

## OUTLINES FOR FINAL EXAM

### CHAPTER 6 – INTRODUCTION TO METABOLISM

#### I. Forms of Energy

- A. Chemical
- B. Potential
- C. Mechanical (Kinetic)
- D. Thermal

#### II. Energetics

- A. Assimilation
- B. Utilization (work)
  - 1. biosynthesis
  - 2. internal work (maintenance)
  - 3. external work
- C. Heat Production

#### III. Metabolic rate

- A. Definition and importance
- B. Methods of measurement
  - 1. Calorimetry (advantages and limitations)
    - a. direct
    - b. indirect
  - 2. Isotopes (advantages and limitations)
- C. Factors that affect metabolic rate
  - 1. Temperature
  - 2. Activity level
  - 3. Digestive state
  - 4. Body size (allometry)
    - a. size and total metabolic rate
    - b. size and mass-specific metabolic rate

### CHAPTER 7 – AEROBIC AND ANAEROBIC METABOLISM

#### I. Metabolic pathways

- A. Anabolic vs. catabolic
- B. Aerobic vs. anaerobic
- C. Redox reactions

#### II. Aerobic metabolism (know main outcome, products, and energy yield)

- A. Glycolysis
- B. Kreb's cycle (citric acid cycle)
- C. Oxidative phosphorylation
  - 1. electron transport chain (ETC), role of O<sub>2</sub>
  - 2. chemiosmosis, uncoupling

#### III. Anaerobic metabolism

- A. Glycolysis
- B. Fermentation
- C. Clearance of anaerobic byproducts
- D. Role of phosphagens

- IV. Metabolism during activity
  - A. Supply and demand
    - 1. Steady state
    - 2. Non-steady state
    - 3. Interplay of aerobic and anaerobic pathways
  - B. Fatigue
  - C. Variations in metabolic capacity and poise

## CHAPTER 8 – ENERGETICS OF AEROBIC ACTIVITY

### I. Energetics of locomotion

- A. Drag
- B. Relationship between metabolic rate and speed
  - 1. swimming
  - 2. flying
  - 3. walking/running

### II. Cost of transport

- A. Difference between COT and metabolic rate
- B. Factors affecting COT
  - 1. mode of locomotion
  - 2. body size
- C. COT and migration

### III. VO<sub>2</sub>max

- A. Definition
- B. Impact on aerobic scope and performance
- C. Factors affecting VO<sub>2</sub>max
  - 1. genetics
  - 2. training

## CHAPTER 9 – THERMAL RELATIONS

### I. General concepts

- A. Heat
- B. Temperature
- C. Temperature effects on protein structure/function
- D. Q<sub>10</sub>

### II. Heat transfer

- A. Conduction
- B. Convection
- C. Evaporation
- D. Radiation

### III. Thermal Classifications

- A. Homeothermy vs. Poikilothermy (advantages/disadvantages)
- B. Endothermy vs. Ectothermy (advantages/disadvantages)
- C. Heterothermy
  - 1. temporal vs. spatial

#### IV. Ectothermic animals

##### A. Options for thermoregulation

1. behavioral
2. physiological

##### B. Options for dealing with changes in $T_B$

1.  $Q_{10}$  and thermal sensitivity
2. thermal acclimation (definition and mechanisms)
3. evolutionary adaptation

##### C. Adjustments to extreme heat

1. behavioral
2. heat shock proteins

##### D. Adjustments to extreme cold

1. antifreeze
2. supercooling
3. freeze tolerance

#### V. Endothermic animals

##### A. Thermoneutral zone

1. Thermoregulatory strategies inside the TNZ
  - a. insulation
  - b. blood flow
  - c. posture
2. Thermoregulation below the TNZ (heat production)
  - a. shivering thermogenesis
  - b. non-shivering thermogenesis
3. Thermoregulation above the TNZ (evaporative cooling)
  - a. sweating
  - b. panting
  - c. gular fluttering

### CHAPTER 10 – ENDOTHERMIC HETEROOTHERMY

#### I. Sleep

##### A. Potential function

#### II. Torpor

##### A. Definition

##### B. Daily torpor

##### C. Seasonal torpor

1. Winter sleep
2. True hibernation
3. Arousal