

# Contents

## SECTION I

### Introduction to Cell Biology

---

- 1 Introduction to Cells, 3
- 2 Evolution of Life on Earth, 15

## SECTION II

### Chemical and Physical Background

---

- 3 Molecules: Structures and Dynamics, 31
- 4 Biophysical Principles, 53
- 5 Macromolecular Assembly, 63
- 6 Research Strategies, 75

## SECTION III

### Chromatin, Chromosomes, and the Cell Nucleus

---

- 7 Chromosome Organization, 107
- 8 DNA Packaging in Chromatin and Chromosomes, 123
- 9 Nuclear Structure and Dynamics, 143

## SECTION IV

### Central Dogma: From Gene to Protein

---

- 10 Gene Expression, 165
- 11 Eukaryotic RNA Processing, 189
- 12 Protein Synthesis and Folding, 209

## SECTION V

### Membrane Structure and Function

---

- 13 Membrane Structure and Dynamics, 227
- 14 Membrane Pumps, 241
- 15 Membrane Carriers, 253
- 16 Membrane Channels, 261
- 17 Membrane Physiology, 285

## SECTION VI

### Cellular Organelles and Membrane Trafficking

---

- 18 Posttranslational Targeting of Proteins, 303
- 19 Mitochondria, Chloroplasts, Peroxisomes, 317
- 20 Endoplasmic Reticulum, 331
- 21 Secretory Membrane System and Golgi Apparatus, 351
- 22 Endocytosis and the Endosomal Membrane System, 377
- 23 Processing and Degradation of Cellular Components, 393

## SECTION VII

### Signaling Mechanisms

---

- 24 Plasma Membrane Receptors, 411
- 25 Protein Hardware for Signaling, 425
- 26 Second Messengers, 443
- 27 Integration of Signals, 463

## SECTION VIII

### Cellular Adhesion and the Extracellular Matrix

---

- 28 Cells of the Extracellular Matrix and Immune System, 491
- 29 Extracellular Matrix Molecules, 505
- 30 Cellular Adhesion, 525
- 31 Intercellular Junctions, 543
- 32 Connective Tissues, 555

## SECTION IX

### Cytoskeleton and Cellular Motility

---

- 33 Actin and Actin-Binding Proteins, 575
- 34 Microtubules and Centrosomes, 593

- 35 Intermediate Filaments, 613
- 36 Motor Proteins, 623
- 37 Intracellular Motility, 639
- 38 Cellular Motility, 651
- 39 Muscles, 671

## SECTION X Cell Cycle

- 40 Introduction to the Cell Cycle, 697
- 41  $G_1$  Phase and Regulation of Cell Proliferation, 713

- 42 S Phase and DNA Replication, 727
- 43  $G_2$  Phase, Responses to DNA Damage, and Control of Entry Into Mitosis, 743
- 44 Mitosis and Cytokinesis, 755
- 45 Meiosis, 779
- 46 Programmed Cell Death, 797

Cell Snapshots, 817

Glossary, 823

Index, 851