

Contents

Preface *iii*

Acknowledgments *iv*

1. PLASMA MEMBRANE 1

- I. Overview—The Plasma Membrane (Plasmalemma; Cell Membrane) 1
- II. Fluid Mosaic Model of the Plasma Membrane 1
- III. Plasma Membrane Transport Processes 5
- IV. Cell-to-Cell Communication 7
- V. Plasmalemma-Cytoskeleton Association 9

Review Test 12

2. NUCLEUS 15

- I. Overview—The Nucleus 15
- II. Nuclear Envelope 15
- III. Nucleolus 18
- IV. Nucleoplasm 18
- V. Chromatin 19
- VI. Chromosomes 20
- VII. DNA 21
- VIII. RNA 22
- IX. Cell Cycle 25
- X. Apoptosis (Programmed Cell Death) 28
- XI. Meiosis 29

Review Test 31

3. CYTOPLASM AND ORGANELLES 33

- I. Overview—The Cytoplasm 33
- II. Structural Components 33
- III. Interactions among Organelles 49

Review Test 58

4. EXTRACELLULAR MATRIX

61

- I. Overview—The Extracellular Matrix 61
- II. Ground Substance 61
- III. Fibers 64

Review Test 72**5. EPITHELIA AND GLANDS**

75

- I. Overview—Epithelia 75
- II. Lateral Epithelial Surfaces 77
- III. Basal Epithelial Surfaces 80
- IV. Apical Epithelial Surfaces 83
- V. Glands 87

Review Test 89**6. CONNECTIVE TISSUE**

92

- I. Overview—Connective Tissue 92
- II. Extracellular Matrix 92
- III. Connective Tissue Cells 93
- IV. Classification of Connective Tissue 99

Review Test 103**7. CARTILAGE AND BONE**

106

- I. Overview—Cartilage 106
- II. Overview—Bone 110
- III. Joints 120

Review Test 121**8. MUSCLE**

124

- I. Overview—Muscle 124
- II. Structure of Skeletal Muscle 124
- III. Contraction of Skeletal Muscle 130
- IV. Innervation of Skeletal Muscle 132
- V. Cardiac Muscle 133
- VI. Smooth Muscle 135
- VII. Contractile Nonmuscle Cells 139

Review Test 140

9.5 NERVOUS SYSTEM**143**

- I. Overview—Nervous System 143
- II. Histogenesis of the Nervous System 143
- III. Cells of Nervous System 145
- IV. Synapses 151
- V. Nerve Fibers 152
- VI. Nerves 153
- VII. Ganglia 155
- VIII. Histophysiology of Nervous System 155
- IX. Somatic Nervous System and Autonomic Nervous System 157
- X. Central Nervous System 158
- XI. Degeneration and Regeneration of Nerve Tissue 160

Review Test 162**10. BLOOD AND HEMOPOIESIS****166**

- I. Overview—Blood 166
- II. Blood Constituents 166
- III. Blood Coagulation 172
- IV. Bone Marrow 174
- V. Prenatal Hemopoiesis 175
- VI. Postnatal Hemopoiesis 175
- VII. Hemopoietic Growth Factors (CSFs) 179

Review Test 181**11. CIRCULATORY SYSTEM****184**

- I. Overview—Blood Vascular System 184
- II. Overview—Lymphatic Vascular System 195

Review Test 196**12. LYMPHOID TISSUE****199**

- I. Overview—The Lymphoid (Immune) System 199
- II. Cells of the Immune System 201
- III. Antigen Presentation and the Role of MHC Molecules 209
- IV. Immunoglobulins 210
- V. Diffuse Lymphoid Tissue 211
- VI. Lymphoid Organs 212

Review Test 218

13. ENDOCRINE SYSTEM**NEUROUS SYSTEM****221**

- I. Overview—The Endocrine System 221
- II. Hormones 221
- III. Overview—Pituitary Gland (Hypophysis) and Hypothalamus 222
- IV. Overview—Thyroid Gland 228
- V. Parathyroid Glands 232
- VI. Overview—Adrenal (Suprarenal) Glands 234
- VII. Pineal Gland (Pineal Body, Epiphysis) 237

Review Test 239**14. SKIN****242**

- I. Overview—The Skin 242
- II. Epidermis 242
- III. Dermis 248
- IV. Glands in the Skin 249
- V. Hair, Hair Follicle, and Arrector Pili Muscle 251
- VI. Nails 252

Review Test 254**15. RESPIRATORY SYSTEM****257**

- I. Overview—The Respiratory System 257
- II. Conducting Portion of the Respiratory System 257
- III. Overview—Respiratory Portion of the Respiratory System 262
- IV. Lung Lobules 269
- V. Pulmonary Vascular Supply 269
- VI. Pulmonary Nerve Supply 269

Review Test 270**16. DIGESTIVE SYSTEM: ORAL CAVITY AND ALIMENTARY TRACT****273**

- I. Overview—The Digestive System 273
- II. Oral Region 273
- III. Divisions of the Alimentary Canal 278
- IV. Digestion and Absorption 289

Review Test 291

17. DIGESTIVE SYSTEM: GLANDS

SPECIAL SERIES 294

- I. Overview—Extrinsic Glands of the Digestive System 294
- II. Major Salivary Glands 294
- III. Overview—Pancreas 296
- IV. Liver 299
- V. Gallbladder 304

Review Test 306**18. THE URINARY SYSTEM**

309

- I. Overview—The Urinary System 309
- II. Kidneys 309
- III. Uriniferous Tubules 310
- IV. Renal Blood Circulation 320
- V. Regulation of Urine Concentration 321
- VI. Excretory Passages 324

Review Test 327**19. FEMALE REPRODUCTIVE SYSTEM**

330

- I. Overview—Female Reproductive System 330
- II. Ovaries 330
- III. Oviducts (Fallopian Tubes) 338
- IV. Uterus 339
- V. Cervix 341
- VI. Fertilization and Implantation 342
- VII. Placenta 343
- VIII. Vagina 345
- IX. External Genitalia (Vulva) 345
- X. Mammary Glands 346

Review Test 348**20. MALE REPRODUCTIVE SYSTEM**

350

- I. Overview—Male Reproductive System 350
- II. Testes 350
- III. Genital Ducts 357
- IV. Accessory Genital Glands 359
- V. Urethra 361
- VI. Penis 362

Review Test 363

21. SPECIAL SENSES	EM	DIGESTIVE SYSTEM: GLANDS	366
I. Overview—Special Sense Receptors 366			
II. Specialized Diffuse Receptors 366			
III. Sense of Sight—Eye 368			
IV. Sense of Hearing—Ear (Vestibulocochlear Apparatus) 378			
Review Test 384			
A. Multiple Choice Questions 384			
B. Short Answer Questions 386			
C. Essay Questions 387			
Comprehensive Examination 387			
Index 405			
22. URINARY SYSTEM	THE URINARY SYSTEM	388	22. URINARY SYSTEM
I. Overview—The Urinary System 388			
II. Kidneys 389			
III. Ureters 390			
IV. Bladder 391			
V. Urethra 392			
VI. Disorders of the Urinary System 393			
Review Test 394			
A. Multiple Choice Questions 394			
B. Short Answer Questions 396			
C. Essay Questions 397			
Comprehensive Examination 398			
23. FEMALE REPRODUCTIVE SYSTEM	FEMALE REPRODUCTIVE SYSTEM	398	23. FEMALE REPRODUCTIVE SYSTEM
I. Overview—Female Reproductive System 398			
II. Ovaries 399			
III. Uterus 400			
IV. Cervix 401			
V. Fallopian Tubes 401			
VI. Uterine Ligaments 401			
VII. Blood Circulation 402			
VIII. Distinguishable Features 402			
IX. External Passages 403			
X. Internal Passages 403			
XI. External Genitalia (Vulva) 404			
XII. Mammary Glands 406			
Review Test 408			
A. Multiple Choice Questions 408			
B. Short Answer Questions 410			
C. Essay Questions 411			
Comprehensive Examination 412			
24. DIGESTIVE SYSTEM: ORAL CAVITY AND ALIMENTARY TRACT	DIGESTIVE SYSTEM: ORAL CAVITY AND ALIMENTARY TRACT	412	24. DIGESTIVE SYSTEM: ORAL CAVITY AND ALIMENTARY TRACT
I. Overview—The Oral Cavity 412			
II. Mouth 413			
III. Pharynx 414			
IV. Esophagus 415			
V. Stomach 416			
VI. Small Intestine 417			
VII. Large Intestine 418			
VIII. Accessory Digestive Organs 419			
Review Test 420			
A. Multiple Choice Questions 420			
B. Short Answer Questions 422			
C. Essay Questions 423			
Comprehensive Examination 424			
25. MALE REPRODUCTIVE SYSTEM	MALE REPRODUCTIVE SYSTEM	424	25. MALE REPRODUCTIVE SYSTEM
I. Overview—The Male Reproductive System 424			
II. Testes 425			
III. Ejaculatory Ducts 426			
IV. Accessory Glands 426			
V. Penis 426			
VI. Prostate 426			
VII. Seminal Vesicles 426			
VIII. Utricle 426			
VIII. Utricle 426			
Review Test 427			
A. Multiple Choice Questions 427			
B. Short Answer Questions 429			
C. Essay Questions 430			
Comprehensive Examination 431			