

# BRS

BOARD REVIEW SERIES

The Most Trusted Name in  
Board and Course Review!

# Gross Anatomy

**NINTH EDITION**

**Nancy L. Halliday, PhD**


**Harold M. Chung, MD**

**Succeed in your anatomy course and board exams with this up-to-date resource!**

Presented in the popular Board Review Series outline format, this powerful resource helps you understand the essentials of human anatomy through concise descriptions, clinical correlations, radiographs, full-color illustrations, and tables. More than 550 board-style questions with complete answers and explanations, organized into chapter review tests and an end-of-book comprehensive exam, help you master key information.

- **Updated clinical correlations** demonstrate connections between anatomical knowledge and clinical medicine.
- **More than 200 color illustrations** help you understand difficult concepts and complicated anatomical structures.
- **Chapter-ending high-yield reviews** provide targeted preparation for USMLE Step 1 and anatomy course examinations.
- **Chapter review test and an end-of-book comprehensive exam**, available both in print and online, provide unlimited practice and review.

[shop.lww.com](http://shop.lww.com)

 **Wolters Kluwer**

ISBN:9781975120146



9 781975 120146 90000



## 1. INTRODUCTION

1

### Skeletal System 1

- I. Bones 1
- II. Joints 2

### Muscular System 4

- I. Muscle 4
- II. Structures Associated With Skeletal Muscles 5

### Nervous System 5

- I. Nervous System 5
- II. Neurons 6
- III. Central Nervous System 7
- IV. Peripheral Nervous System 7
- V. Autonomic Nervous System 9

### Circulatory System 11

- I. Vascular System 11
- II. Lymphatic System 12

### Organ Systems 13

- I. Digestive System 13
- II. Respiratory System 14
- III. Urinary System 14
- IV. Reproductive System 14
- V. Endocrine System 15
- VI. Integumentary System 15
- High-Yield Topics 15

### Review Test 18

## 2. BACK

22

### Vertebral Column 22

- I. General Characteristics 22
- II. Typical Vertebra 24
- III. Intervertebral Disks 26
- IV. Regional Characteristics of Vertebrae 27
- V. Ligaments of the Vertebral Column 29
- VI. Vertebral Venous System 30



## **Structures of the Back 31**

- I. Superficial Back 31
- II. Structures of the Deep Back 33
- III. Suboccipital Region 34

## **Spinal Cord and Associated Structures 36**

- I. Spinal Cord 36
- II. Spinal Nerves 37
- III. Meninges 38
- IV. Structures Associated With the Spinal Cord 40
- V. Dermatome, Myotome, and Sclerotome 41
- VI. Development of Back Structures 42
- High-Yield Topics 42

## **Review Test 45**

# **3. THORAX**

## **Thoracic Wall 52**

- I. Skeleton of the Thorax 52
- II. Articulations of the Thorax 54
- III. Breasts and Mammary Glands 55
- IV. Muscles of the Thoracic Wall 55
- V. Nerves and Blood Vessels of the Thoracic Wall 55
- VI. Lymphatic Drainage of the Thorax 56
- VII. Thymus 56
- VIII. Diaphragm and Its Openings 57

## **Mediastinum, Pleura, and Organs of Respiration 57**

- I. Mediastinum 57
- II. Trachea and Bronchi 58
- III. Pleurae and Pleural Cavities 59
- IV. Lungs 62
- V. Respiration 64
- VI. Lymphatic Vessels of the Lung 65
- VII. Blood Vessels of the Lung 65
- VIII. Nerve Supply to the Lung 67
- IX. Development of the Respiratory System 68

## **Pericardium and Heart 69**

- I. Pericardium 69
- II. Heart 70
- III. Great Vessels 79
- IV. Development of the Heart 80
- V. Development of the Arterial System 83
- VI. Development of the Venous System 84
- VII. Fetal Circulation 84

## **Structures in the Posterior Mediastinum 85**

- I. Esophagus 85
- II. Blood Vessels and Lymphatic Vessels 86
- III. Autonomic Nervous System in the Thorax 89
- High-Yield Topics 91

## **Review Test 97**



## 4. ABDOMEN

### Anterior Abdominal Wall 109

- I. Abdomen 109
- II. Muscles of the Anterior Abdominal Wall 110
- III. Fasciae and Ligaments of the Anterior Abdominal Wall 110
- IV. Inguinal Region 112
- V. Spermatic Cord, Scrotum, and Testis 113
- VI. Inner Surface of the Anterior Abdominal Wall 114
- VII. Nerves of the Anterior Abdominal Wall 115
- VIII. Lymphatic Drainage of the Anterior Abdominal Wall 116
- IX. Blood Vessels of the Anterior Abdominal Wall 116

### Peritoneum and Peritoneal Cavity 117

- I. Peritoneum 117
- II. Peritoneal Reflections 117
- III. Peritoneal Cavity 119

### Gastrointestinal (GI) Viscera 120

- I. Esophagus (Abdominal Portion) 120
- II. Stomach 121
- III. Small Intestine 123
- IV. Large Intestine 124
- V. Accessory Organs of the Digestive System 126
- VI. Spleen 130
- VII. Development of Digestive System 131
- VIII. Celiac and Mesenteric Arteries 133
- IX. Hepatic Portal Venous System 137

### Retroperitoneal Viscera, Diaphragm, and Posterior Abdominal Wall 140

- I. Kidney, Ureter, and Suprarenal Gland 140
- II. Development of Kidney, Urinary Bladder, and Suprarenal Gland 143
- III. Posterior Abdominal Blood Vessels and Lymphatics 144
- IV. Nerves of the Posterior Abdominal Wall 145
- V. The Diaphragm and Its Openings 148
- VI. Muscles of the Posterior Abdominal Wall 150
- High-Yield Topics 150

### Review Test 156

## 5. PERINEUM AND PELVIS

### Perineal Region 170

- I. Perineum 170
- II. Urogenital Triangle 170
- III. Anal Triangle 174
- IV. External Genitalia and Associated Structures 175
- V. Nerve Supply of the Perineal Region 178
- VI. Blood Supply of the Perineal Region 180

### Pelvis 181

- I. Bony Pelvis 181
- II. Joints of the Pelvis 184
- III. Pelvic Diaphragm 184



- IV. Ligaments or Folds and Pouches of the Pelvis 184
- V. Ureter and Urinary Bladder 186
- VI. Male Genital Organs 190
- VII. Female Genital Organs 194
- VIII. Rectum and Anal Canal 197
- IX. Blood Vessels of the Pelvis 199
- X. Nerve Supply to the Pelvis 202
- XI. Development of the Lower Gastrointestinal Tract and Urinary Organs 203
- XII. Development of the Reproductive System 205
- High-Yield Topics 205

## Review Test 211

# 6. LOWER LIMB

224

## Bones of the Lower Limb 224

- I. Hip (Coxal) Bone (Os Coxa) 224
- II. Bones of the Thigh and Leg 226
- III. Bones of the Ankle and Foot 228

## Joints and Ligaments of the Lower Limb 230

- I. Hip (Coxal) Joint 230
- II. Knee Joint 232
- III. Tibiofibular Joints 236
- IV. Ankle (Talocrural) Joint 236
- V. Tarsal Joints 237

## Cutaneous Nerves, Superficial Veins, and Lymphatics 238

- I. Cutaneous Nerves of the Lower Limb 238
- II. Superficial Veins of the Lower Limb 240
- III. Lymphatics of the Lower Limb 240

## Muscles of the Lower Limb 241

- I. Muscles of the Gluteal Region 241
- II. Posterior Muscles of the Thigh 242
- III. Muscles of the Anterior and Medial Thigh 243
- IV. Anterior and Lateral Muscles of the Leg 245
- V. Posterior Muscles of the Leg 246
- VI. Muscles of the Foot 247

## Nerves of the Lower Limb 250

- I. Branches of the Lumbar and Sacral Plexuses 250

## Blood Vessels of the Lower Limb 254

- I. Arteries of the Lower Limb 254
- II. Deep Veins of the Lower Limb 258
- III. Development of the Lower Limb 259
- High-Yield Topics 259
- Summary 263

## Review Test 265



## 7. UPPER LIMB 280

### Bones and Joints of the Upper Limb 280

- I. Bones of the Shoulder Girdle 280
- II. Bones of the Arm and Forearm 282
- III. Bones of the Hand 285
- IV. Joints and Ligaments of the Upper Limb 286

### Cutaneous Nerves, Superficial Veins, and Lymphatics 288

- I. Cutaneous Nerves of the Upper Limb 288
- II. Superficial Veins of the Upper Limb 290
- III. Superficial Lymphatics of the Upper Limb 291

### Axilla and Breast 291

- I. Fasciae of the Axilla and Pectoral Regions 291
- II. Axilla (Armpit) 292
- III. Breast and Mammary Gland 295

### Muscles of the Upper Limb 298

- I. Muscles of the Pectoral Region and Axilla 298
- II. Muscles of the Shoulder Region 299
- III. Muscles of the Arm and Forearm 301
- IV. Muscles of the Hand 303

### Nerves of the Upper Limb 308

- I. Brachial Plexus 308
- II. Nerves of the Arm, Forearm, and Hand 311
- III. Functional Components of the Peripheral Upper Limb Nerves 314

### Blood Vessels of the Upper Limb 315

- I. Branches of the Subclavian Artery 315
- II. Axillary Artery 315
- III. Brachial Artery 316
- IV. Radial Artery 317
- V. Ulnar Artery 318
- VI. Veins of the Upper Limb 319
- VII. Development of the Limbs 320
- High-Yield Topics 321
- Summary 323

### Review Test 327

## 8. HEAD AND NECK

### Structures of the Neck 345

- I. Major Divisions and Bones 345
- II. Muscles 347
- III. Nerves 348
- IV. Blood Vessels 350
- V. Lymphatics 356



## 7. UPPER LIMB 280

### Bones and Joints of the Upper Limb 280

- I. Bones of the Shoulder Girdle 280
- II. Bones of the Arm and Forearm 282
- III. Bones of the Hand 285
- IV. Joints and Ligaments of the Upper Limb 286

### Cutaneous Nerves, Superficial Veins, and Lymphatics 288

- I. Cutaneous Nerves of the Upper Limb 288
- II. Superficial Veins of the Upper Limb 290
- III. Superficial Lymphatics of the Upper Limb 291

### Axilla and Breast 291

- I. Fasciae of the Axilla and Pectoral Regions 291
- II. Axilla (Armpit) 292
- III. Breast and Mammary Gland 295

### Muscles of the Upper Limb 298

- I. Muscles of the Pectoral Region and Axilla 298
- II. Muscles of the Shoulder Region 299
- III. Muscles of the Arm and Forearm 301
- IV. Muscles of the Hand 303

### Nerves of the Upper Limb 308

- I. Brachial Plexus 308
- II. Nerves of the Arm, Forearm, and Hand 311
- III. Functional Components of the Peripheral Upper Limb Nerves 314

### Blood Vessels of the Upper Limb 315

- I. Branches of the Subclavian Artery 315
- II. Axillary Artery 315
- III. Brachial Artery 316
- IV. Radial Artery 317
- V. Ulnar Artery 318
- VI. Veins of the Upper Limb 319
- VII. Development of the Limbs 320
- High-Yield Topics 321
- Summary 323

### Review Test 327

## 8. HEAD AND NECK

### Structures of the Neck 345

- I. Major Divisions and Bones 345
- II. Muscles 347
- III. Nerves 348
- IV. Blood Vessels 350
- V. Lymphatics 356



## **Deep Neck and Prevertebral Region 357**

- I. Deep Structures of the Neck 357
- II. Deep Cervical Fasciae 360
- III. Prevertebral or Deep Neck Muscles 362
- IV. Development of Thyroid and Parathyroid Gland 362

## **Face and Scalp 363**

- I. Muscles of Facial Expression 363
- II. Nerve Supply to the Face and Scalp 364
- III. Blood Vessels of the Face and Scalp 366
- IV. Scalp 368

## **Temporal and Infratemporal Fossae 369**

- I. Introduction 369
- II. Muscles of Mastication 371
- III. Nerves of the Infratemporal Region 372
- IV. Blood Vessels of the Infratemporal Region 373
- V. Parotid Gland 375
- VI. Joints and Ligaments of the Infratemporal Region 376

## **Skull and Cranial Cavity 377**

- I. Skull 377
- II. Bones of the Cranium 377
- III. Sutures of the Skull 378
- IV. Foramina in the Skull 379
- V. Structures in the Cranial Fossae 382
- VI. Meninges of the Brain 383
- VII. Cranial Venous Channels 385
- VIII. Blood Supply of the Brain 386
- IX. Nerves of the Head and Neck 388
- X. Development of the Skull 388

## **Orbit 389**

- I. Bony Orbit 389
- II. Nerves 391
- III. Blood Vessels 393
- IV. Muscles of Eye Movement 395
- V. Lacrimal Apparatus 397
- VI. Eyeball 398
- VII. Development of the Eye 401

## **Oral Cavity and Palate 401**

- I. Oral Cavity 401
- II. Palate 402
- III. Tongue 404
- IV. Teeth and Gums or Gingivae 405
- V. Salivary Glands 407
- VI. Development of the Palate 408
- VII. Development of the Tongue 408
- VIII. Development of Teeth 408
- IX. Development of Salivary Glands 409



## **Pharynx and Tonsils 409**

- I. Pharynx 409
- II. Subdivisions of the Pharynx 409
- III. Innervation and Blood Supply of the Pharynx 410
- IV. Muscles of the Pharynx 411
- V. Swallowing (Deglutition) 412
- VI. Tonsils 412
- VII. Fascia and Space of the Pharynx 413
- VIII. Pharyngeal (Branchial) Apparatus 414

## **Nasal Cavity and Paranasal Sinuses 415**

- I. Nasal Cavity 415
- II. Subdivisions and Mucous Membranes 417
- III. Blood Supply to the Nasal Cavity 417
- IV. Nerve Supply to the Nasal Cavity 418
- V. Paranasal Sinuses 418
- VI. Development of the Nasal Cavity 419

## **Pterygopalatine Fossa 420**

- I. Boundaries and Openings 420
- II. Contents 420

## **Larynx 422**

- I. Introduction 422
- II. Cartilages 422
- III. Ligaments of the Larynx 423
- IV. Cavities and Folds 424
- V. Muscles 425
- VI. Innervation 426
- VII. Development of the Larynx 427

## **Ear 427**

- I. External Ear 427
- II. Middle Ear 429
- III. Inner Ear 432
- IV. Hearing and Equilibrium 433
- V. Development of the Ear 433
- High-Yield Topics 434

## **Review Test 446**

# **9. CRANIAL AND AUTONOMIC NERVES 463**

- I. Cranial Nerves 463
- II. Autonomic Nerves of the Head 476
- High-Yield Topics 480

## **Review Test 483**

## **Comprehensive Examination 489**

## **Index 510**