Chapter Objectives

• Cover the key features of the subdiscipline of physiology of physical activity and employment opportunities available to exercise science professionals.
• Explain how physiology of physical activity fits within kinesiology.
• Review the history and development of physiology of physical activity as a subdiscipline.
Chapter Objectives (continued)

• Identify the research methods used by kinesiologists working in exercise physiology.

• Examine how the body responds to physical activity and how these changes relate to physical performance and health.
Goals of Exercise Physiology

- To understand how to enhance physical performance
- To understand how to improve physical function in altered environments, such as those characterized by high temperature or high altitude
- To understand how physical activity and exercise improve health and fitness
- To understand how exercise can be used in treating and preventing disease and alleviating symptoms of disease
- To understand adaptations in physiology and pathophysiology in response to physical activity
Why Use Physiology of Physical Activity?

- Enhance sport performance and training.
- Improve physical fitness.
- Promote health and treating disease with physical activity.
- Understand physiological changes from physical activity.
What Do Exercise Physiologists Do?

- University professors
- Researchers for the military or NASA
- Corporate fitness or hospital-based wellness programs
- Clinical exercise physiologists employed by hospitals in cardiac rehabilitation programs
- Exercise instructors
- Personal trainers
- Strength and conditioning professionals
- Specialization (older adults, children, pulmonary patients)
History of Physiology of Physical Activity

• Early beginnings evolved from physiology
  • Antoine Lavoisier and Pierre de Laplace
  • August Krogh
  • A.V. Hill

• Early laboratories (1920s-1940s)
  • Harvard Fatigue Lab: D.B. Dill
  • Springfield College: Peter V. Karpovich
  • University of Illinois: Thomas K. Cureton, Jr.
History of Physiology of Physical Activity *(continued)*

- 1950s: Morris coronary heart disease study in England stimulated research in epidemiology of PA, fitness, and chronic disease

- 1990s: NIH and surgeon general’s reports
  - “[M]oderate levels of regular physical activity confer significant health benefits” (NIH Consensus Development Panel, 1996, p. 245).
Research Methods for Physiology of Physical Activity

- Ergometers: treadmills, leg and arm cycles, and swimming flume
- Oxygen uptake: electronic analyzers, gas volumes
- Body composition: underwater weighing, calipers, DEXA
- Biochemical methods: blood samples, muscle biopsies
- Animal models: mammals that match humans as closely as possible; can control the subject and environment more easily and specifically
- Fieldwork (outside lab): technological advances have made fieldwork more practical
Overview of Knowledge in Physiology of Physical Activity

- How physiological systems (cardiovascular, muscular, and respiratory) respond and adapt to physical activity (single and repeated bouts)
- Factors that influence physiological responses (e.g., temperature, diet, and altitude)
- The relationship among fitness, activity, and health
Skeletal Muscles

- Muscle fiber types (fast-twitch, slow-twitch)
- Muscular strength versus muscular endurance
- Adaptations
  - To anaerobic and aerobic training
  - To resistance training
- Training principles
  - Progressive overload
  - Specificity
Cardiovascular System

• Cardiac output: heart rate and stroke volume
• Blood flow distribution
• Cardiorespiratory adaptations to training; aerobic endurance
Respiratory System

• The respiratory system regulates the exchange of gases (including oxygen) between the external environment (air) and the internal environment (inside the body).

• Ventilation increases rapidly at the onset of physical activity and is also a function of exercise intensity.

• Training can alter the efficiency of the body to move and utilize oxygen.
Variation in Temperature and the Response to Physical Activity

- Effects of exercise
- Effects of acclimatization
- Effect of increased internal heat related to increased physical activity and its impact on vasodilation of skin blood vessels and sweating
Nutritional Intake and Physical Activity

- Carbohydrate intake for optimal performance and health
- Protein intake for repairing and replacing damaged proteins, aiding adaptations, maintaining functioning of metabolic pathways
- Fluid intake for optimal performance and health
- Iron intake for optimal performance and health
- Interdisciplinary research that blends exercise physiology with dietetics to both improve personal health and support high-level sport performance
Physical Activity, Fitness, and Health

- Effects of age on fitness
- Physical activity, fitness, and coronary heart disease
- Physical activity and weight control
- The recommended amount of weekly physical activity for improved health and decreased disease risk: 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity
Body Mass Index

• BMI = body mass in kilograms ÷ the square of height in meters.

• BMI assessment is easy and noninvasive; elevated values are indicative of obesity-related disease risk.

• A BMI of >30 is classified as obese (in 2011-12, 35% of adults, 21% of adolescents 12-19, and 17% of children 6-11 were obese).
This subdiscipline of kinesiology centers on acute and chronic changes that occur in the physiology of the human body in response to physical activity.

Exercise scientists have studied and measured these changes in order to help people be healthier and improve their physical performance.

Exercise science provides many career opportunities.
Preparing for Part III

- Health and fitness
- Sport management
- Coaching and sport education
- Therapeutic exercise
- Teaching physical education

Physical activity experience
Professional experience in physical activity
Scholarship of physical activity