

Contents

- Preface to the third edition 7
- Acknowledgements to the third edition 7
- Figure key 8
- SI/mass unit conversions 9

Part 1 **Acids, bases and pH**

- 1 Acids, bases and hydrogen ions (protons) 10
- 2 Understanding pH 12
- 3 Production and removal of protons into and from the blood 14
- 4 Metabolic alkalosis and metabolic acidosis 16
- 5 Respiratory alkalosis and respiratory acidosis 18

Part 2 **Structure of amino acids and proteins**

- 6 Amino acids and the primary structure of proteins 20
- 7 Secondary structure of proteins 22
- 8 Tertiary and quaternary structure and collagen 24

Part 3 **Formation of ATP: oxidation and reduction reactions**

- 9 Oxidation/reduction reactions, coenzymes and prosthetic groups 26
- 10 Anaerobic production of ATP by substrate-level phosphorylation, from phosphocreatine and by the adenylate kinase (myokinase) reaction 28
- 11 Aerobic production of ATP 30
- 12 Biosynthesis of ATP by oxidative phosphorylation I 32
- 13 Biosynthesis of ATP by oxidative phosphorylation II 34
- 14 What happens when protons or electrons leak from the respiratory chain? 36
- 15 Free radicals, reactive oxygen species and oxidative damage 38
- 16 Aerobic oxidation of glucose to provide energy as ATP 40
- 17 Anaerobic oxidation of glucose by glycolysis to form ATP and lactate 42
- 18 Anaerobic glycolysis in red blood cells, 2,3-BPG (2,3-DPG) and the Bohr effect 44

Part 4 **Carbohydrates**

- 19 Carbohydrates 46
- 20 Absorption of carbohydrates and metabolism of galactose 48
- 21 Fate of glucose in liver: glycogenesis and lipogenesis 50
- 22 Fructose metabolism 52
- 23 Glucose homeostasis 54
- 24 Glucose-stimulated secretion of insulin from β -cells 56
- 25 Regulation of glycogen metabolism 58
- 26 Glycogen breakdown (glycogenolysis) and glycogen storage diseases 60
- 27 Insulin signal transduction and diabetes mellitus 62
- 28 Diabetes mellitus 64
- 29 Alcohol metabolism: hypoglycaemia, hyperlactataemia and steatosis 66

Part 5 **Enzymes and regulation of pathways**

- 30 Enzymes: nomenclature, kinetics and inhibitors 68
- 31 Regulation of enzyme activity 70

- 32 Regulation of glycolysis and Krebs cycle 72
- 33 Oxidation of fatty acids to produce ATP in muscle and ketone bodies in liver 74
- 34 Regulation of lipolysis, β -oxidation, ketogenesis and gluconeogenesis 76

Part 6 **Lipids and lipid metabolism**

- 35 Structure of lipids 78
- 36 Phospholipids I: phospholipids and sphingolipids 80
- 37 Phospholipids II: micelles, liposomes, lipoproteins and membranes 82
- 38 Metabolism of carbohydrate to cholesterol 84
- 39 VLDL and LDL metabolism I: "forward" cholesterol transport 86
- 40 VLDL and LDL metabolism II: endogenous triacylglycerol transport 88
- 41 HDL metabolism: "reverse" cholesterol transport 90
- 42 Absorption and disposal of dietary triacylglycerols and cholesterol by chylomicrons 92
- 43 Steroid hormones: aldosterone, cortisol, androgens and oestrogens 94

Part 7 **Metabolism of amino acids and porphyrins**

- 44 Urea cycle and overview of amino acid catabolism 96
- 45 Non-essential and essential amino acids 98
- 46 Amino acid metabolism: to energy as ATP; to glucose and ketone bodies 100
- 47 Amino acid disorders: maple syrup urine disease, homocystinuria, cystinuria, alkaptonuria and albinism 102
- 48 Phenylalanine and tyrosine metabolism in health and disease 104
- 49 Products of tryptophan and histidine metabolism 106
- 50 Haem, bilirubin and porphyria 108

Part 8 **Vitamins**

- 51 Fat-soluble vitamins I: vitamins A and D 110
- 52 Fat-soluble vitamins II: vitamins E and K 112
- 53 Water-soluble vitamins I: thiamin, riboflavin, niacin and pantothenate 114
- 54 Water-soluble vitamins II: pyridoxal phosphate (B_6) 116
- 55 Water-soluble vitamins III: folate and vitamin B_{12} 118
- 56 Water-soluble vitamins IV: biotin and vitamin C 120

Part 9 **Molecular biology**

- 57 The cell cycle 122
- 58 Pyrimidine metabolism 124
- 59 Purine metabolism 126
- 60 Structure of DNA 128
- 61 The "central dogma" of molecular biology 130
- 62 Organisation of DNA in chromosomes 132
- 63 Replication of DNA (part 1) 134
- 64 Replication of DNA (part 2) 136
- 65 DNA damage and repair 138
- 66 Transcription of DNA to make messenger RNA (part 1) 140
- 67 Transcription of DNA to make messenger RNA (part 2) 142

- 68 Transcription of DNA to make transfer RNA 144
- 69 Transcription of DNA to make ribosomal RNA 146
- 70 Translation and protein synthesis 148
- 71 Comparison of DNA replication, DNA transcription and protein synthesis in eukaryotes and prokaryotes 150

Part 10 **Diagnostic clinical biochemistry**

- 72 Diagnostic clinical biochemistry (with Dr J. W. Wright FRCP, MRCPath) 152
- Index 154