Contents

Energy—The Name of the Game 2

Introduction 4 Applications of Energy Concepts 4 Summary 10 Selected References and Readings 10

2

The Energy Systems 12

Introduction 14 Definitions 14 The Energy Systems 16 Relationship between Oxygen Consumption and Energy (Heat) Production 29 Summary 35 Selected References and Readings 36

3

Sports Activities and the Energy Continuum 38

Introduction 40 The Energy Continuum Concept 40 The Common Denominator—Performance Time 44 Setting Up Continuum Guidelines 47 Laboratory Evidence for the Energy Continuum Concept 49 Summary 50 Selected References and Readings 52

4

The Fuel for Exercise 54

Introduction 56 The Foodstuffs 56 Forms of Carbohydrate Fuels 59 Forms of Fat as Fuels 67 Summary 71 Selected References and Readings 72

The Recovery Process 74

Introduction 76 The Concept of the Recovery Oxygen (Oxygen Debt) 76 Restoration of Muscle Phosphagen Stores 79 Replenishment of Myoglobin with Oxygen 82 Restoration of Muscle Glycogen Stores 85 Removal of Lactic Acid from Muscle and Blood 92 Putting It All Together 98 Summary 98 Selected References and Readings 100

6

5

Neuromuscular Concepts Applied to Sports 102

Introduction 104 Structure of Nerves 104 Function of Nerves 105 Structure of Skeletal Muscle 108 Function of Skeletal Muscle 110 Method of Classifying Fiber Types 118 Higher Centers and Control of Movement 134 Summary 137 Selected References and Readings 139

7

Weight-Resistance Training: Methods and Effects 142

Introduction 144 Basic Principles Associated with Weight-Training Programs 144 Construction of Weight-Resistance Programs for Various Sports 149 Effects of Weight-Resistance Programs 173 Summary 179 Selected References and Readings 180

8

The Oxygen Transport System: Respiration and Circulation 184

Introduction 186 Movement of Air: Pulmonary Ventilation 186 Gas Exchange 191 Transport of Gases by Blood 194 Transport of Gases—Blood Flow 198 The Oxygen Transport System 208 Summary 219 Selected References and Readings 221

9

Sprint and Endurance Training: Methods and Effects 224

Introduction 226 Specificity of Training 226 Construction or Selection of the Training Program 229 Warm-Up 243 Warm-Down 246 Year-Round Training—The Training Phases 246 Effects of Sprint and Endurance Training 250 Factors Influencing the Effects of Training 261 Training Supplements 271 Summary 274 Selected References and Readings 278

10

Nutrition and Sports Performance 282

Introduction 284 Nutrition 284 Diet and Performance 294 Summary 308 Selected References and Readings 309

11

Body Composition and Weight Control 312

Introduction 314 Body Composition 314 Wrestlers 326 Energy Balance and Weight Control 333 Summary 342 Selected References and Readings 343

12

Dehydration, Heat Problems, and Prevention of Heat Illness 346

Introduction 348 Dehydration (Water Loss) 348 Environmental Heat Problems in Athletics 349 Prevention of Heat Disorders 352 Summary 366 Selected References and Readings 367

Frequently Asked Questions Concerning Sports Performance and Physiology 368

Introduction 370

13

Questions Related to Human Energy Production 370 Questions Related to Recovery From Exercise 371 Questions Related to Muscle Function and Weight Training 373 Questions Related to the Oxygen Transport System 377 Questions Related to Aerobic and Anaerobic Training 380 Questions Related to Nutrition and Sports Performance 384 Questions Related to Body Composition and Weight Control 386 Questions Related to Water Needs and Heat Illness 387

Body Composition 110

Appendix A: Journal Abbreviations and Titles 390 Appendix B: Symbols and Abbreviations 392 Appendix C: Description of Weight-Lifting Exercises 394 Appendix D: Examples of Basic Eight-Week-Long Aerobic and Anaerobic Interval-Training Programs 410 Appendix E: Some Suggested Stretching Exercises 415 Appendix F: Units of Measure 421

> Glossary 423 Author Index 433 Subject Index 437