Prelims.qxd 10/9/07 5:53 PM Page v

CONTENTS

List of Figures ix
List of Tables xi
Preface xiii

1 The Foundation 1
Structure and Function 1
Homeostasis, Equilibrium, and the Steady State 7
Physiological Gradients 9
Physiological Reflexes 11
Control Systems Analysis 13
Feedback and Feedforward 15

2 Understanding the Mammalian Nervous System 18
What Are Neurons? 18
What Is the Nervous System? 19
Neuron Communication, Electrical and Chemical Transmission 22
Different Neurotransmitters and Their Locations and Functions 25
Discomfort, Pain, and the Nervous System 29
Mental Activity, Cerebral Blood Flow, and Health of the Nervous System 32

3 The Endocrine System and Physiological Communication 35
Advances in Endocrinology 35
Hormones, Proteins, and Peptides 39
The Hypothalamic-Pituitary Axis 41
Excesses and Deficiencies of GH and Health 44
The Adrenal Gland and Growth 47
The Thyroid Gland 48

Prelims.qxd 10/9/07 5:53 PM Page vi

4	**The Cardiovascular System and the Blood**	**53**
	The Blood	54
	The Heart and Cardiac Cycle	57
	The Blood Vessels	62
	Lifestyle and Monitoring Cardiovascular Health	68
	Reactive Hyperemia and Blood Flow to Organs and Tissues	72
5	**Health and the Respiratory System**	**76**
	Components of the Respiratory System	77
	Pulmonary Ventilation or Lung Inflation and Deflation	80
	Respiration, Exchange, and Transport of Blood Gases	83
	Central and Peripheral Regulation of the Respiratory System	86
	Lungs and Balance of Acids and Bases	89
	Lifestyle and Care of the Lungs	92
6	**Kidneys and Renal Physiology**	**94**
	Functional Morphology of the Kidneys	95
	Glomerular Filtration Rate and Urine	96
	Regulation of GFR and RPF	99
	Reabsorption, Secretion, and the Formation of Urine	102
	Renal Health, Hydration, and Urination	103
	Diabetes and Sugar in the Urine	105
7	**The Gastrointestinal System**	**109**
	Components of the Gastrointestinal (GI) or Enteric System	110
	Mechanics and Reflexes of the GI Tract	113
	Secretions of the GI Tract	115
	Digestion of Carbohydrates, Fats, and Proteins	119
	Health of the Oral Cavity and Vocalization	123
	Health of the GI Tract and Diet	125
8	**The Reproductive System**	**128**
	Gametogenesis, Genetic, Gonadal, and Phenotypic Sex	128
	The Sexually Indifferent Embryonic Gonad	130
	Spermatogenesis and the Male Reproductive System	132
	Oogenesis, Folliculogenesis, and the Female Reproductive System	133
	Sexually Transmitted Diseases (STDs), Sexual Behavior, and Infertility	136
9	**The Immune System**	**138**
	Cellular Defenses	138
	Chemotaxis, Margination, Diapedesis, and Phagocytosis	140
	Ports of Entry for Pathogens and the Reticuloendothelial System (RES)	142
	Immunity, Regenerative Medicine, and Stem Cells	145

Prelims.qxd 10/9/07 5:53 PM Page vii

10 Muscle Function **151**
Muscle Diversification 151
Excitation-Contraction Coupling in Muscle 153
Cycling of Cross-Bridges and Shortening of Sarcomeres 154
Muscle Levers, Hypertrophy, and Atrophy 156
Muscle Diseases and Conditions 158
Experimenting with Muscle 160

11 Integrated Physiological Responses **162**
Hypovolemic Hypotension 162
Baroreceptor Reflexes and Cardiac Output 163
Vasomotor Responses and Blood Pressure 165
Renal Response and the Renin-Angiotensin System 166
Blood Flow and Its Distribution and Redistribution during Hypotension 168
Long-Term Responses to Hypotension 168

12 For the Record **170**
Blood Pressure and Your Health 172
Blood Lipids and Physical Activity 174
Blood Cells and Good Health 178
Blood Sugar, Diabetes, and Metabolic Syndrome 180

Glossary 185
Notes and Selected Reading 199
About the Author 209
Index 211