

# Contents

|   |           |
|---|-----------|
| Preface   | vi        |
| Acknowledgments   | vii       |
| <b>Chapter 1 Exercise Metabolism</b>  | <b>1</b>  |
| Foundations of Metabolism . . . . .   | 1         |
| Energy Transfer . . . . .   | 2         |
| Energy Substrates for Metabolism . . . . .  | 4         |
| Energy Systems . . . . .  | 6         |
| Total Yield From Metabolism . . . . .   | 17        |
| Metabolic Regulation During Exercise . . . . .                                      | 18        |
| Factors That Influence Exercise Metabolism . . . . .                                | 22        |
| Summary . . . . .   | 23        |
| Definitions . . . . .   | 23        |
| <b>Chapter 2 Dynamics of Skeletal-Neuromuscular and Gastrointestinal Physiology</b> | <b>25</b> |
| Structure of Skeletal Muscle and Mechanisms of Contraction . . . . .                | 25        |
| Neuromuscular Control of Movement . . . . .   | 31        |
| Functional Properties of Muscle . . . . .   | 37        |
| Regulatory Control of the GI System . . . . .                                       | 40        |
| Smooth Muscle . . . . .   | 43        |
| Overview of the GI Organs . . . . .   | 43        |
| Summary . . . . .   | 48        |
| Definitions . . . . .   | 48        |
| <b>Chapter 3 Cardiovascular System: Function and Control</b>                        | <b>51</b> |
| General Anatomy of the Cardiovascular System . . . . .                              | 51        |
| Mechanisms of Contraction . . . . .   | 53        |
| Cardiac Electrophysiology . . . . .   | 57        |
| Conduction System and Electrocardiogram . . . . .                                   | 59        |
| Coronary Blood Supply . . . . .   | 61        |
| Cardiac Cycle and Mechanics . . . . .   | 63        |
| Cardiac Performance . . . . .   | 64        |
| Changes in Heart Rate, Stroke Volume, and Cardiac Output                            |           |
| During an Acute Bout of Exercise . . . . .  | 67        |
| Circulatory Hemodynamics and Distribution of Blood Flow . . . . .                   | 70        |
| Transport of O <sub>2</sub> and CO <sub>2</sub> . . . . .                           | 74        |
| Cardiorespiratory Fitness: The Whole Picture . . . . .                              | 77        |
| Cardiovascular Regulation . . . . .   | 77        |
| Other Important Topics in Advanced Cardiovascular Exercise Physiology . . . . .     | 80        |
| The Kidneys and Exercise . . . . .  | 82        |
| Summary . . . . .   | 82        |
| Definitions . . . . .   | 83        |

|   |            |
|---|------------|
| <b>Chapter 4 Pulmonary Exercise Physiology</b>  | <b>85</b>  |
| Lung Structure and Function . . . . .   | 85         |
| Names, Human, Social . . . . .  | 94         |
| author   Koenig, Scott . . . . .  | 101        |
| Title, Advances in . . . . .  | 104        |
| Journal, <i>Journal of . . . . .</i>  | 104        |
| Des . . . . .   | 107        |
| <b>Chapter 5 Immune and Endocrine System</b>  | <b>107</b> |
| Identifiers: LCCN 2017 . . . . .  | 107        |
| Subjects:   MESH: Exer . . . . .  | 110        |
| Classification: LCC Q . . . . .   | 110        |
| gov/2017067456 . . . . .  | 114        |
| ISBN: 978-1-4925-0571- . . . . .  | 116        |
| Copyright © 2016 by J . . . . .   | 117        |
| All rights reserved. Exclu . . . . .  | 119        |
| the material contained in . . . . .   | 119        |
| any part of this book . . . . .   | 120        |
| and the exercise book . . . . .   | 120        |
| the exercise book . . . . .   | 121        |
| the exercise book . . . . .   | 122        |
| Definitions . . . . .   | 123        |
| <b>Chapter 6 Principles for Testing and Training for Aerobic Power</b>                                | <b>125</b> |
| Work and Power . . . . .  | 125        |
| Direct and Indirect Measurement of Energy Production . . . . .  | 126        |
| Net O <sub>2</sub> Cost of Exercise . . . . .   | 128        |
| Caloric Equivalent of O <sub>2</sub> . . . . .  | 129        |
| Protocols for Assessing Aerobic Power . . . . .   | 132        |
| Matching Training Regimen to Energy and Organ Systems and Training to Improve Aerobic Power . . . . . | 137        |
| Physiological Adaptations Attributable to Aerobic Training . . . . .                                  | 142        |
| Summary . . . . .   | 156        |
| Definitions . . . . .   | 156        |
| <b>Chapter 7 Principles for Testing and Training: Anaerobic Strength, Power, and Range of Motion</b>  | <b>157</b> |
| Anaerobic Exercise Training Principles . . . . .  | 157        |
| Resistance Testing and Training . . . . .   | 172        |
| Range of Motion . . . . .   | 191        |
| Putting it All Together . . . . .   | 200        |
| Summary . . . . .   | 204        |
| Definitions . . . . .   | 204        |
| <b>Chapter 8 Body Composition and Weight Management</b>   | <b>207</b> |
| Body Composition Models and Theories . . . . .  | 207        |
| Weight Management Principles . . . . .  | 218        |
| Summary . . . . .   | 226        |
| Definitions . . . . .   | 227        |

|  |            |
|--|------------|
| <b>Chapter 9 Performance: Environmental Stressors, Genetics, Nutrition, and Ergogenic Aids</b> | <b>229</b> |
| Exercise and the Environment . . . . .   | 229        |
| Performance Exercise Physiology . . . . .  | 253        |
| Summary . . . . .  | 267        |
| Definitions . . . . .  | 270        |
| <b>Chapter 10 Physical Activity and Exercise for Health and Fitness 271</b>                    |            |
| Epidemiology of Physical Activity, Inactivity, and Exercise . . . . .                          | 271        |
| Relationship Between Physical Activity, Exercise, Fitness, and Disease Prevention . . . . .    | 272        |
| Proper Screening Before Exercise and the Risks Associated With Exercise . . . . .              | 280        |
| How Much Exercise is Enough? . . . . .   | 283        |
| Exercise in the Treatment of Common Noncommunicable Chronic Diseases . . . . .                 | 285        |
| Challenges of Exercise Adherence and Facilitating Behavior Change . . . . .                    | 291        |
| Summary . . . . .  | 293        |
| Definitions . . . . .  | 293        |
| <b>Chapter 11 Emerging Concepts: Exercise Pharmacology and Exercise Genomics 295</b>           |            |
| Exercise Pharmacology . . . . .  | 295        |
| Exercise Genomics . . . . .  | 301        |
| Summary . . . . .  | 308        |
| Definitions . . . . .  | 308        |
| <b>Appendix A: Calculations for Oxygen Consumption and Carbon Dioxide Production 311</b>       |            |
| <b>Appendix B: Efficiency and Energy Expenditure 313</b>                                       |            |
| <b>Appendix C: Metabolic Equivalent of Task Values of Common Activities 315</b>                |            |
| <b>Appendix D: Professionalization of the Exercise Professional 319</b>                        |            |
| <b>Appendix E: Common Scientific Abbreviations and Units 327</b>                               |            |
| <b>References 329</b>  |            |
| <b>Index 363</b>   |            |
| <b>About the Authors 375</b>   |            |

— Steven J. Keteyian