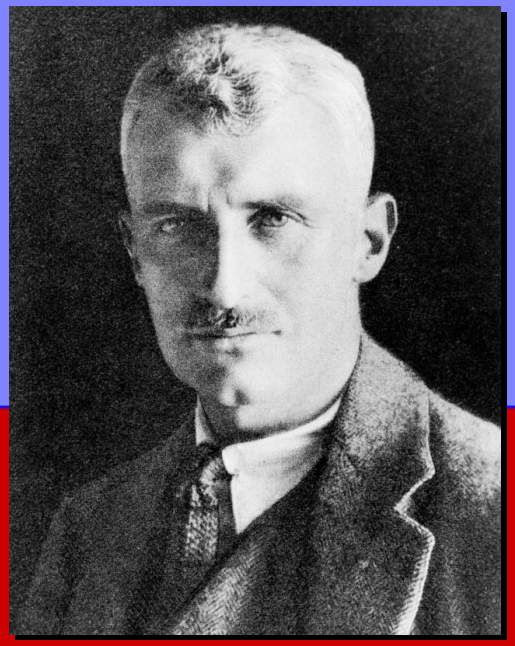
AN INTRODUCTION TO EXERCISE AND SPORT PHYSIOLOGY



Learning Objectives

- Learn to differentiate exercise physiology and sport physiology.
- Become familiar with the evolution of exercise physiology and its early scholars.
- Note the differences between acute responses to exercise and chronic adaptations to training.

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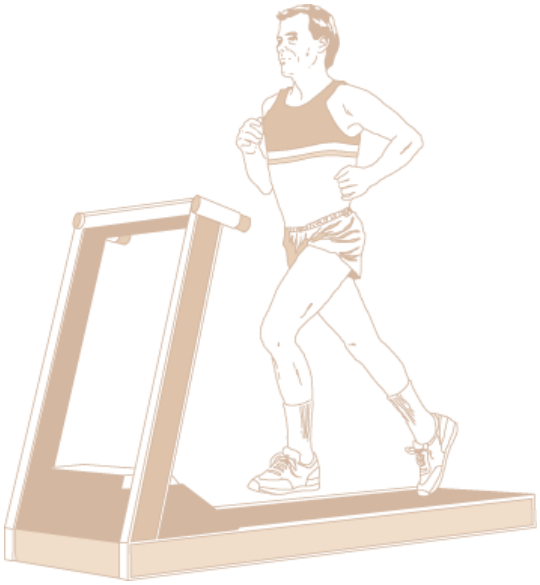
Learning Objectives

- Learn what factors affect the body's acute response to exercise.
- Understand the six basic principles of training.
- Learn how to accurately read and interpret tables and graphs.
- Learn whether cross-sectional studies or longitudinal studies are more accurate.

Exercise Physiology vs Sport Physiology

Exercise physiology studies how the body's structures and functions are altered when exposed to acute and chronic bouts of exercise.

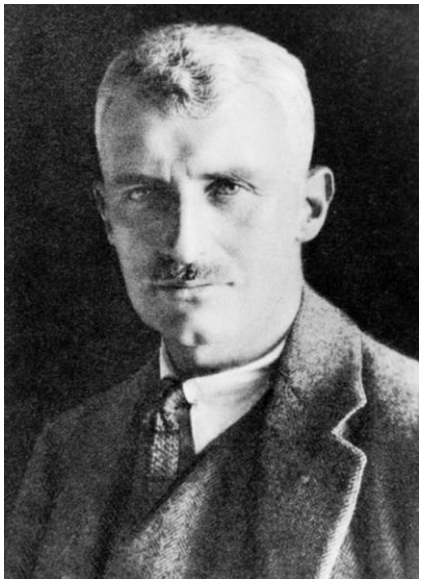
Sport physiology applies exercise physiology concepts to an athlete's training and performance.



Early Exercise Physiologists

Archibald V. Hill

- Nobel Prize winner (1921)
- Studied energy metabolism
- First studies on runners

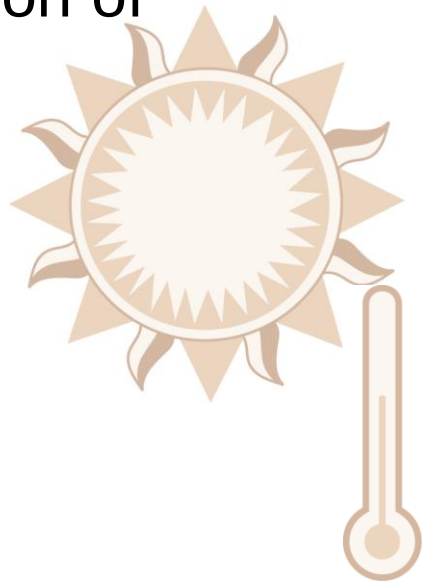


John S. Haldane

- Developed methods to measure oxygen use during exercise

Harvard Fatigue Laboratory

- Founded by Lawrence J. Henderson in 1927
- Directed by David Bruce Dill
- Focused on the physiology of human movement and the effects of environmental stress on exercise
- Pioneered studies that resulted in an explosion of interest in exercise physiology
- Closed in 1947



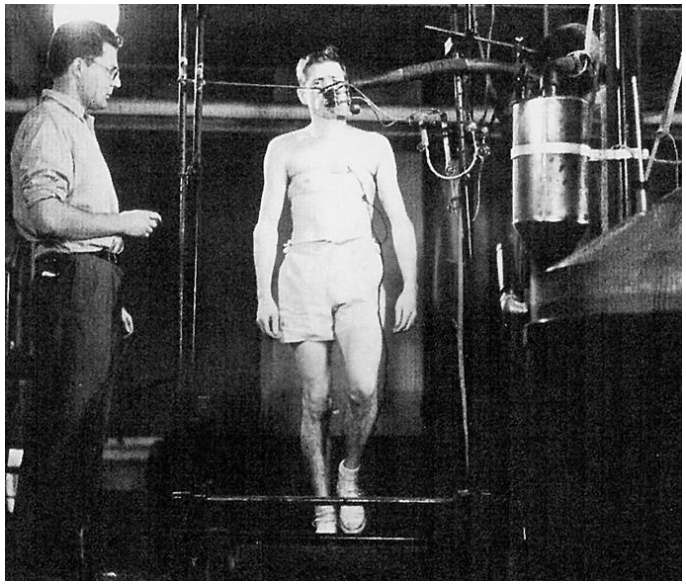
Early Exercise Physiologists

David Bruce ("D.B.") Dill

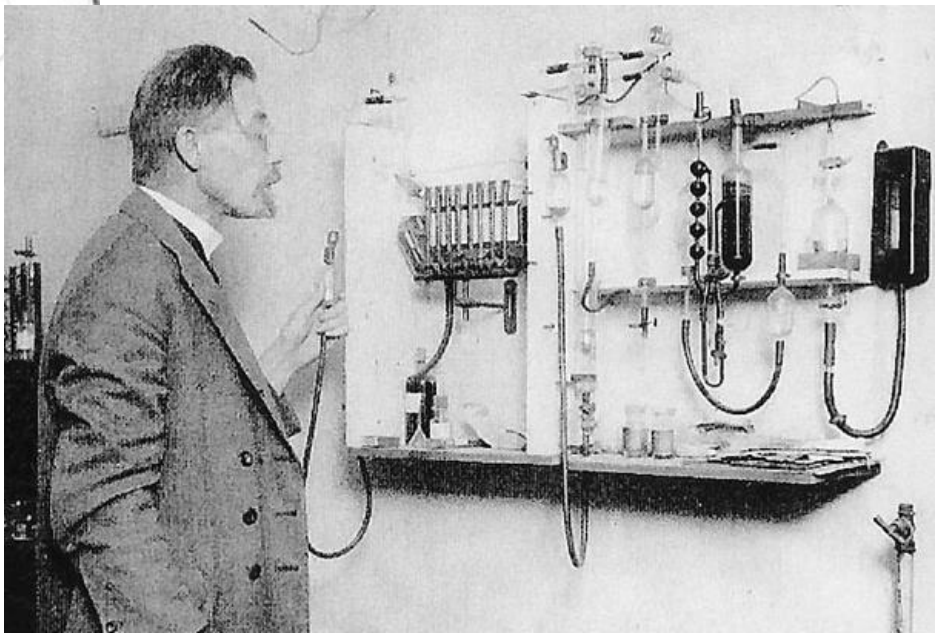
- Directed Harvard Fatigue Laboratory (HFL) from 1927-1947
- Later studied human tolerance to exercise in the desert and at altitude

Sid Robinson

- Studied exercise and aging while a student at HFL



EARLY MEASUREMENT DEVICES



Scandinavian Influence

Erik Hohwü-Christensen

- Published important early research on carbohydrate and fat metabolism

Per-Olof Åstrand

- Conducted studies on physical fitness and endurance capacity

Scandinavian Influence

Bengt Saltin

- Contributed greatly to exercise and clinical physiology

Jonas Bergstrom

- Reintroduced biopsy needle to study human muscle biochem-istry

Exercise Physiology and Physical Fitness

Peter Karpovich

- Introduced physiology to physical education

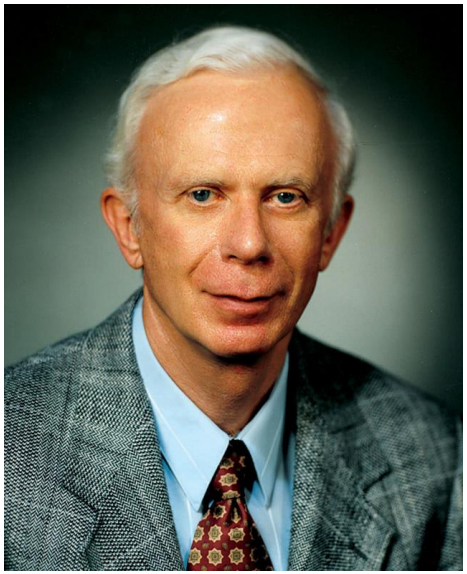
Thomas K. Cureton

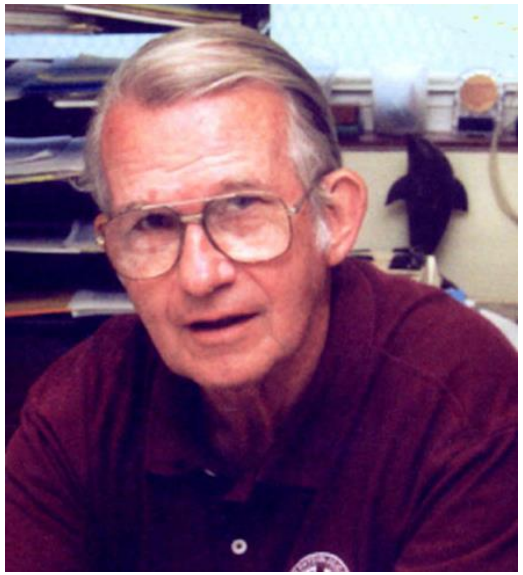
- Taught many of today's leaders in physical fitness and exercise physiology

Contemporary Exercise Physiologists

John Holloszy, Charles Tipton, and Phil Gollnick

- Introduced biochemical approach to exercise physiology research
- First to use rats and mice to study muscle metabolism and fatigue

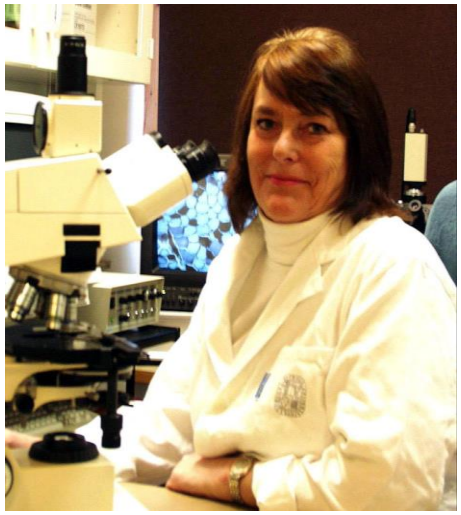




Women in Exercise Physiology

Birgitta Essen

- Adapted micro-biochemical methods for better studying muscle samples obtained with muscle biopsy



Karen Piehl

- Published several studies illustrating which fibers were activated during aerobic and anaerobic exercise

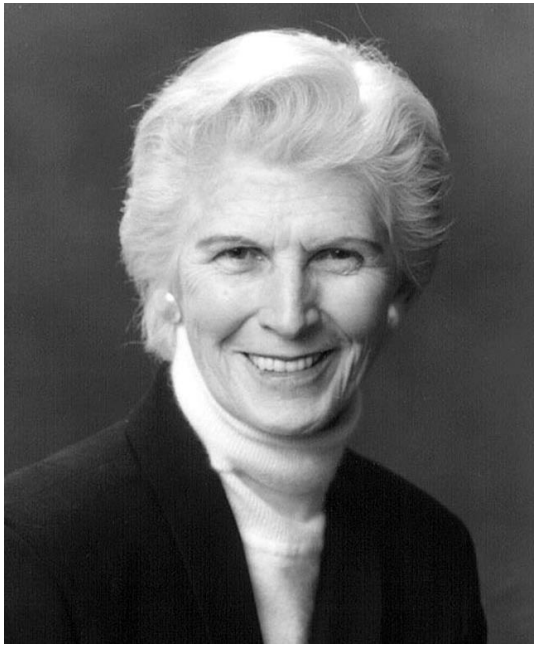
Women in Exercise Physiology

Bodil Nielsen

- Studied human responses to environmental heat stress and dehydration

Barbara Drinkwater

- Studied environmental physiology and the physiological issues unique to female athletes



Acute Responses vs Chronic Adaptations

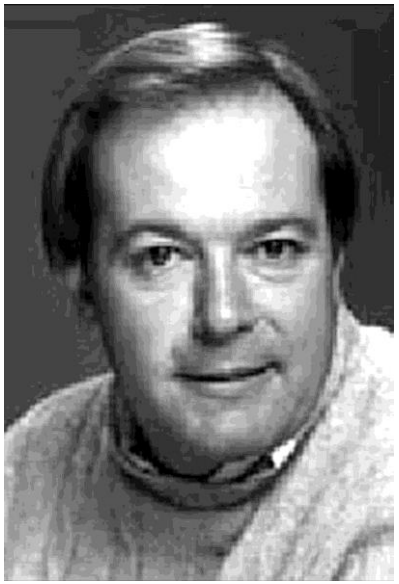
Acute responses to training involve how the body responds to one bout of exercise.

Chronic physiological adaptations to training mark how the body responds over time to the stress of repeated exercise bouts.

Molecular Biology & Exercise Physiology

Frank Booth and Ken Baldwin

- Dedicated their careers to understanding the molecular regulation of muscle fibers
- Contributed to what we now know of the genetic controls of muscle growth and atrophy



Cycle Ergometer

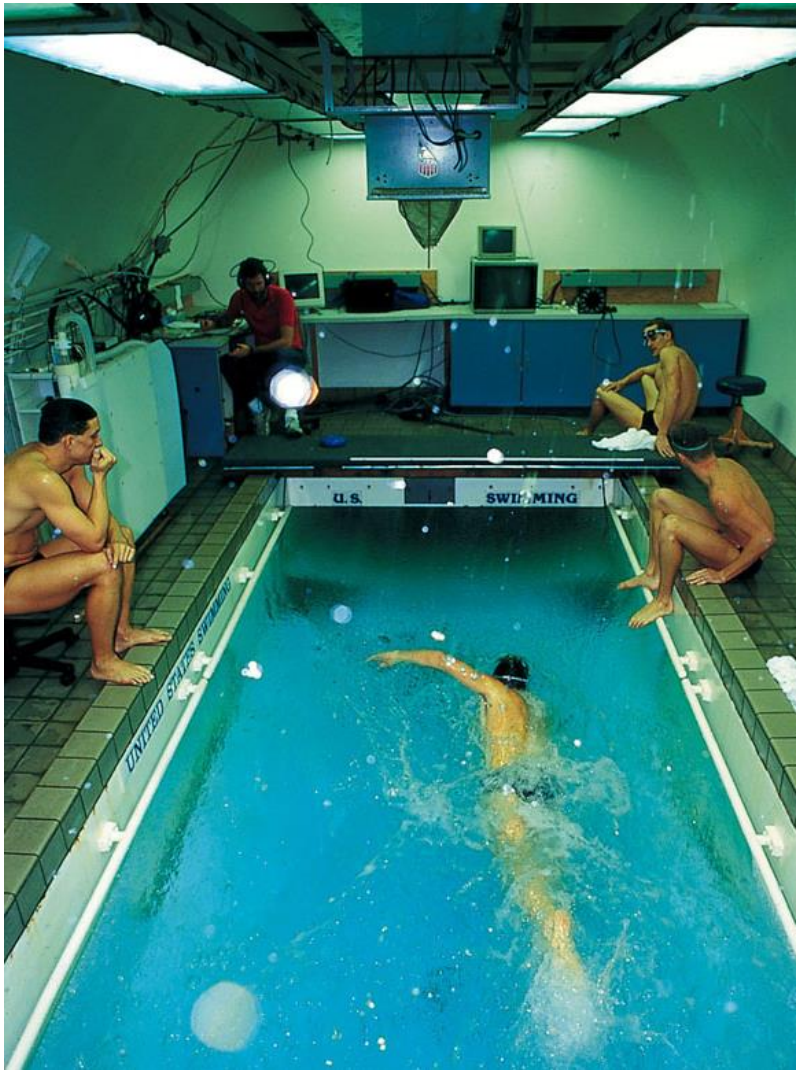
- Makes it easier to assess blood pressure and collect blood because upper body is relatively immobile
- Results are not greatly affected by body weight or changes in body weight

Treadmill

- Results in generally higher maximal physiological values—heart rate, ventilation, and oxygen uptake—than cycle ergometer

Swimming Flume

- Allows swimmers to closely simulate their natural swimming strokes while researchers collect data



Key Points

Acute Responses to Exercise

- Control environmental factors such as temperature, humidity, light, and noise.
- Account for diurnal cycles, menstrual cycles, and sleep patterns.
- Use ergometers to measure physical work in standardized conditions.
- Match the mode of testing to the type of activity the subject usually performs.

Basic Training Principles

Individuality—Consider the specific needs and abilities of the individual.

Specificity—Training adaptations are highly specific to the type of activity and the volume and intensity of training.

Disuse—Include a program to maintain fitness.

Progressive overload—Increase the training stimulus as the body adapts.

Hard/easy—Alternate high-intensity with low-intensity workouts.

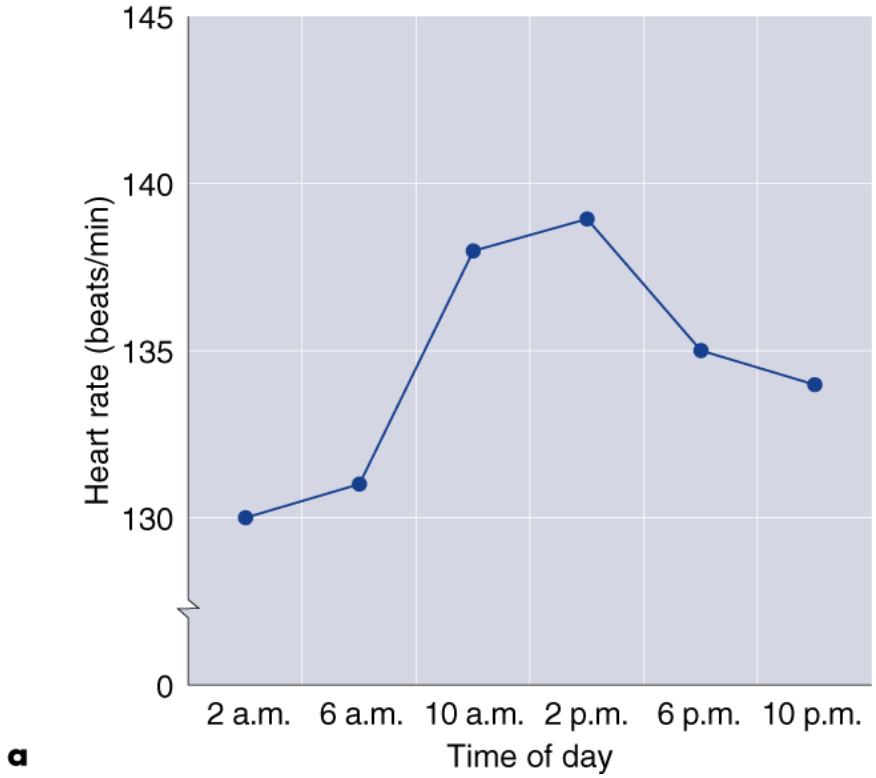
Periodization—Cycle specificity, intensity, and volume of training.

An Example of Diurnal Variations in Heart Rate at Rest and During Exercise

	Time of day					
	2 a.m.	**6 a.m.**	**10 a.m.**	**2 p.m.**	**6 p.m.**	**10 p.m.**
Condition	Heart rate (beats/min)					
Resting	65	69	73	74	72	69
Light exercise	100	103	109	109	105	104
Moderate exercise	130	131	138	139	135	134
Maximal exercise	179	179	183	184	181	181
Recovery, 3 min	118	122	129	128	128	125

Data from Reilly and Brooks (1990).

READING AND INTERPRETING GRAPHS



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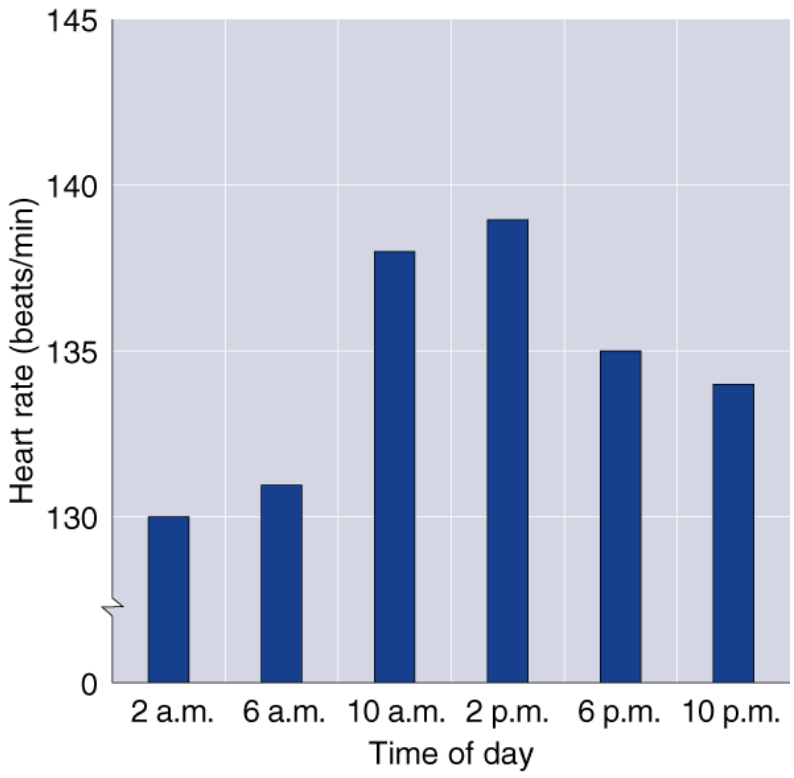

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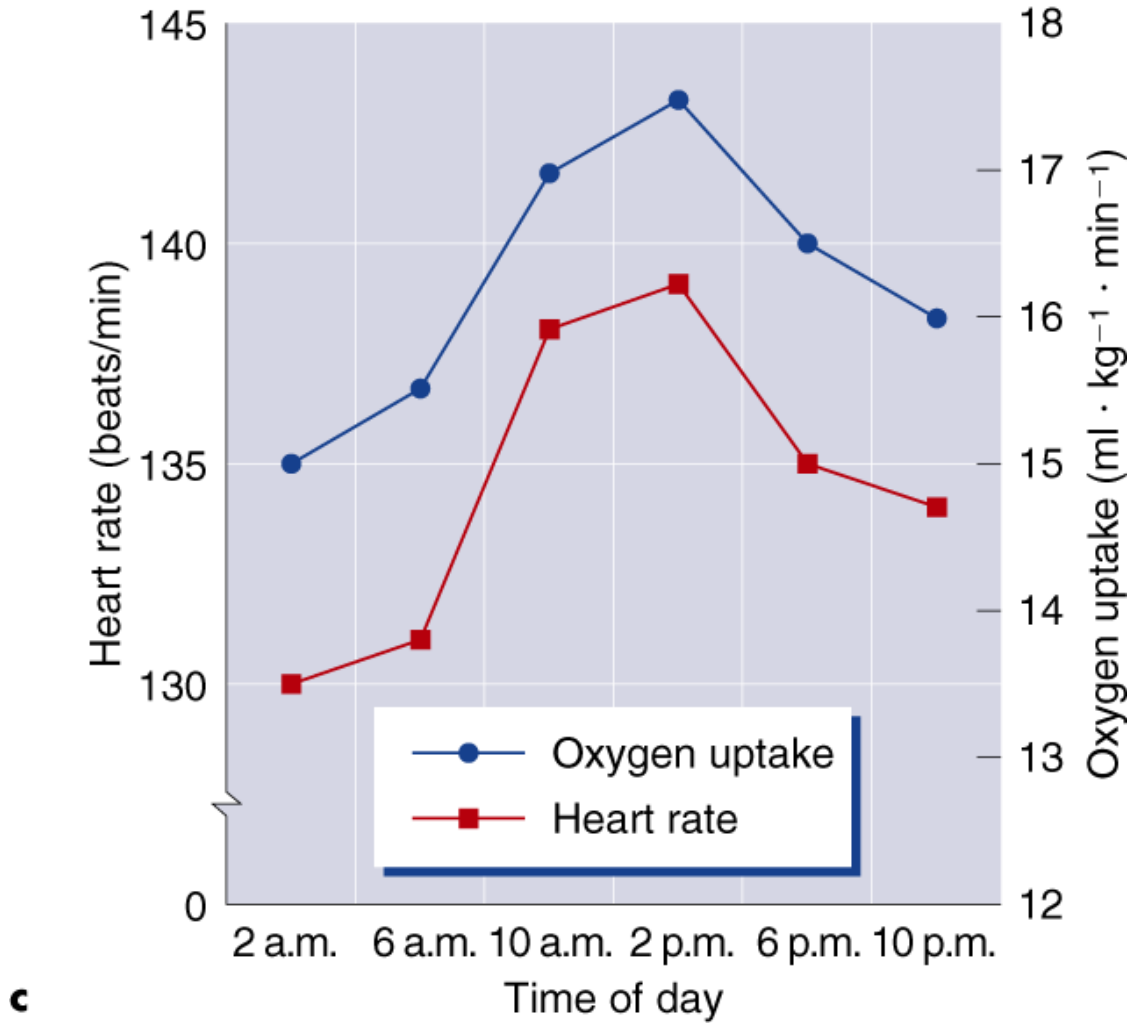
READING AND INTERPRETING GRAPHS



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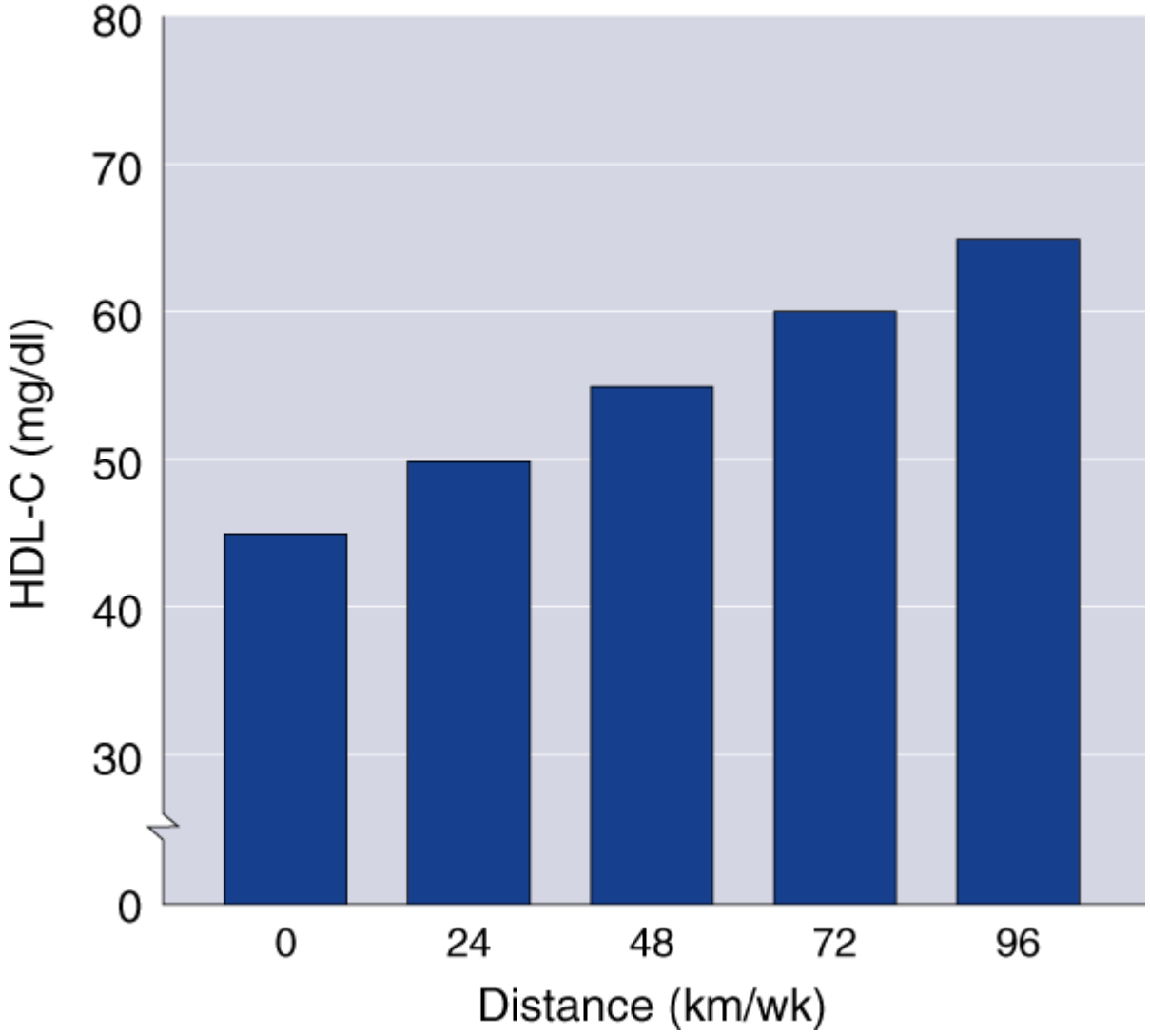
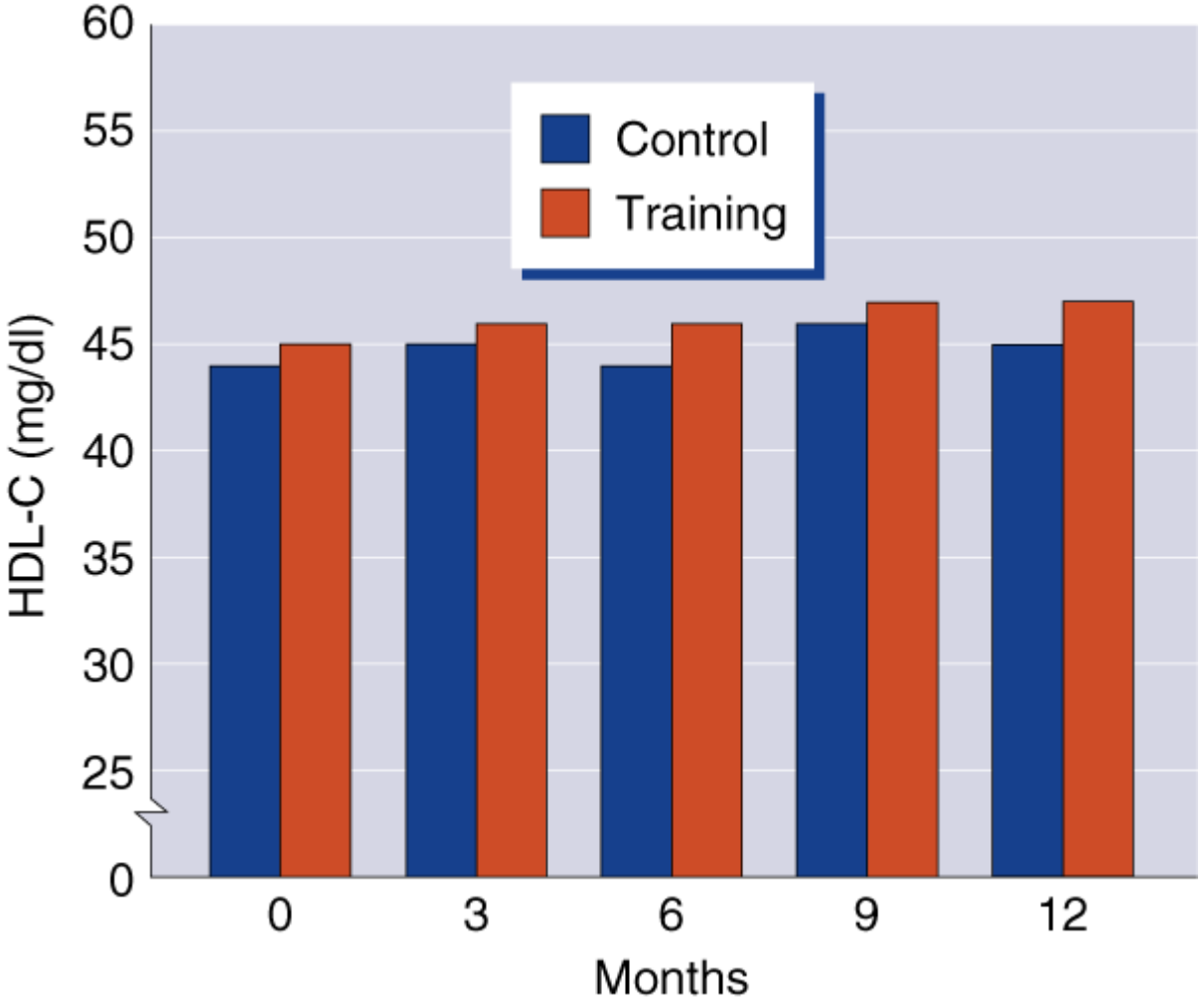
CROSS-SECTIONAL RESEARCH



LONGITUDINAL RESEARCH



Key Points

Research Methodology

- Longitudinal research tests the same subjects and compares results over time.
- Cross-sectional research collects data from a diverse population and compares the data for each group in that population.
- Longitudinal studies are often more accurate than cross-sectional studies, but they can't always be done.

(continued)

Key Points

Research Methodology

- Laboratory research allows investigators to carefully control variables and use accurate equipment.
- Field research allows for less control of variables and equipment, but participant's activities are often more natural.