

CONTENTS

Preface xi

Acknowledgments xiii

| Part I | Introduction to Human Movement Studies | 1 |
|------------------|---|-----------|
| Chapter 1 | Human Movement Studies as a Discipline and a Profession | 3 |
| | What Is Human Movement Studies and Why Is It Important? | 4 |
| | Disciplines and Professions | 5 |
| | Is Human Movement Studies a Discipline? | 5 |
| | Structure of a Discipline of Human Movement Studies | 6 |
| | What Should the Discipline of Human Movement Studies Be Called? | 8 |
| | Professions Based on Human Movement Studies | 9 |
| | Professional Organisations | 9 |
| | Relationships Between the Discipline and the Professions | 12 |
| | Summary | 12 |
| | Further Reading and References | 12 |
| Chapter 2 | Historical Origins of the Academic Study of Human Movement | 13 |
| | Scholarly Writings on Human Movement From Ancient Civilisations (ca. 1000 BC-350 AD) | 14 |
| | The Middle Ages as a Period of Suppression of the Study of Human Movement (ca. 350-1350 AD) | 15 |
| | Scholarly Works on Human Movement From the Renaissance and Reformation Periods (ca. 1350-1650 AD) | 15 |
| | Scholarly Works on Human Movement During the Period 1650-1885 | 15 |
| | Professionalisation of Physical Education During the Period 1885-1929 | 16 |
| | Organisation of Research Efforts in Physical Education During the Period 1930-1959 | 19 |
| | Beginnings of a Discipline of Human Movement Studies During the Period 1960-1970 | 20 |
| | Emergence of Subdisciplines and Specialisations, 1970-Present | 22 |
| | Future Directions, Challenges, and Opportunities | 22 |
| | Summary | 23 |
| | Further Reading and References | 23 |

| | | |
|------------------|--|-----------|
| Part II | Anatomical Bases of Human Movement: Functional Anatomy | 25 |
| Chapter 3 | Basic Concepts of the Musculoskeletal System | 31 |
| | Tools for Measurement | 32 |
| | Skeletal System | 32 |
| | Articular System | 37 |
| | Muscular System | 40 |
| | Summary | 47 |
| | Further Reading and References | 48 |
| Chapter 4 | Basic Concepts of Anthropometry | 49 |
| | Definition of Anthropometry | 49 |
| | Tools for Measurement | 50 |
| | Body Size | 50 |
| | Determination of Body Shape | 51 |
| | Tissues Composing the Body | 51 |
| | Somatotyping as a Description of Body Build | 53 |
| | Human Variation | 55 |
| | Summary | 57 |
| | Further Reading and References | 57 |
| Chapter 5 | Musculoskeletal Changes Across the Life Span | 59 |
| | Definitions of Auxology and Gerontology | 60 |
| | Tools for Measurement | 60 |
| | Physical Growth, Maturation, and Ageing | 60 |
| | Age-Related Changes in the Skeletal and Articular Systems | 62 |
| | Age-Related Changes in the Muscular System | 66 |
| | Changes in Body Dimensions Across the Life Span | 67 |
| | Methods of Determining Age | 71 |
| | Summary | 72 |
| | Further Reading and References | 72 |
| Chapter 6 | Musculoskeletal Adaptations to Training | 73 |
| | Effects of Physical Activity on Bone | 73 |
| | Effects of Physical Activity on Joint Structure and Ranges of Motion | 76 |
| | Effects of Physical Activity on Muscle–Tendon Units | 78 |
| | Effects of Physical Activity on Body Size, Shape, and Composition | 79 |
| | Summary | 82 |
| | Further Reading and References | 82 |

| | | |
|-----------------|---|------------|
| Part III | Mechanical Bases of Human Movement: Biomechanics | 83 |
| Chapter 7 | Basic Concepts of Kinematics and Kinetics | 87 |
| | Vectors | 88 |
| | Motion | 89 |
| | Generalized Coordinates and Degrees of Freedom | 93 |
| | Force | 94 |
| | Moment of Force | 94 |
| | Force Analyses | 97 |
| | Equations of Motion | 99 |
| | Computer Modelling of Movement | 101 |
| | Summary | 103 |
| | Further Reading and References | 103 |
| Chapter 8 | Basic Concepts of Energetics | 105 |
| | Kinetic Energy | 106 |
| | Potential Energy | 106 |
| | Total Mechanical Energy | 107 |
| | Power | 109 |
| | Elastic Strain Energy | 114 |
| | Metabolic Energy Consumption | 116 |
| | Efficiency of Movement | 118 |
| | Summary | 118 |
| | Further Reading and References | 119 |
| Chapter 9 | Biomechanics Across the Life Span | 121 |
| | Biomechanics of Normal Gait | 121 |
| | Changes in Muscle Strength With Age | 129 |
| | Gait Development in Children | 130 |
| | Gait Changes in Older Adults | 134 |
| | Summary | 137 |
| | Further Reading and References | 138 |
| Chapter 10 | Biomechanical Adaptations to Training | 139 |
| | Muscular Adaptations to Training | 139 |
| | Neuromuscular Adaptations to Training | 143 |
| | Training to Prevent Anterior Cruciate Ligament Injury | 143 |
| | Biomechanical Adaptations to Injury | 149 |
| | Dependence of Motor Performance on Changes in Muscle Properties | 150 |
| | Using Computer Modelling to Study Vertical Jumping Performance | 150 |
| | Insights Into the Effects of Training Provided by Computer Models | 151 |
| | Summary | 152 |
| | Further Reading and References | 153 |

| | |
|---|------------|
| Part IV Physiological Bases of Human Movement: Exercise Physiology | 155 |
| Chapter 11 Basic Concepts of Exercise Metabolism | 159 |
| Production of Energy for Exercise | 160 |
| Oxygen Supply During Sustained Exercise | 164 |
| $\dot{V}O_{2\text{max}}$ as an Indicator of Endurance-Exercise Capacity | 165 |
| Measurement of Exercise Capacity | 165 |
| Human Skeletal Muscle Cells | 170 |
| Summary | 173 |
| Further Reading and References | 173 |
| Chapter 12 Basic Concepts of Nutrition and Exercise. | 175 |
| Energy Requirements of Exercise | 175 |
| Nutrients for Exercise | 176 |
| Fluid Requirements During Exercise | 178 |
| Summary | 180 |
| Further Reading and References | 180 |
| Chapter 13 Physiological Capacity Across the Life Span | 181 |
| Responses to Exercise in Children | 182 |
| Exercise in Older Adult Life | 186 |
| Summary | 192 |
| Further Reading and References | 192 |
| Chapter 14 Physiological Adaptations to Training. | 193 |
| Training-Induced Metabolic Adaptations | 194 |
| Immediate and Anaerobic-System Changes After High-Intensity Sprint and Strength Training | 195 |
| Changes in Aerobic Metabolism After Endurance Training | 196 |
| Endurance Training-Induced Changes in the Cardiorespiratory System | 197 |
| Endurance Training-Induced Respiratory Changes | 200 |
| Endurance Training-Induced Changes in Lactate Threshold | 200 |
| Changes in the Muscular System After Strength Training | 201 |
| Basic Principles of Training | 203 |
| Continuous and Interval Training | 205 |
| Training for Cardiovascular Endurance | 206 |
| Methods of Strength Training | 207 |
| Causes of Muscle Soreness | 210 |
| Summary | 210 |
| Further Reading and References | 211 |

| | |
|---|------------|
| Part V Neural Bases of Human Movement: Motor Control | 213 |
| Chapter 15 Basic Concepts of Motor Control: Neuroscience Perspectives | 219 |
| Nervous System as an Elaborate Communications Network | 220 |
| Components of the Nervous System | 220 |
| Neurons and Synapses as the Building Blocks of the Nervous System | 221 |
| Sensory Receptor Systems for Movement | 223 |
| Effector Systems for Movement | 230 |
| Motor Control Functions of the Spinal Cord | 230 |
| Motor Control Functions of the Brain | 234 |
| Integrative Brain Mechanisms for Movement | 238 |
| Summary | 239 |
| Further Reading and References | 239 |
| Chapter 16 Basic Concepts of Motor Control: Cognitive Science Perspectives | 241 |
| Using Models to Study Motor Control | 242 |
| Key Properties to Be Explained by Models of Motor Control | 242 |
| Information-Processing Models of Motor Control | 243 |
| Some Alternative Models of Motor Control | 253 |
| Summary | 256 |
| Further Reading and References | 256 |
| Chapter 17 Motor Control Changes Throughout the Life Span | 257 |
| Changes in Observable Motor Performance | 258 |
| Changes at the Neurophysiological Level | 268 |
| Changes in Information-Processing Capabilities | 272 |
| Summary | 274 |
| Further Reading and References | 274 |
| Chapter 18 Motor Control Adaptations to Training | 275 |
| Changes in Observable Motor Performance | 276 |
| Changes at the Neurophysiological Level | 278 |
| Changes in Information-Processing Capabilities | 280 |
| Factors Affecting the Learning of Motor Skills | 286 |
| Summary | 290 |
| Further Reading and References | 291 |

| | |
|--|-------------|
| Part VI Psychological Bases of Human Movement: Sport and Exercise Psychology | 293 |
| Chapter 19 Basic Concepts in Sport Psychology | .297 |
| Personality | 298 |
| Motivation in Sport | 299 |
| Self-Determination Theory | 301 |
| Arousal, Anxiety, and Sport Performance | 302 |
| The Practice of Applied Sport Psychology | 305 |
| Imagery: An Example of Psychological Skill | 306 |
| Summary | 308 |
| Further Reading and References | 308 |
| Chapter 20 Basic Concepts in Exercise Psychology | 309 |
| Effects of Psychological Factors on Exercise | 310 |
| Effects of Exercise on Psychological Factors | 317 |
| Summary | 318 |
| Further Reading and References | 319 |
| Chapter 21 Physical Activity and Psychological Factors Across the Life Span | .321 |
| Changes in Personality | 321 |
| Psychosocial Development Through Sport Participation | 322 |
| Exercise in the Aged | 324 |
| Termination of Athletic Careers | 326 |
| Summary | 328 |
| Further Reading and References | 328 |
| Chapter 22 Psychological Adaptations to Training | .329 |
| Aerobic Fitness and the Response to Psychological Stress | 329 |
| Changes in Personality | 330 |
| Changes in Motivation: Staleness, Overtraining, and Burnout | 331 |
| Changes in Mental Skills | 334 |
| Summary | 336 |
| Further Reading and References | 336 |

| | |
|---|------------|
| Part VII Multi- and Cross-Disciplinary Applications of Human Movement Science | 337 |
| Chapter 23 Applications to Health in Chronic-Disease Prevention and Management | 341 |
| Major Causes of Disease and Death Globally | 342 |
| Cost of Physical Inactivity | 345 |
| Measuring Physical Activity and Sedentary Behaviour | 345 |
| Levels of Physical Inactivity in Adults and Children | 346 |
| Recommendations for Physical Activity | 347 |
| Summary | 351 |
| Further Reading and References | 351 |
| Chapter 24 Applications to Health in Injury Prevention and Management | 353 |
| Preventing Manual-Lifting Injuries in the Workplace | 353 |
| Preventing and Managing Overuse Injuries in Sport | 354 |
| Preventing Injuries Related to Osteoporosis | 356 |
| Summary | 357 |
| Further Reading and References | 358 |
| Chapter 25 Applications to Performance Enhancement in Sport and the Workplace | 359 |
| Talent Identification | 360 |
| Performance Optimisation | 361 |
| Summary | 365 |
| Further Reading and References | 365 |
| Glossary | 367 |
| Index | 379 |
| About the Authors | 393 |