

Contents

Contributors xi ■ Preface xiii

PART I Framework 1

J. Larry Durstine, PhD, FACSM

1 Introduction 3

Geoffrey E. Moore, MD, FACSM ■ Scott O. Roberts, PhD, FACSM
J. Larry Durstine, PhD, FACSM

Concept of Exercise Is Medicine 4 ■ Evidence-Based Guidelines 4 ■ How to Use This Book 6
Problem-Oriented Management 7 ■ How to Use the Tables 8 ■ How to Read the Tables 8
What's in the Tables 8 ■ What's Not in the Tables 8

2 Approach to Exercise and Disease Management 9

Geoffrey E. Moore, MD, FACSM ■ Anthony P. Marsh, PhD ■ J. Larry Durstine, PhD, FACSM

Problem-Oriented Exercise Management 9 ■ Categories of Exercise Test Measures 12 ■ Exercise and Medications 16
Exercise Dose-Response 18 ■ Risk, Cost, and Benefit 19 ■ Putting It All Together 19

3 Exercise Is Medicine 21

J. Larry Durstine, PhD, FACSM ■ J. Brent Peel, MS ■ Michael J. LaMonte, PhD, FACSM
Steven J. Keteyian, PhD, FACSM ■ Emma Fletcher, MA ■ Geoffrey E. Moore, MD, FACSM

Terminology 22 ■ Epidemiology 22 ■ Exercise and Cardiovascular Diseases 25 ■ Biological Plausibility 26
Current and Future Priorities 26 ■ Education for Exercise Professionals 27 ■ Summary 30

4 Managing Exercise in Persons With Multiple Chronic Conditions 31

Geoffrey E. Moore, MD, FACSM ■ Patricia L. Painter, PhD, FACSM ■ G. William Lyerly, MS
J. Larry Durstine, PhD, FACSM

Overview of the Pathophysiology 31 ■ Effects on the Exercise Response 35 ■ Role of Exercise Training 35
Recommendations for Exercise Testing 36 ■ Recommendations for Exercise Programming 36 ■ Case Study 37

5 Physical Activity for Children and Adolescents 38

William F. Riner, PhD, FACSM ■ Richard J. Sabath, EdD, FACSM

Effects of Health Status and Physical Activity on Growth and Development 39
Normal Responses to Physical Activity in Children and Adolescents 39 ■ Exercise Testing of Children and Adolescents 41
General Physical Activity Concerns for Children With a Chronic Health Condition or Disability 41
Selected Diseases and Disorders of Children and Youth 42 ■ Summary 44

PART II Cardiovascular Diseases**47**

Scott O. Roberts, PhD, FACSM ■ Peter H. Brubaker, PhD, FACSM

- 6 Myocardial Infarction 49**
 Barry A. Franklin, PhD, FACSM
 Overview of the Pathophysiology 49 ■ Effects on the Exercise Response 50 ■ Effects of Exercise Training 51
 Management and Medications 51 ■ Special Precautions 52 ■ Recommendations for Exercise Testing 53
 Recommendations for Exercise Programming 53 ■ Case Study 56
- 7 Revascularization: CABGS and PTCA or PCI 58**
 Barry A. Franklin, PhD, FACSM
 Overview of the Pathophysiology 58 ■ Effects on the Exercise Response 60 ■ Effects of Exercise Training 60
 Management and Medications 61 ■ Recommendations for Exercise Testing 61
 Recommendations for Exercise Programming 62 ■ Case Study 64
- 8 Angina and Silent Ischemia 66**
 Daniel Friedman, MD, FACSM ■ Scott O. Roberts, PhD, FACSM
 Overview of the Pathophysiology 66 ■ Effects on the Exercise Response 67 ■ Effects of Exercise Training 68
 Management and Medications 68 ■ Recommendations for Exercise Testing 69
 Recommendations for Exercise Programming 70 ■ Case Study 72
- 9 Atrial Fibrillation 73**
 J. Edwin Atwood, MD ■ Jonathan N. Myers, PhD, FACSM
 Overview of the Pathophysiology 73 ■ Effects on the Exercise Response 73 ■ Effects of Exercise Training 74
 Management and Medications 74 ■ Recommendations for Exercise Testing 74
 Recommendations for Exercise Programming 76 ■ Case Study 77
- 10 Pacemakers and Implantable Cardioverter Defibrillators 79**
 Scott O. Roberts, PhD, FACSM ■ Michael West, MD
 Overview of the Pathophysiology 79 ■ Effects on the Exercise Response 80 ■ Effects of Exercise Training 81
 Management and Medications 81 ■ Recommendations for Exercise Testing 81
 Recommendations for Exercise Programming 81 ■ Case Study 83
- 11 Valvular Heart Disease 85**
 Daniel Friedman, MD, FACSM ■ Scott O. Roberts, PhD, FACSM
 Overview of the Pathophysiology 85 ■ Effects on the Exercise Response 87 ■ Effects of Exercise Training 88
 Management and Medications 88 ■ Surgical Considerations 88 ■ Recommendations for Exercise Testing 88
 Recommendations for Exercise Programming 89 ■ Special Considerations 90 ■ Case Study 91
- 12 Chronic Heart Failure 92**
 Jonathan N. Myers, PhD, FACSM ■ Peter H. Brubaker, PhD, FACSM
 Overview of the Pathophysiology 92 ■ Effects on the Exercise Response 92 ■ Effects of Exercise Training 93
 Management and Medications 94 ■ Recommendations for Exercise Testing 94
 Recommendations for Exercise Programming 96 ■ Case Study 97
- 13 Cardiac Transplant 99**
 Ross Arena, PhD, PT, FACSM ■ Reed Humphrey, PhD, PT, FACSM
 Overview of the Pathophysiology 99 ■ Effects on the Exercise Response 100 ■ Effects of Exercise Training 100
 Management and Medications 100 ■ Recommendations for Exercise Testing 101
 Recommendations for Exercise Programming 103 ■ Case Study 105

14	Hypertension	107
	Neil F. Gordon, MD, PhD, MPH, FACSM	
	Overview of the Pathophysiology 107 ■ Effects on the Exercise Response 107 ■ Effects of Exercise Training 108 Management and Medications 108 ■ Recommendations for Exercise Testing 110 Recommendations for Exercise Programming 111 ■ Case Study 113	
15	Peripheral Arterial Disease	114
	Christopher J. Womack, PhD, FACSM ■ Andrew W. Gardner, PhD ■ Raha Nael, MD	
	Overview of the Pathophysiology 114 ■ Effects on the Exercise Response 115 ■ Effects of Exercise Training 115 Management and Medications 115 ■ Recommendations for Exercise Testing 115 Recommendations for Exercise Programming 117 ■ Case Study 118	
16	Aneurysms	120
	Jonathan N. Myers, PhD, FACSM	
	Overview of the Pathophysiology 120 ■ Effects on the Exercise Response 121 ■ Effects of Exercise Training 121 Management and Medications 122 ■ Recommendations for Exercise Testing 122 Recommendations for Exercise Programming 122 ■ Special Considerations 123 ■ Case Study 125	
PART III	Pulmonary Diseases	127
	Christopher B. Cooper, MD, FACSM	
17	Chronic Obstructive Pulmonary Disease	129
	Christopher B. Cooper, MD, FACSM	
	Overview of the Pathophysiology 129 ■ Effects on the Exercise Response 130 ■ Effects of Exercise Training 131 Management and Medications 131 ■ Recommendations for Exercise Testing 132 Recommendations for Exercise Programming 132 ■ Case Study 135	
18	Chronic Restrictive Pulmonary Disease	136
	Connie C.W. Hsia, MD	
	Overview of the Pathophysiology 136 ■ Effects on the Exercise Response 137 ■ Effects of Exercise Training 138 Management and Medications 138 ■ Recommendations for Exercise Testing 139 Recommendations for Exercise Programming 139 ■ Case Study 142	
19	Asthma	143
	Christopher J. Clark, MD ■ Lorna M. Cochrane, MD	
	Overview of the Pathophysiology 143 ■ Effects on the Exercise Response 143 ■ Effects of Exercise Training 144 Management and Medications 144 ■ Recommendations for Exercise Testing 145 Recommendations for Exercise Programming 146 ■ Case Study 149	
20	Cystic Fibrosis	150
	Patricia A. Nixon, PhD, FACSM	
	Overview of the Pathophysiology 150 ■ Effects on the Exercise Response 150 ■ Effects of Exercise Training 151 Management and Medications 151 ■ Recommendations for Exercise Testing 152 Recommendations for Exercise Programming 153 ■ Special Considerations 153 ■ Case Study 155	
21	Lung and Heart-Lung Transplantation	156
	David L. Balfe, MD ■ David J. Ross, MD	
	Overview of the Pathophysiology 156 ■ Effects on the Exercise Response 157 ■ Effects of Exercise Training 158 Management and Medications 158 ■ Recommendations for Exercise Testing 159 Recommendations for Exercise Programming 161 ■ Special Considerations 163 ■ Case Study 163	

PART IV Metabolic Diseases 165

Patricia L. Painter, PhD, FACSM ■ J. Larry Durstine, PhD, FACSM

22 Hyperlipidemia 167

J. Larry Durstine, PhD, FACSM ■ Geoffrey E. Moore, MD, FACSM ■ Donna Polk, MD, MPH

Overview of the Pathophysiology 167 ■ Effects on the Exercise Response 168 ■ Effects of Exercise Training 168
 Management and Medications 169 ■ Recommendations for Exercise Testing 171
 Recommendations for Exercise Programming 171 ■ Case Study 173

23 End-Stage Metabolic Disease: Chronic Kidney Disease and Liver Failure 175

Patricia L. Painter, PhD, FACSM ■ Joanne B. Krasnoff, PhD

Overview of the Pathophysiology 175 ■ Effects on the Exercise Response 176 ■ Effects of Exercise Training 176
 Management and Medications 177 ■ Recommendations for Exercise Testing 178
 Recommendations for Exercise Programming 179 ■ Case Study 180

24 Diabetes 182

W. Guyton Hornsby Jr., PhD, CDE, FACSM ■ Ann L. Albright, PhD, RD

Overview of the Pathophysiology 182 ■ Effects on the Exercise Response 184 ■ Effects of Exercise Training 184
 Management and Medications 184 ■ Recommendations for Exercise Testing 187
 Recommendations for Exercise Programming 188 ■ Case Study 190

25 Obesity 192

Janet P. Wallace, PhD, FACSM ■ Shahla Ray, PhD

Overview of the Pathophysiology 192 ■ Effects on the Exercise Response 194 ■ Effects of Exercise Training 195
 Management and Medications 195 ■ Recommendations for Exercise Testing 196
 Recommendations for Exercise Programming 196 ■ Special Considerations 197 ■ Case Study 199

26 Frailty 201

Constance Mols Bayles, PhD, FACSM ■ Selena Chan, BS ■ Joseph Robare, MS, RD, LDN

Overview of the Pathophysiology 201 ■ Effects on the Exercise Response 201 ■ Effects of Exercise Training 203
 Management and Medications 203 ■ Recommendations for Exercise Testing 204
 Recommendations for Exercise Programming 206 ■ Case Study 207

PART V Immunological and Hematological Disorders 209

Geoffrey E. Moore, MD, FACSM ■ Michael J. LaMonte, PhD, FACSM

27 Cancer 211

Anna L. Schwartz, PhD, ARNP, FAAN

Overview of the Pathophysiology 211 ■ Effects on the Exercise Response 211 ■ Effects of Exercise Training 212
 Management and Medications 213 ■ Recommendations for Exercise Testing 214
 Recommendations for Exercise Programming 214 ■ Case Study 217

28 Acquired Immune Deficiency Syndrome (AIDS) 219

Gregory A. Hand, PhD, FACSM ■ G. William Lyerly, MS ■ Wesley D. Dudgeon, PhD

Overview of the Pathophysiology 219 ■ Effects on the Exercise Response 220 ■ Effects of Exercise Training 221
 Management and Medications 221 ■ Recommendations for Exercise Testing 222
 Recommendations for Exercise Programming 223 ■ Special Considerations 224 ■ Case Study 224

29 Abdominal Organ Transplant (Kidney, Liver, Pancreas) 226

Patricia L. Painter, PhD, FACSM ■ Joanne B. Krasnoff, PhD

Overview of the Pathophysiology 226 ■ Effects on the Exercise Response 227 ■ Effects of Exercise Training 227
 Management and Medications 227 ■ Recommendations for Exercise Testing 228
 Recommendations for Exercise Programming 228 ■ Case Study 231

30 Chronic Fatigue Syndrome 233

Stephen P. Bailey, PhD, PT, FACSM

Overview of the Pathophysiology 233 ■ Effects on the Exercise Response 234 ■ Effects of Exercise Training 234
 Management and Medications 234 ■ Recommendations for Exercise Testing 235
 Recommendations for Exercise Programming 235 ■ Special Considerations 237 ■ Case Study 237

31 Fibromyalgia 239

Kathy Lemley, PT, MS ■ Barbara B. Meyer, PhD

Overview of the Pathophysiology 239 ■ Effects on the Exercise Response 239 ■ Effects of Exercise Training 240
 Management and Medications 240 ■ Recommendations for Exercise Testing 241
 Recommendations for Exercise Programming 242 ■ Special Considerations 244 ■ Case Study 245

32 Anemia 246

Kirsten L. Johansen, MD

Overview of the Pathophysiology 246 ■ Effects on the Exercise Response 247 ■ Effects of Exercise Training 247
 Management and Medications 247 ■ Recommendations for Exercise Testing 248
 Recommendations for Exercise Programming 248 ■ Case Study 249

33 Bleeding and Clotting Disorders 250

Geoffrey E. Moore, MD, FACSM ■ Michael Lockard, MA

Overview of the Pathophysiology 250 ■ Effects on the Exercise Response 251 ■ Effects of Exercise Training 252
 Management and Medications 253 ■ Recommendations for Exercise Testing 254
 Recommendations for Exercise Programming 254 ■ Special Considerations 255 ■ Case Study 256

PART VI Orthopedic Diseases and Disabilities 257

Kenneth H. Pitetti, PhD, FACSM

34 Arthritis 259

Marian A. Minor, PhD, PT ■ Donald R. Kay, MD

Overview of the Pathophysiology 259 ■ Effects on the Exercise Response 260 ■ Effects of Exercise Training 260
 Management and Medications 261 ■ Recommendations for Exercise Testing 261
 Recommendations for Exercise Programming 262 ■ Case Study 265

35 Lower Back Pain Syndrome 266

Maureen J. Simmonds, PhD, PT, MCSP ■ Tamar Derghazarian, PT

Overview of the Pathophysiology 266 ■ Effects on the Exercise Response 266 ■ Effects of Exercise Training 267
 Management and Medications 267 ■ Recommendations for Exercise Testing 267
 Recommendations for Exercise Programming 267 ■ Case Study 269

- 36 Osteoporosis 270**
 Susan S. Smith, PT, PhD, CCD ■ Che-Hsiang Elizabeth Wang, PT, MS
 Susan A. Bloomfield, PhD, FACSM
 Overview of the Pathophysiology 270 ■ Effects on the Exercise Response 272 ■ Effects of Exercise Training 272
 Management and Medications 272 ■ Recommendations for Exercise Testing 273
 Recommendations for Exercise Programming 275 ■ Special Considerations 276 ■ Case Study 277
- 37 Lower Limb Amputation 280**
 Kenneth H. Pitetti, PhD, FACSM ■ Mark H. Pedrotty, PhD
 Overview of the Pathophysiology 280 ■ Effects on the Exercise Response 281 ■ Effects on Exercise Training 281
 Management and Medications 281 ■ Recommendations for Exercise Testing 282
 Recommendations for Exercise Programming 283 ■ Case Study 284
- PART VII Neuromuscular Disorders 285**
- Terry Nicola, MD, MS
- 38 Stroke and Brain Injury 287**
 Karen Palmer-McLean, PhD, PT ■ Kimberly B. Harbst, PhD, PT
 Overview of the Pathophysiology 287 ■ Effects on the Exercise Response 288 ■ Effects of Exercise Training 289
 Management and Medications 289 ■ Recommendations for Exercise Testing 290
 Recommendations for Exercise Programming 292 ■ Case Study 295
- 39 Spinal Cord Disabilities: Paraplegia and Tetraplegia 298**
 Stephen F. Figoni, PhD, RKT, FACSM
 Overview of the Pathophysiology 298 ■ Effects on the Exercise Response 299
 Effects of Exercise Training 299 ■ Management and Medications 299 ■ Recommendations for Exercise Testing 300
 Recommendations for Exercise Programming 301 ■ Special Considerations 302 ■ Case Study 304
- 40 Muscular Dystrophy 306**
 Mark A. Tarnopolsky, MD, PhD
 Overview of the Pathophysiology 306 ■ Effects on the Exercise Response 307 ■ Effects of Exercise Training 307
 Management and Medications 308 ■ Recommendations for Exercise Testing 308
 Recommendations for Exercise Programming 310 ■ Special Considerations 311 ■ Case Study 312
- 41 Epilepsy 314**
 Karl Otto Nakken, MD, PhD
 Overview of the Pathophysiology 314 ■ Effects on the Exercise Response 316 ■ Effects of Exercise Training 316
 Management and Medications 316 ■ Recommendations for Exercise Testing 318
 Recommendations for Exercise Programming 318 ■ Case Study 320
- 42 Multiple Sclerosis 321**
 Kurt Jackson, PhD, PT, GCS ■ Janet A. Mulcare, PhD, FACSM
 Overview of the Pathophysiology 321 ■ Effects on the Exercise Response 321 ■ Effects of Exercise Training 321
 Management and Medications 322 ■ Recommendations for Exercise Testing 322
 Recommendations for Exercise Programming 323 ■ Special Considerations 324 ■ Case Study 325

43 Polio and Post-Polio Syndrome 327

Thomas J. Birk, PhD, MPT, FACSM

Overview of the Pathophysiology 327 ■ Effects on the Exercise Response 328 ■ Effects of Exercise Training 328
 Management and Medications 328 ■ Recommendations for Exercise Testing 329
 Recommendations for Exercise Programming 331 ■ Special Considerations 333 ■ Case Study 333

44 Amyotrophic Lateral Sclerosis 336

Vanina Dal Bello-Haas, PhD, PT ■ Lisa Stroud Krivickas, MD

Overview of the Pathophysiology 336 ■ Effects on the Exercise Response 337 ■ Effects of Exercise Training 337
 Management and Medications 338 ■ Recommendations for Exercise Testing 338
 Recommendations for Exercise Programming 338 ■ Special Considerations 340 ■ Case Study 342

45 Cerebral Palsy 343

James J. Laskin, PT, PhD

Overview of the Pathophysiology 343 ■ Effects on the Exercise Response 344 ■ Effects of Exercise Training 344
 Management and Medications 345 ■ Recommendations for Exercise Testing 345
 Recommendations for Exercise Programming 347 ■ Case Study 348

46 Parkinson's Disease 350

Elizabeth J. Protas, PhD, PT, FACSM ■ Rhonda K. Stanley, PhD, PT ■ Joseph Jankovic, MD

Overview of the Pathophysiology 350 ■ Effects on the Exercise Response 351 ■ Effects of Exercise Training 351
 Management and Medications 352 ■ Recommendations for Exercise Testing 353
 Recommendations for Exercise Programming 353 ■ Case Study 355

PART VIII Cognitive, Psychological, and Sensory Disorders 357

Lorraine E. Colson Bloomquist, EdD, FACSM

47 Intellectual Disabilities 359

Patricia Fegan, PhD

Overview of the Pathophysiology 359 ■ Effects on the Exercise Response 361 ■ Effects of Exercise Training 361
 Management and Medications 362 ■ Recommendations for Exercise Testing 362
 Recommendations for Exercise Programming 365 ■ Special Considerations 366 ■ Case Study 367

48 Alzheimer's Disease 368

James H. Rimmer, PhD ■ Donald L. Smith, MS, RCEP

Overview of the Pathophysiology 368 ■ Management and Medications 370
 Effects on the Exercise Response and Exercise Training 370 ■ Recommendations for Exercise Testing 370
 Recommendations for Exercise Programming 371 ■ Special Considerations 373 ■ Case Study 374

49 Mental Illness 375

Gary S. Skrinar, PhD, FACSM ■ Dori S. Hutchinson, ScD

Overview of the Pathophysiology 375 ■ Effects on the Exercise Response 375 ■ Effects of Exercise Training 376
 Management and Medications 376 ■ Recommendations for Exercise Testing 376
 Recommendations for Exercise Programming 377 ■ Case Study 378

50 Stress and Anxiety Disorders 379

Gregory A. Hand, PhD, FACSM ■ Jason R. Jagers, MS ■ Wesley D. Dudgeon, PhD

Overview of the Pathophysiology **379** ■ Effects on the Exercise Response **380** ■ Effects of Exercise Training **380**
Management and Medications **381** ■ Recommendations for Exercise Testing **382**
Recommendations for Exercise Programming **382** ■ Special Considerations **383** ■ Case Study **383**

51 Deaf and Hard of Hearing. 385

M. Kathleen Ellis, PhD ■ Tracy Karasinski, MSW

Overview of the Pathophysiology **385** ■ Effects on the Exercise Response **387** ■ Effects of Exercise Training **387**
Recommendations for Exercise Testing **388** ■ Recommendations for Exercise Programming **388**
Special Considerations **388** ■ Case Study **390**

52 Visual Impairment. 392

Larry J. Leverenz, PhD, ATC

Overview of the Pathophysiology **392** ■ Effects on the Exercise Response **392** ■ Effects of Exercise Training **393**
Management and Medications **393** ■ Recommendations for Exercise Testing **393**
Recommendations for Exercise Programming **394** ■ Case Study **395**

Appendix **397** ■ Suggested Readings **407** ■ Index **429** ■ About the ACSM **440**