

University of Arkansas, College of Education
Department of Health Science, Kinesiology,
Recreation and Dance

- I. Course Number and Title:** KINS 3153 Exercise Physiology
- Catalog Description:** Examination of effects of exercise on the physiological systems of the body. The exploration includes effects during, immediately after, and as long term results of work and exercise.

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- II. Goals:** To provide basic information regarding the physiological adjustments and adaptations to exercise and training.

- III. Competencies:** Students should be able to answer questions about and discuss:

- A. Physiological and biochemical adaptations of the human body to exercise training and other stressors.
- B. Physiological and biochemical responses of the human body to exercise and other stressors.
- C. Exercise training methods in relation to specific physiological and biochemical systems.
- D. The relationship between exercise and inactivity-induced diseases.

IV. Content:

- A. Energy metabolism
2,3
 - 1. Energy provision for different kinds of exercise
 - 2. Oxidative and non-oxidative pathways

- a. Non-oxidative
 1. Phosphagen stores
 2. Glycolysis
 - b. Oxidative
 1. Glycolysis
 2. Fatty acid oxidation
 3. Krebs cycle
 4. Electron transport
3. Glycogenolysis
 - a. Stimulators
 1. Calcium
 2. Epinephrine
 3. Muscular activity
 - b. Phosphorylase a and b
 - c. End products - glucose 6-PO₄
 4. Gluconeogenesis
 - a. Production of blood glucose
 - b. Precursors
 5. Glycolysis
 - a. Regulation
 - b. End products
 6. Cori cycle
 7. Regulation of blood glucose
 - a. Insulin mediated glucose uptake
 - b. Non-insulin mediated glucose uptake
- B. Recovery from exercise
- 3

1. Energy/oxygen cost of exercise
2. Oxygen deficit
 - a. Oxidative energy metabolism
 - b. Non-oxidative energy metabolism
3. Oxygen debt
 - a. Lactacid component
 - b. Alactacid component
 - c. Other factors (Brooks et al)

4. Significance of endurance training adaptations

C. Structure of muscle and control of movement
5,6

1. Structure

a. Myofibrils

KINS 3153/CER/Summer, 2001/page 2

b. Actin and myosin

c. Cellular structure

d. Fiber types

e. Skeletal, smooth, and cardiac

f. Myoneural junction

g. Neurotransmitters

2. Cross-bridge cycling (Excitation-contraction coupling) 6

D. Respiration
7,8

1. Anatomy of respiratory system

2. Mechanics of breathing

3. Gas exchange in the lungs

a. Factors affecting gas exchange

b. Value of supplemental gas

4. Respiratory exchange ratio

5. Gas transport

a. Binding of oxygen to hemoglobin

b. Transport of CO₂

c. Effects of pH, temperature, CO₂

E. Cardiovascular system
9,10,11

1. Anatomy of the heart

2. Pacemaker cells and heart function

a. Ion channels

b. Action potentials

3. Electrical conduction system of the heart

- a. Basic system
 - b. Relation to the ECG
4. Heart Rate
- a. Autonomic control
 - 1. Sympathetic effect
 - 2. Parasympathetic effect
 - b. Stretch receptors
 - c. pH effects, temperature effects, CO₂ effects
- d. Exercise responses
- 1. Progressively intense exercise
 - 2. Prolonged exercise
- e. Training
5. Stroke Volume
- a. Control mechanisms
 - b. HR x SV
6. Cardiac Output
- a. Intrinsic autoregulation (Starling's Law)
 - b. Autonomic control
 - 1. Sympathetic effects
 - 2. Parasympathetic effects
 - c. Training
7. Blood Pressure
- a. "Normal blood pressure"
 - b. Systolic determinants
 - c. Diastolic determinants
 - d. Response to exercise
 - 1. Progressively intense exercise
 - 2. Prolonged exercise
 - e. Training
8. Oxygen Consumption
- F. Training
- 11
- 1. Aerobic training effects
 - a. FIT requirements
 - b. Skeletal muscle adaptations
 - 1. Energy substrate

- a. Glycogen sparing
- b. Enhanced fat metabolism
- 2. Enzymatic changes
 - a. PFK
 - b. LDH
 - c. Cytochrome oxidase
- d. Enzymes of fat metabolism
- 3. Energy utilization changes
 - a. Changes in calcium transport
 - b. Actomyosin ATPase

KINS 3153/CER/Summer, 2001/page 4

- 2. Anaerobic training effects
 - a. General considerations
 - b. Training methods
 - c. Physiological effects
- 3. Muscular strength and endurance
 - a. Weight training programs
 - b. Flexibility

13 G. Strength and Muscular Endurance

- 1. Types of muscular contraction
 - a. Isotonic
 - b. Isometric
- 2. Types of work
 - a. Isotonic
 - b. Isometric
 - c. Isokinetic
- 3. Principles of training
 - a. Overload
 - b. Specificity
- 4. Training programs
- 5. Relationship between strength and flexibility

H. Nutrition and exercise
15,16

- 1. Carbohydrates, fats, proteins
- 2. Vitamins and minerals

3. Nutritional requirements for exercise
4. Weight control

KINS 3153/CER/Summer, 2001/page 5

I. The Endocrine System
17

1. Hormone actions
 - a. Characteristics of hormones
 - b. Mechanisms of hormonal action
2. Glucose regulation
 - a. Insulin and Glucagon
 - b. Catecholamines
3. Other hormones
 - a. Growth hormone
 - b. Cortisol
 - c. Thyroid hormone
 - d. Estrogen and progesterone
 - e. Androgens

J. The Environment and Work
19

1. Control of body temperature
 - a. Keeping cool
 1. Mechanisms for dissipating body heat
 - a. Conduction
 - b. Convection
 - c. Radiation
 - d. Evaporation
 2. Factors limiting the ability to cool in the heat
 3. Dress appropriately
 4. Heat injuries
 - b. Staying warm
 1. Mechanisms for retaining body heat
 - a. Shivering
 - b. Pilo erection
 - c. Dressing appropriately
 2. Hypothermia

3. Local vs. Total body cooling

K. Ergogenic aids

18

V. Evaluation: There will be four (4) examinations. Each will be worth 50 points and each will be cumulative. **No make-up examinations will be given unless prior approval is obtained.** An additional component of the evaluation process will be a written paper (50 pts). Assigned work must be turned in during class on or prior to the due date. Academic dishonesty will not be tolerated (see below).

VI. Grading Scale:

Final Grades:

A	225-250 points
B	200-224 points
C	175-199 points
D	150-174 points
F	149 points and below

VII. Academic Honesty: "The application of the University of Arkansas Academic Honesty Policy, as stated in the Student Handbook will be fully adhered to in this course. Grades and degrees earned by dishonest means devalue those earned by all students; therefore, it is important that students are aware of the University of Arkansas Academic Honesty Policy. Academic dishonesty involves acts which may subvert or compromise the integrity of the educational process."

VIII. Inclement Weather Policy: Unless the University of Arkansas cancels classes due to inclement weather, class will be held as scheduled.

VIII. Required Text:

Foss, Merle L. and Steven J. Keteyian. Fox's The Physiological Basis for Exercise and Sport, McGraw-Hill, Dubuque, Iowa, 1998.

Muller, Susan. Student Study Guide to accompany Fox's Physiological Basis For Exercise and Sport. McGraw-Hill, Dubuque, Iowa, 1998.