ZOOL0GY 331
Lecture Outline

A. General metabolic functions
   I. Nutrition
      Foods, food factors, and their sources
         General foods
         Essential foodstuffs
      Feeding mechanisms
         Mechanisms for small particles
         Mechanisms for large particles
         Mechanisms for soft tissues and fluids
      Digestion
         Intracellular
         Extracellular
         Digestive enzymes

II. Respiration
    Aerobic and anaerobic respiration
    Factors influencing respiration
    Respiration in water
       Without specific organs
       With specific organs
    Transitional types between aquatic and aerial respiration
    Respiration in air
       Gills
       Lungs
       Tracheal systems
    Respiratory functions of the blood
       Transport of carbon dioxide
       Transport of oxygen
    Adaptation of circulation to respiratory needs

III. Body fluids: their composition, properties and circulation
    Composition and properties
       Chemical constitution
       Phagocytosis
       Coagulation
       Immunological reactions
    Circulation
       Without a true vascular system
       With a vascular system
       Physiology of hearts
       External control of heart rhythm
       Physiology of blood vessels

IV. Body fluids: their regulation
    Osmotic and ionic regulation
       Aquatic organisms
          Marine invertebrates
          Fresh-water invertebrates
          Vertebrates
       Terrestrial organisms
          Invertebrates
          Vertebrates
    Elimination of nitrogen
       Aquatic organisms
       Terrestrial organisms
    Acid-base regulation
    Regulation of sugar etc.
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B. Integration and Reaction

V. Receptor physiology and response to stimuli
   photoreceptors
   mechanoreceptors
   chemoreceptors
   stimulation organs

VI. Effector physiology
    contractile elements
    glands
    cilia and flagella
    ameboid activity
    chromatophores
    electric organs
    photogenic organs
    trichocysts and nematocysts

VII. Nervous mechanisms of integration
     neuroid transmission
     nerve conduction
     physiology of the synapse
     specific systems and their physiology
       the protozoan system
       the parazoan system
       the coelenterate system
       the annelid system
       the arthropod system
       the vertebrate system
     analysis of locomotory mechanisms
       intracellular
       dermomuscular
       ambulacral
       skeleto-muscular

VIII. Endocrine mechanisms of integration
      circulating hormones
      reproduction and development
      general metabolic regulation
      responses of effector organs
      diffusion hormones
      acetylcholine
      adrenaline
In view of the limited facilities available for conducting laboratory work in comparative physiology and also because of the very nature of the subject, we have decided to divide the class into groups of 2, 3 or 4, each group of which will conduct one project approximately 13 hours in length, selected after consultation with the instructor, in each of the following areas of comparative physiology:

I. Nutrition and respiration
II. Body fluids: their composition, properties, circulation and regulation
III. Receptor and effector physiology, and behavior
IV. Integration (nervous and humoral)

After each group has completed its project it will be given 15 minutes during the 2:30 hour on Monday or Tuesday to report its methods (demonstrations whenever possible), results and conclusions to the remainder of the class.

Suggested Laboratory Experiments

I. NUTRITION AND RESPIRATION
   1. Feeding mechanisms in animals
   2. Comparative study of digestion in animals
   3. Comparative study of digestive enzymes
   4. Comparative study of basal metabolic rates
   5. $\text{O}_2$ and $\text{CO}_2$ partial pressures upon respiratory rhythms and $\text{O}_2$ consumption
   6. The effect of temperature upon respiratory rates
   7. Comparative $\text{O}_2$ dissociation curves for bloods
   8. Physiology of fish swimbladders

II. BODY FLUIDS: THEIR COMPOSITION, PROPERTIES, CIRCULATION AND REGULATION
   1. Comparative study of osmotic pressures of bloods
   2. Comparative study of phagocytosis and blood clotting
   3. Comparative physiology of hearts
   4. Osmotic regulation in protozoa
   5. Osmotic regulation in higher invertebrates and lower vertebrates
   6. Conservation of water in terrestrial forms
   7. Buffer capacities of body fluids
   8. Comparative study of nitrogen excretory products

III. RECEPTOR AND Effector PHYSIOLOGY, AND BEHAVIOR
   1. Properties of photoreceptive mechanisms of Daphnia, Drosofila, Limax, etc.
   2. Comparative physiology of muscle contraction
   3. Physiology of ciliary movement
   4. Physiology of amoeboid movement
   5. Chemoreception, statoreception, and thermoreception
   6. Background selection in animals
   7. Experimental modulation of animal responses
   8. Kineses, taxis, and transverse orientations

IV. INTEGRATION
   1. Coelenterate neuromuscular physiology
   2. Arthropod neuromuscular physiology
   3. Frog neuromuscular physiology
   4. Central nervous physiology of animals
   5. Mechanisms for locomotion
   6. Hormonal control of molt, pupation, and metamorphosis
   7. Hormonal control of chromatophores and retinal pigments
   8. Hormonal control of respiratory, water, and carbohydrate metabolism
   9. Organismic rhythmicity and arrhythmicity
One Hour Exam.
Zoology 351.
Tuesday, July 15th.

Answer any four:

1. Give an account of proteases and their distribution through the animal kingdom.

2. Outline, briefly, types of mechanisms for feeding upon fine particles. Give in some detail the operation of a molluscan ciliary and a crustacean setose mechanism.

3. Discuss factors influential in modifying the rate of oxygen consumption of animals.

4. Compare the properties of hemoglobins of a number of animals taken from environments widely different from one another in the availability of oxygen.

5. What are some of the physiological adaptations of birds and mammals to diving. Explain the significance of each.