

- Length–Tension Relationship* 73
- Muscle Architecture* 74
- Clinical Considerations 74
 - Dosage* 74
 - Program Design* 77
 - Training Specificity* 78
 - Neurologic Adaptation* 78
 - Muscle Fatigue* 79
 - Muscle Soreness* 79
 - Life Span Considerations* 80
 - Cognitive Aspects of Performance* 84
 - Effects of Alcohol* 84
 - Effects of Medications* 84
- Causes of Decrease Muscle Performance 85
 - Neurologic Pathology* 85
 - Muscle Strain* 85
 - Disuse and Deconditioning* 86
 - Length-Associated Changes* 87
- Physiologic Adaptations to Training 87
 - Strength and Power* 87
 - Endurance* 89
- Examination and Evaluation of Muscle Performance 89
- Classification of Resistance Exercise 90
 - Isometric Exercise* 90
 - Dynamic Exercise* 92
- Methods of Resistance Training 93
 - Manual Resistance* 93
 - Pulley System* 94
 - Variable Resistance Machines* 95
 - Elastic Resistance* 96
 - Free Weights* 98
 - Isokinetic Devices* 101
 - Body Weight* 103
- Therapeutic Exercise Intervention for Impaired Muscle Performance 103
 - Program Initiation* 103
 - Program Progression* 105
- Therapeutic Exercise Intervention for Prevention, Health Promotion, and Wellness 107
 - Dosage for Strength Training* 107
 - Dosage for Power Training* 108
 - Plyometric Exercise* 108
 - Dosage for Endurance Training* 109
 - Dosage for the Advanced or Elite Athlete* 109
- Precautions and Contraindications 110
- Key Points 110

CHAPTER 6
Impaired Aerobic Capacity/Endurance 116

JANET R. BEZNER

- Aerobic Capacity and Endurance 117
 - Definitions* 117
 - Normal and Abnormal Responses to Acute Aerobic Exercise* 117
 - Physiologic and Psychological Adaptations to Cardiorespiratory Endurance Training* 118
- Causes of Impaired Aerobic Capacity/Rehabilitation Indications 120
- Examination/Evaluation of Aerobic Capacity 122
 - Patient/Client History* 122

- Systems Review* 122
- Screening Examination* 122
- Tests and Measures* 123
- Therapeutic Exercise Intervention 128
 - Mode* 128
 - Dosage* 129
- Precautions and Contraindications 133
 - Graded Exercise Testing Contraindications and Supervision Guidelines* 133
 - Supervision During Exercise* 134
- Patient-Related Instruction/Education and Adjunctive Interventions 134
- Life Span Issues 135
 - Guidelines for Cardiovascular Endurance Training in the Young* 135
 - Guidelines for Cardiovascular Endurance Training in the Elderly* 136
- Key Points 137

CHAPTER 7
Impaired Range of Motion and Joint Mobility 140

LORI THEIN BRODY

- Continuum of Mobility 140
- Morphology and Physiology of Normal Mobility 141
- Immobilization, Immobilization, and Remobilization 141
- Mobility Examination and Evaluation 143
- Range of Motion Intervention For Impaired Mobility 144
 - Subsystems of the Movement System* 144
 - Considerations in Choosing Mobility Activities* 145
 - Range of Motion* 145
- Stretching 156
 - Indications* 156
 - Principles and Considerations in Stretching* 156
 - Neurophysiology of Stretching* 157
 - Static Stretching* 158
 - Ballistic Stretching* 158
 - Proprioceptive Neuromuscular Facilitation Stretching* 159
 - Dynamic Stretching* 159
 - Effects of Stretching* 160
 - Stretching and Joint Contractures* 162
- Joint Mobilization to Increase Mobility 163
 - Biomechanics of Joint Mobilization* 164
 - Mobilization Grades* 165
 - General Procedures* 165
 - Applications to Specific Joints* 165
- Neural Mobility 165
- Self-Mobilization 172
- Mobility Exercise Dosage 174
 - Sequence* 174
 - Frequency, Intensity, and Duration* 175
- Hypomobility Exercise Precautions and Contraindications 176
- Causes and Effects of Hypermobility 177
- Therapeutic Exercise Intervention for Hypermobility 178
 - Stabilization Exercises* 178
 - Exercise Dosage* 180
 - Hypermobility Exercise Precautions and Contraindications* 180
- Lifespan Issues 180
- Adjunctive Agents 181
- Key Points 181

CHAPTER 8**Impaired Balance and Mobility 187**

COLIN R. GROVE, JUDITH DEWANE, and LORI THEIN BRODY

- Definitions 187
- Physiology of Balance 188
 - Biomechanical Contributions* 189
 - Contributions of the Sensory Systems* 189
 - Neural Integration and Processing of Sensory Information* 190
 - Generating Motor Output—Movement Strategies* 191
 - Control of Walking—Navigation* 193
 - Higher-Level Influences* 193
- Causes of Impaired Balance 193
- Examination and Evaluation of Impaired Balance and Mobility 194
 - Biomechanical Domain* 195
 - Sensory Strategies Domain* 196
 - Movement Strategies Domain* 197
 - Dynamic Control Domain* 197
 - Cognitive Domain* 197
 - Affective Domain* 197
 - Determining Risk for Falling* 198
- Treating Impaired Balance 198
 - Diagnosis and Prioritization* 198
 - Customization* 199
 - Environmental Context* 199
 - Mode* 199
 - Motor Learning* 200
 - Intervention Strategies for Specific Systems—Examples* 200
 - Sequencing Considerations* 207
 - Feedback* 208
- Expanded Ecological Model of Balance Rehabilitation 208
- Precautions and Contraindications 209
- Patient Education 209
 - Falls—A Significant Problem* 209
- Effects of Training on Balance 210
- Key Points 211

CHAPTER 9**Impaired Posture and Movement 216**

CARRIE M. HALL

- Definitions 218
 - Posture* 218
 - Standard Posture* 218
 - Deviations in Posture* 220
- Movement 221
- Contributors to Impaired Posture and Movement 223
 - Range of Motion* 224
 - Muscle Length* 224
 - Joint Mobility* 224
 - Muscle Performance* 225
 - Pain* 227
 - Anatomic Impairments and Anthropometric Characteristics* 228
 - Psychologic Impairments* 229
 - Lifespan Considerations* 229
 - Environmental Influences* 230
- Examination and Evaluation 230
 - Posture* 230
 - Movement* 232

- Intervention 233
 - The Movement System* 233
 - Activity and Dosage* 234
 - Patient-Related Instruction and Adjunctive Interventions* 235
- Key Points 236

CHAPTER 10**Pain 240**

LORI THEIN BRODY

- Definitions 240
- Physiology of Pain 240
 - Sources of Pain* 241
 - Pain Pathways* 242
 - Pain Theory* 243
- Examination and Evaluation 244
 - Pain Scales* 244
 - McGill Pain Questionnaire* 245
 - Disability and Health-Related Quality of Life Scales* 246
- Therapeutic Exercise Intervention for Pain 250
 - Acute Pain* 251
 - Chronic Pain* 253
 - Therapeutic Exercise Guidelines for Patients with Chronic Pain* 253
- Adjunctive Agents 260
 - Transcutaneous Electrical Nerve Stimulation* 261
 - Heat* 261
 - Cold* 261
 - Medication* 261
- Special Considerations in Chronic Pain: Complex Regional Pain Syndrome, Fibromyalgia, and Chronic Fatigue Syndrome 262
 - Complex Regional Pain Syndrome* 262
 - Fibromyalgia Syndrome* 264
 - Chronic Fatigue Syndrome* 266
- Therapeutic Exercise Interventions for Common Impairments 267
 - Impaired Muscle Power Functions* 267
 - Exercise Tolerance Functions: Impaired Aerobic Capacity* 268
 - Mobility of Joint Functions: Impaired Range of Motion* 269
 - Muscle Endurance Functions: Impaired Posture* 269
 - Emotional Functions: Impaired Response to Emotional Stress* 271
- Precautions and Contraindications 272
 - Pacing* 272
 - Pharmacological and Psychological Intervention* 272
- Key Points 273

UNIT 3**Special Physiologic Considerations in Therapeutic Exercise 281****CHAPTER 11****Soft-Tissue Injury and Postoperative Management 282**

LORI THEIN BRODY

- Physiology of Connective Tissue Repair 282
 - Microstructure of Connective Tissues* 282

Response to Loading 283
Phases of Healing 284
 Principles of Treating Connective Tissue Injuries 286
Restoration of Normal Tissue Relationships 286
Optimal Loading 286
Specific Adaptations to Imposed Demands 287
Preventing Complications 287
 Management of Impairments Associated with Connective Tissue Dysfunction and Localized Inflammation 287
Sprain: Injury to Ligament and Capsule 287
Strain: Musculotendinous Injury 288
Application of Treatment Principles 288
Tendinopathy 291
Articular Cartilage Injury 294
Contusion 296
 Management of Impairments Associated with Fractures 296
Classification of Fractures 296
Application of Treatment Principles 297
 Management of Impairments Associated with Bony and Soft-Tissue Surgical Procedures 298
Soft-Tissue Procedures 299
Bony Procedures 305
 Management of Impairments Associated with Joint Arthroplasty 308
 Key Points 309

CHAPTER 12

Therapeutic Exercise for Arthritis 313

LORI THEIN BRODY and KIMBERLY D. BENNETT

Pathology 313
Osteoarthritis 313
Rheumatoid Arthritis 314
 Exercise Recommendations for Prevention and Wellness in OA and RA 318
 Therapeutic Exercise Intervention For Common Impairments 318
Pain and Fatigue 319
Impaired Mobility and ROM 320
Impaired Muscle Performance 321
Impaired Aerobic Capacity 324
Special Considerations in Exercise Prescription and Modification 325
 Patient Education 327
 Key Points 327

CHAPTER 13

Therapeutic Exercise in Obstetrics 330

ELIZABETH A. V. BLOOM, MELISSA FISCHER, and M. J. STRAUHAL

Physiologic Changes Related to Pregnancy 330
Endocrine System 330
Cardiovascular System 331
Respiratory System 333
Musculoskeletal System 334
 Therapeutic Exercise Intervention in Pregnancy 335
Uncomplicated Antepartum Pregnancy 335
High-Risk Antepartum 343
 Therapeutic Exercise Intervention for Common Impairments 346
Nerve Compression Syndromes 346
Other Impairments 347

Therapeutic Exercise Intervention for Wellness in Pregnancy 348
Precautions and Contraindications 349
Exercise Guidelines 349
Exercise Intensity 350
Exercise Classes 351
 Key Points 351

UNIT 4

Sample Specialties of Therapeutic Exercise Intervention 357

CHAPTER 14

Kinetic Chain Applications in Functional Movement 358

DANNY MCMILLIAN

Understanding the Kinetic Chain 358
Posture and Alignment 359
Muscle Performance 360
Neuromuscular Control 361
 Examination and Evaluation 363
Qualitative Examination 363
Quantitative Examination 365
 Choosing Therapeutic Movements to Enhance Kinetic Chain Function 366
 Applying Therapeutic Movement 369
 Key Points 384

CHAPTER 15

Proprioceptive Neuromuscular Facilitation 388

KYLE M. YAMASHIRO and RAFAEL F. ESCAMILLA

History and Background 388
 Philosophy and Principles of PNF 388
 PNF Physiology and Applied Concepts 389
Research in PNF to Increase Muscle Length 390
Research in PNF to Improve Muscle Performance 391
 PNF Procedures 393
Manual Therapeutic Exercise Using PNF Procedures 393
 Evaluation and Treatment Implementation 395
Direct Treatment 395
Indirect Treatment 395
 Manual Therapeutic Exercise Using PNF Techniques 395
Movement 395
Stability 404
Flexibility 405
 Key Points 409

CHAPTER 16

Aquatic Therapeutic Exercise 413

LORI THEIN BRODY

Physical Properties of Water 413
Buoyancy 413
Hydrostatic Pressure 415
Viscosity 416
 Physiologic Responses to Immersion 418
Effects of Hydrostatic Pressure 418
Effects of Water Temperature 419
 Physiologic Responses to Exercise While Immersed 419
 Examination and Evaluation for Aquatic Rehabilitation 420

Therapeutic Exercise Intervention	420
<i>Mobility Impairment</i>	421
<i>Muscle Strength/Power/Endurance Impairment</i>	422
<i>Balance Impairment</i>	424
Aquatic Rehabilitation to Treat Activity Limitations	426
Coordinating Land and Water Activities	427
Patient-Related Education	427
Precautions/Contraindications	428
Key Points	428

UNIT 5

Functional Approach to Therapeutic Exercise of the Lower Extremities 433

CHAPTER 17

The Lumbopelvic Region 434

CARRIE M. HALL

Review of Anatomy and Kinesiology	435
<i>Myology</i>	435
<i>Gait</i>	438
Examination and Evaluation	439
<i>Patient History</i>	440
<i>Screening Examination</i>	441
<i>Tests and Measures</i>	441
Therapeutic Exercise Intervention for Common Impairments of Body Functions	448
<i>Aerobic Capacity Impairment</i>	448
<i>Balance and Coordination Impairment</i>	449
<i>Muscle Performance Impairment</i>	450
<i>Range of Motion, Muscle Length, and Joint Mobility</i>	462
<i>Pain</i>	464
<i>Posture and Movement Impairment</i>	470
Therapeutic Exercise Intervention for Common Diagnoses	473
<i>Lumbar Disk Herniation</i>	473
<i>Spinal Stenosis</i>	477
<i>Spondylolysis and Spondylolisthesis</i>	478
Key Points	479

CHAPTER 18

The Pelvic Floor 488

ELIZABETH R. SHELLY and SHERRI S. HOLT

Review of Anatomy and Kinesiology	488
<i>Skeletal Muscles</i>	488
<i>Pelvic Diaphragm Muscles</i>	489
<i>Pelvic Floor Function</i>	491
<i>Physiology of Micturition</i>	492
Impairments of Body Structures	493
<i>Birth Injury</i>	493
<i>Neurologic Dysfunction</i>	493
Impairments of Mental Functions	493
<i>Motivation</i>	493
<i>Sexual Abuse</i>	493
Examination/Evaluation	494
<i>Risk Factors</i>	494
<i>Screening Questionnaires</i>	495
<i>Results of the Internal Examination</i>	496
<i>Patient Self-Assessment Tests</i>	496
<i>Ultrasound Imaging for PFM Dysfunction</i>	497

Therapeutic Exercise Interventions for Common Physiologic Impairments	497
<i>Impaired Muscle Performance</i>	498
<i>Active PFEs</i>	498
<i>Pain</i>	501
<i>Joint Mobility and Range of Motion (Including Muscle Length) Impairments</i>	503
<i>Posture Impairment</i>	504
<i>Coordination Impairment</i>	504
Clinical Classifications of Pelvic Floor Muscle Dysfunction	506
<i>Underactive PFM</i>	506
<i>Overactive PFM</i>	508
<i>Incoordination Dysfunction</i>	509
<i>Visceral Dysfunction</i>	510
Therapeutic Exercise Interventions for Common Diagnoses	510
<i>Incontinence</i>	511
<i>Pelvic Organ Prolapse</i>	513
<i>Chronic Pelvic Pain</i>	514
<i>Levator Ani Syndrome</i>	514
<i>Coccygodynia</i>	514
<i>Vulvodynia</i>	515
<i>Vaginismus</i>	515
<i>Nonrelaxing Puborectalis Syndrome</i>	516
<i>Dyspareunia</i>	516
Adjunctive Interventions	516
<i>Biofeedback</i>	516
<i>Basic Bladder Training</i>	517
<i>Scar Mobilization</i>	518
<i>Externally Palpating the Pelvic Floor Muscles</i>	519
Key Points	520

CHAPTER 19

The Hip 526

CARRIE M. HALL

Impairments of Body Structures	526
<i>Angles of Inclination and Torsion</i>	526
<i>Center Edge Angle or Angle of Wiberg</i>	527
<i>Leg Length Discrepancy</i>	527
<i>Cam and Pincer Morphology</i>	528
Examination and Evaluation	529
<i>History</i>	530
<i>Lumbar Spine Clearing Examination</i>	530
<i>Other Clearing Tests</i>	530
<i>Gait and Balance</i>	530
<i>Joint Mobility and Integrity</i>	531
<i>Muscle Performance</i>	531
<i>Pain and Inflammation</i>	531
<i>Posture and Movement</i>	532
<i>Range of Motion and Muscle Length</i>	532
<i>Work (Job/School/Play), Community, and Leisure Integration or Reintegration (Including Instrumental Activities of Daily Living)</i>	533
<i>Special Tests</i>	533
Therapeutic Exercise Interventions for Common Physiologic Impairments	535
<i>Pain</i>	535
<i>Muscle Performance</i>	536
<i>ROM, Muscle Length, Joint Mobility, and Integrity Impairments</i>	549
<i>Balance</i>	557
<i>Posture and Movement Impairment</i>	562

- Therapeutic Exercise Interventions for Common Diagnoses 563
 - Osteoarthritis* 563
 - Iliotibial Band–Related Diagnoses* 569
 - Nerve Entrapment Syndromes* 573
- Key Points 577

CHAPTER 20

The Knee 586

JILL THEIN-NISSENBAUM and LORI THEIN BRODY

- Review of Anatomy and Kinesiology 586
 - Anatomy* 586
 - Kinematics* 587
 - Kinetics* 588
- Impairments of Body Structures 589
 - Genu Valgum* 589
 - Genu Varum* 590
- Examination and Evaluation 590
 - Patient/Client History* 590
 - Tests and Measures* 590
- Therapeutic Exercise Intervention for Body Function
 - Impairments 590
 - Mobility Impairment* 590
 - Muscle Performance Impairments* 596
- Therapeutic Exercise Intervention for Common Diagnoses 600
 - Ligament Injuries* 600
 - Treatment of Ligament Injuries* 605
 - Fractures* 607
 - Treatment of Fractures* 609
 - Meniscal Injuries* 610
 - Treatment* 611
- Degenerative Arthritis Problems 612
 - Articular Cartilage Lesions* 612
 - Surgical Procedures* 613
 - Interventions for Degenerative Arthritis Problems* 615
- Tendinopathies 616
 - Patellar Tendinopathy* 616
 - Iliotibial Band Syndrome* 617
 - Patellofemoral Pain Syndrome* 617
- Key Points 623

CHAPTER 21

The Ankle and Foot 629

JILL MCVEY and CARRIE M. HALL

- Common Foot Types 629
 - Subtalar Varus* 629
 - Forefoot Varus* 629
 - Forefoot Valgus* 629
 - Ankle Equinus* 630
- Examination and Evaluation 630
 - Patient/Client History* 630
 - Balance* 630
 - Joint Integrity and Mobility* 630
 - Muscle Performance* 630
 - Pain* 630
 - Posture* 630
 - Range of Motion and Muscle Length* 630
 - Impairments of Body Structures* 631
 - Other Examination Procedures* 631
- Therapeutic Exercise Intervention for Common Impairments of
 - Body Functions 631
 - Balance Impairment* 631
 - Muscle Performance* 632

- Pain* 635
- Posture and Movement Impairment* 635
- ROM, Muscle Length, Joint Integrity, and Mobility* 637
- Swelling* 641

- Therapeutic Exercise Intervention for Common Ankle and Foot
 - Diagnoses 641
 - Ligament Sprains* 642
 - Ankle Fractures* 644
 - Functional Nerve Disorders* 645
 - Plantar Fasciitis* 646
 - Posterior Tibial Tendon Dysfunction* 648
 - Medial Tibial Stress Syndrome* 649
 - Achilles Tendinosis* 649
 - Postoperative Management* 650
- Adjunctive Interventions 651
 - Adhesive Strapping* 651
 - Wedges and Pads* 651
 - Biomechanical Foot Orthotics* 652
 - Heel and Full Sole Lifts* 652
- Key Points 653

UNIT 6

Functional Approach to Therapeutic Exercise for the Upper Extremities 657

CHAPTER 22

The Temporomandibular Joint 658

LISA M. FLEXNER and DARLENE HERTLING

- Review of Anatomy and Kinesiology 658
 - The Temporomandibular Joint Structures* 658
 - Associated Structures* 660
 - Kinesiology* 660
- Examination and Evaluation 662
 - Subjective History* 663
 - Screening Exam for the TMJ* 664
- Therapeutic Exercise for Common Impairments of Body
 - Functions 664
 - Mobility Impairments* 664
 - Posture Impairments* 673
 - Swallowing and Respiratory Impairments* 674
 - The Rocabado 6 × 6* 675
- Therapeutic Exercise for Common Diagnoses 675
 - Capsulitis and Retrodiskitis* 676
 - Internal Derangement of the Disk* 676
 - Degenerative Joint Disease/Osteoarthritis* 678
 - Postoperative Physical Therapy Following Surgical Intervention* 678
- Adjunctive Therapies 679
- Key Points 679

CHAPTER 23

The Cervical Spine 684

CAROL N. KENNEDY

- Review of Anatomy and Kinesiology 684
 - Muscles* 685
- Examination and Evaluation 686
 - History and Clearing Tests* 686
 - Physical Examination* 686

- Therapeutic Exercise Interventions for Common Impairments of Body Functions 687
 - Impaired Muscle Performance* 687
 - Mobility Impairment* 697
 - Posture Impairment* 703
- Therapeutic Exercise Interventions for Common Diagnoses 708
 - Disk Dysfunction* 708
 - Cervical Sprain and Strain* 709
 - Neural Entrapment* 710
 - Cervicogenic Headache* 710
- Key Points 711

CHAPTER 24**The Thoracic Spine 714**

ELIZABETH A. V. BLOOM and CARRIE M. HALL

- Examination and Evaluation 715
 - History* 715
 - Systems Review* 715
 - Tests and Measures* 716
- Therapeutic Exercise Interventions for Common Impairments of Body Structures and Functions 716
 - Impaired Muscle Performance* 718
 - Impaired ROM, Muscle Length, and Joint Mobility/Integrity* 722
 - Pain* 728
 - Impaired Posture and Motor Function* 728
- Therapeutic Exercise Intervention for Common Diagnoses 736
 - Prevention and Intervention in Patients with Osteoporosis* 736
 - Exercise Management of Parkinson Disease* 736
 - Thoracic Outlet Syndrome* 738
- Key Points 739

CHAPTER 25**The Shoulder Girdle 743**

CARRIE M. HALL

- Review of Anatomy and Kinesiology 743
- Examination and Evaluation 743
 - Patient/Client History* 743
 - Clearing Examinations* 744
 - Motor Function (Motor Control and Motor Learning)* 744
 - Muscle Performance* 745
 - Pain* 745
 - Peripheral Nerve Integrity* 746
 - Posture* 746
 - ROM, Muscle Length, Joint Mobility, and Joint Integrity* 746
 - Work (Job/School/Play), Community, and Leisure Integration or Reintegration (Including Instrumental ADLs)* 747
- Therapeutic Exercise Interventions for Common Impairments of Body Structures and Functions 747
 - Pain* 747
 - ROM and Joint Mobility Impairments* 757
 - Impaired Muscle Performance* 761
 - Posture and Movement Impairment* 770
- Therapeutic Exercise Interventions for Common Diagnoses 771
 - Rotator Cuff Disorders* 771
 - Pathomechanics* 771
 - Pathogenesis* 773
 - Glenohumeral Hypermobility/Instability* 780
 - Frozen Shoulder* 783

- Adjunctive Interventions: Taping 786
 - Scapular Corrections* 787
 - Prevention of Allergic Reaction* 787
- Key Points 789

CHAPTER 26**The Elbow, Forearm, Wrist, and Hand 798**

LORI THEIN BRODY

- Anatomy 798
 - Elbow and Forearm* 798
 - Wrist* 799
 - Hand* 801
 - Regional Neurology* 802
 - Kinesiology* 803
 - Wrist* 805
 - Hand* 805
- Examination and Evaluation 808
 - History and Observation* 808
 - Mobility Examination* 808
 - Muscle Performance Examination* 808
 - Other Tests* 809
- Therapeutic Exercise Interventions for Common Impairments of Body Functions 809
 - Mobility of Joint Functions: Impaired Range of Motion* 809
 - Impaired Muscle Power Functions* 811
 - Endurance Impairment* 814
 - Pain and Inflammation Impairment* 814
 - Muscle Endurance Functions: Impaired Posture and Movement* 815
- Therapeutic Exercise Interventions for Common Diagnoses 816
 - Osteoarthritis and Rheumatoid Arthritis* 816
 - Cumulative Trauma Disorders* 817
 - Nerve Injuries* 818
 - Musculotendinous Disorders* 822
 - Bone and Joint Injuries* 827
 - Stiff Hand and Restricted Motion* 836
- Key Points 837

UNIT 7**Case Studies 845**

LORI THEIN BRODY, CARRIE M. HALL, and ELIZABETH A. V. BLOOM

APPENDIX 1**Red Flags: Recognizing Signs and Symptoms 872**

DAVID MUSNICK and CARRIE M. HALL

APPENDIX 2**Red Flags: Potentially Serious Symptoms and Signs in Exercising Patients 877**

SCOTT TAUFERNER and CARRIE M. HALL

APPENDIX 3**2016 PAR-Q +: The Physical Activity Readiness Questionnaire for Everyone 881****INDEX 886**