

Contents

Preface xi

SECTION I

Structures & Functions of Proteins & Enzymes 1

- 1 Biochemistry & Medicine 1**
Victor W. Rodwell, PhD & Robert K. Murray, MD, PhD
- 2 Water & pH 6**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 3 Amino Acids & Peptides 15**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 4 Proteins: Determination of Primary Structure 25**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 5 Proteins: Higher Orders of Structure 36**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD

SECTION II

Enzymes: Kinetics, Mechanism, Regulation, & Bioinformatics 51

- 6 Proteins: Myoglobin & Hemoglobin 51**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 7 Enzymes: Mechanism of Action 60**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 8 Enzymes: Kinetics 73**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 9 Enzymes: Regulation of Activities 87**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD

SECTION III

Bioenergetics 113

- 10 Bioinformatics & Computational Biology 97**
Peter J. Kennelly, PhD & Victor W. Rodwell, PhD
- 11 Bioenergetics: The Role of ATP 113**
Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc
- 12 Biologic Oxidation 119**
Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc
- 13 The Respiratory Chain & Oxidative Phosphorylation 126**
Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc

SECTION IV

Metabolism of Carbohydrates 139

- 14 Overview of Metabolism & the Provision of Metabolic Fuels 139**
David A. Bender, PhD & Peter A. Mayes, PhD, DSc
- 15 Carbohydrates of Physiological Significance 152**
David A. Bender, PhD & Peter A. Mayes, PhD, DSc
- 16 The Citric Acid Cycle: The Central Pathway of Carbohydrate, Lipid & Amino Acid Metabolism 161**
David A. Bender, PhD & Peter A. Mayes, PhD, DSc

17 Glycolysis & the Oxidation of Pyruvate 168*David A. Bender, PhD & Peter A. Mayes, PhD, DSc***18 Metabolism of Glycogen 176***David A. Bender, PhD & Peter A. Mayes, PhD, DSc***19 Gluconeogenesis & the Control of Blood Glucose 185***David A. Bender, PhD & Peter A. Mayes, PhD, DSc***20 The Pentose Phosphate Pathway & Other Pathways of Hexose Metabolism 196***David A. Bender, PhD & Peter A. Mayes, PhD, DSc*

SECTION

V

Metabolism of Lipids 211**21 Lipids of Physiologic Significance 211***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc***22 Oxidation of Fatty Acids: Ketogenesis 223***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc***23 Biosynthesis of Fatty Acids & Eicosanoids 232***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc***24 Metabolism of Acylglycerols & Sphingolipids 245***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc***25 Lipid Transport & Storage 253***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc***26 Cholesterol Synthesis, Transport, & Excretion 266***Kathleen M. Botham, PhD, DSc & Peter A. Mayes, PhD, DSc*

SECTION

VI

Metabolism of Proteins & Amino Acids 281**27 Biosynthesis of the Nutritionally Nonessential Amino Acids 281***Victor W. Rodwell, PhD***28 Catabolism of Proteins & of Amino Acid Nitrogen 287***Victor W. Rodwell, PhD***29 Catabolism of the Carbon Skeletons of Amino Acids 297***Victor W. Rodwell, PhD***30 Conversion of Amino Acids to Specialized Products 313***Victor W. Rodwell, PhD***31 Porphyrins & Bile Pigments 323***Victor W. Rodwell, PhD & Robert K. Murray, MD, PhD*

SECTION

VII

Structure, Function, & Replication of Informational Macromolecules 339**32 Nucleotides 339***Victor W. Rodwell, PhD***33 Metabolism of Purine & Pyrimidine Nucleotides 347***Victor W. Rodwell, PhD***34 Nucleic Acid Structure & Function 359***P. Anthony Weil, PhD***35 DNA Organization, Replication, & Repair 370***P. Anthony Weil, PhD***36 RNA Synthesis, Processing, & Modification 394***P. Anthony Weil, PhD***37 Protein Synthesis & the Genetic Code 413***P. Anthony Weil, PhD***38 Regulation of Gene Expression 428***P. Anthony Weil, PhD***39 Molecular Genetics, Recombinant DNA, & Genomic Technology 451***P. Anthony Weil, PhD*

SECTION
VIIIBiochemistry of
Extracellular & Intracellular
Communication 477

- 40** Membranes: Structure & Function 477
Robert K. Murray, MD, PhD & P. Anthony Weil, PhD
- 41** The Diversity of the Endocrine System 498
P. Anthony Weil, PhD
- 42** Hormone Action & Signal Transduction 518
P. Anthony Weil, PhD

SECTION
IX

Special Topics (A) 537

- 43** Nutrition, Digestion, & Absorption 537
David A. Bender, PhD & Peter A. Mayes, PhD, DSc
- 44** Micronutrients: Vitamins & Minerals 546
David A. Bender, PhD
- 45** Free Radicals & Antioxidant Nutrients 564
David A. Bender, PhD
- 46** Glycoproteins 569
David A. Bender, PhD & Robert K. Murray, MD, PhD
- 47** Metabolism of Xenobiotics 583
David A. Bender, PhD & Robert K. Murray, MD, PhD
- 48** Clinical Biochemistry 589
David A. Bender, PhD, Joe Varghese, MBBS, MD, Molly Jacob, MBBS, MD, PhD, & Robert K. Murray, MD, PhD

SECTION
X

Special Topics (B) 607

- 49** Intracellular Traffic & Sorting of Proteins 607
Kathleen M. Botham, PhD, DSc & Robert K. Murray, MD, PhD
- 50** The Extracellular Matrix 627
Kathleen M. Botham, PhD, DSc & Robert K. Murray, MD, PhD
- 51** Muscle & the Cytoskeleton 647
Peter J. Kennelly, PhD & Robert K. Murray, MD, PhD
- 52** Plasma Proteins & Immunoglobulins 668
Peter J. Kennelly, PhD, Robert K. Murray, MD, PhD, Molly Jacob, MBBS, MD, PhD & Joe Varghese, MBBS, MD
- 53** Red Blood Cells 689
Peter J. Kennelly, PhD & Robert K. Murray, MD, PhD
- 54** White Blood Cells 700
Peter J. Kennelly, PhD & Robert K. Murray, MD, PhD

SECTION
XI

Special Topics (C) 711

- 55** Hemostasis & Thrombosis 711
Peter L. Gross, MD, MSc, FRCP(C), Robert K. Murray, MD, PhD, P. Anthony Weil, PhD, & Margaret L. Rand, PhD
- 56** Cancer: An Overview 722
Molly Jacob, MBBS, MD, PhD, Joe Varghese, MBBS, MD, Robert K. Murray, MD, PhD & P. Anthony Weil, PhD
- 57** Biochemical Case Histories 746
David A. Bender, PhD
- 58** The Biochemistry of Aging 755
Peter J. Kennelly, PhD

The Answer Bank 771

Index 777