compartments	220
The Endoplasmic Reticulum	220
<i>The Membrane of the Endoplasmic Reticulum</i>	221
<i>Two Types of Endoplasmic Reticulum</i>	222
<i>Smooth Endoplasmic Reticulum</i>	222
<i>Rough Endoplasmic Reticulum</i>	225
The Golgi Complex	226
<i>Role of the Golgi Complex in Protein Processing</i>	227
Two Cellular Transport Processes: Exocytosis and Endocytosis	227
<i>Exocytosis</i>	229
<i>Endocytosis</i>	229

Membrane Biosynthesis and Turnover	235
<i>Biosynthesis and Processing of Membrane Proteins</i>	235
<i>Biosynthesis of Membrane Lipids</i>	235
<i>Membrane Turnover</i>	235
Lysosomes and Cellular Digestion	236
<i>Discovery of Lysosomes</i>	236
<i>Biogenesis of Lysosomes</i>	236
<i>Targeting Hydrolases to the Lysosomes</i>	236
<i>Cellular Digestion</i>	237
<i>Lysosomal Storage Diseases</i>	241
Peroxisomes	241
<i>Discovery of Peroxisomes</i>	241
<i>Occurrence and Properties of Animal Peroxisomes</i>	243
<i>Biogenesis of Peroxisomes</i>	246
Perspective	246
Key Terms for Self-Testing	247
Suggested Reading	247
Problem Set	248
Boxed Essay: The Intriguing World of the Coated Vesicle	230

PART THREE

Energy Flow in Cells 251

10	Energy from Chemical Bonds: The Anaerobic Mode	252
	Metabolic Pathways	252
	ATP: The Universal Energy Coupler	252
	<i>ATP Structure and Function</i>	253
	<i>ATP as an Intermediate in Energy Transactions</i>	254
	Chemotrophic Energy Metabolism	256
	<i>Biological Oxidation</i>	256
	<i>Glucose as a Substrate</i>	257
	<i>Respiration with Oxygen, Fermentation Without</i>	259
	<i>Aerobic and Anaerobic Organisms</i>	259
	Fermentation: The Anaerobic Option for ATP Generation	259
	<i>Glycolysis</i>	260
	<i>Pyruvate as a Branching Point</i>	266
	<i>Common Fermentation Options: Lactate and Ethanol Production</i>	266
	<i>The Energetics of Fermentation</i>	267
	Alternative Substrates for Glycolysis	268
	<i>Catabolism of Other Sugars</i>	269
	<i>Catabolism of Storage Polysaccharides</i>	269

Regulation of Glycolysis	270
<i>Allosteric Regulation of Phosphofructokinase</i>	270
Perspective	271
Key Terms for Self-Testing	272
Suggested Reading	272
Problem Set	273
Boxed Essay: Glyceraldehyde-3-Phosphate Oxidation: A Prototype Par Excellence	264

11	Energy from Chemical Bonds: The Aerobic Mode	275
	The Aerobic Mode	275
	Respiratory Metabolism: An Overview	275
	Mitochondrial Structure and Function	277
	<i>Structural Features of Mitochondria</i>	279
	<i>Occurrence and Size of Mitochondria</i>	280
	<i>Localization of Mitochondria</i>	280
	<i>Localization of Function Within the Mitochondrion</i>	281
	The Tricarboxylic Acid Cycle	282
	<i>Oxidative Conversion of Pyruvate to Acetyl Coenzyme A</i>	284
	<i>The Entry of Acetate into the TCA Cycle</i>	285
	<i>The Oxidative Decarboxylation Steps of the Cycle</i>	285
	<i>The ATP-Generating Step of the Cycle</i>	285
	<i>The Final Oxidative Sequence of the Cycle</i>	286
	<i>The TCA Cycle in Summary</i>	286
	<i>The Centrality of the TCA Cycle</i>	287
	<i>The Amphibolic Role of the TCA Cycle</i>	290
	<i>Regulation of TCA Cycle Activity</i>	291
	Electron Transport	291
	<i>Reduction Potentials</i>	292
	<i>The Electron Transport Chain</i>	294
	<i>The Electron Carriers of the Transport Chain</i>	294
	<i>Organization and Function of the Electron Transport Chain</i>	295
	Oxidative Phosphorylation	296
	<i>Coupling of ATP Synthesis to Electron Transport</i>	297
	<i>Respiratory Control</i>	298
	<i>Sites of Synthesis</i>	298
	<i>Mechanism of Coupling</i>	298
	<i>The Electrochemical Proton Gradient</i>	299
	<i>Calculating the Proton Motive Force</i>	301

<i>Testing Chemiosmosis: The Unidirectional Pumping of Protons</i>	301
<i>ATP Synthase and the Proton Translocator</i>	301
<i>The Role of the Electrochemical Gradient: ATP Synthesis</i>	302
Summary of Respiratory Metabolism	303
<i>The ATP Yield of Respiratory Metabolism</i>	304
<i>The Efficiency of Respiratory Metabolism</i>	306
Transport Across the Mitochondrial Membrane	307
<i>Metabolites</i>	308
<i>ATP, ADP, and Phosphate</i>	308
<i>Electrons from Cytoplasmically Generated NADH</i>	308
Perspective	309
Key Terms for Self-Testing	310
Suggested Reading	310
Problem Set	311
Boxed Essay: Salt-Loving Bacteria, Purple Membranes, and the Chemiosmotic Model	305

12 Energy from the Sun: Photosynthesis 314

The Photosynthetic Mode	314
<i>Photosynthesis Defined</i>	314
<i>Photosynthesis in Oxygenic Phototrophs</i>	315
Chloroplast Structure and Function	315
<i>Occurrence and Size</i>	315
<i>Structural Features</i>	316
<i>Localization of Function Within the Chloroplast</i>	317
<i>Thylakoid Structure</i>	318
The Reactions of Photosynthesis	318
<i>The Importance of Chlorophyll</i>	318
<i>Accessory Pigments</i>	319
Photoreduction (NADPH Generation)	320
<i>Photosystem I and the Generation of NADPH</i>	320
<i>Photosystem II and the Oxidation of Water</i>	320
<i>Noncyclic Electron Flow</i>	323
<i>The Emerson Enhancement Effect</i>	324
<i>Photosynthetic Units</i>	324
<i>Visualization of Photosystems</i>	325
ATP Synthesis	325
<i>Noncyclic Photophosphorylation</i>	325
<i>Cyclic Photophosphorylation</i>	327
<i>CF₁ and ATP Synthesis</i>	328

<i>Summary of the Light-Dependent Reactions</i>	329
Photosynthetic Carbon Metabolism: The Calvin Cycle	329
<i>Carbon Fixation</i>	329
<i>Reduction of 3-Phosphoglycerate</i>	331
<i>Carbohydrate Synthesis</i>	331
<i>Regeneration of Ribulose-1,5-Bisphosphate</i>	332
<i>Summary of the Calvin Cycle</i>	335
Some Do It Differently: The C ₄ Plants	336
<i>The Hatch-Slack Pathway</i>	336
<i>The Advantage of Being a C₄ Plant</i>	336
Summary of Photosynthesis	339
Leaf Peroxisomes: Glycolate Oxidation and Photorespiration	339
<i>The Source of Glycolate</i>	340
<i>The Glycolate Pathway</i>	340
<i>Photorespiration</i>	342
Glyoxysomes: The Glyoxylate Cycle and Gluconeogenesis	343
Perspective	345
Key Terms for Self-Testing	346
Suggested Reading	346
Problem Set	347
Boxed Essay: Carbon-14, Paper Chromatography, and the Calvin Cycle	334

PART FOUR

Information Flow in Cells 351

13 The Flow of Information: DNA, Chromosomes, and the Nucleus	352
The Chemical Nature of the Gene	352
<i>Pus, Fish Sperm, and the Discovery of DNA</i>	352
<i>DNA as the Transforming Principle of Pneumococcus</i>	353
<i>DNA as the Genetic Material of Viruses</i>	355
<i>DNA Base Composition and Chargaff's Rules</i>	355
The Structure of DNA	357
<i>Watson, Crick, and the Double Helix</i>	357
<i>Z-DNA</i>	357
<i>Supercoiled DNA</i>	358
<i>DNA Denaturation and Renaturation</i>	359
Organization of DNA into Genomes	362
<i>Genome Size</i>	362
<i>DNA Sequencing</i>	363