

**MIDDLESEX COUNTY COLLEGE  
EDISON, NEW JERSEY**

Course Title: **Human Anatomy and Physiology I**      Catalog #: **Bio. 111**

Class Hours: 3      Laboratory Hours: 3      Credit Hours: 4

Department Chair: \_\_\_\_\_ Division Dean: \_\_\_\_\_ Date: 2007-2008

Prerequisite: One year of high school laboratory biology (or BIO 010), plus one year of high school laboratory chemistry (or CHM 010) and appropriate score on the College Math Placement Test (or MAT 013).

**Required Textbooks for Course:**

<b><u>Author</u></b>	<b><u>Title</u></b>	<b><u>Publisher</u></b>	<b><u>Copyright</u></b>
Marieb, Elaine & Hoehn, Katja	Human Anatomy and Physiology, 7th Edition, with Interactive Physiology and Anatomical Atlas	Addison Wesley/Benjamin Cummings	2007
Allan and Harper	Laboratory Manual for Anatomy & Physiology with wiley Plus for Allen & Harper	John Wiley	2006

**Dissection Kit**  
**Goggles (or safety glasses)**  
**Optional Materials:**

Elaine N. Marieb	Anatomy and Physiology Study Guide, 1 <sup>st</sup> Edition	Benjamin Cummings	2007
Hochbaum, Jeffrey (OPTIONAL EXCEPT AS NOTED)	Human Anatomy & Physiology I & II Laboratory Images on CD-ROM for Student Review with Questions & Answers Workbook. 2 <sup>nd</sup> edition.	Bandi	2003
Kleinelp, William (OPTIONAL EXCEPT AS NOTED)	The InterActive Illustrated Human Skeletal System	Wood River Associates/Biologyworks.com	2007

**ANATOMY AND PHYSIOLOGY I  
LAB SCHEDULE  
2007\*2008**

1. Terms, cavities, A.D.A.M. introduction
2. Skeletal System
3. Skeletal System
4. Skeletal System
5. Articulations
6. **LAB PRACTICAL #1**
7. Muscle – A.D.A.M. and Models
8. Muscle – A.D.A.M. and Models
9. Muscle – A.D.A.M. and Models
10. **LAB PRACTICAL #2**; Neuron Model
11. Brain
12. Spinal Cord
13. Eye/Ear
14. **LAB PRACTICAL #3**
15. **OPEN ( depending on number of weeks in semester)**

Catalog Description:

A study of human cells and tissues as they relate to organs and systems. Structural and functional features of the skeletal, muscular, and nervous systems and special senses are then examined. ***Recommended for students in the health sciences.***

Course Goals:

To provide an understanding of the structure and function of the cells, tissues and organs of the human integumentary, skeletal, muscular and nervous systems, and of the special senses, and their interrelationships. This is accomplished by reinforcing lecture material with relevant laboratory dissections, computer simulations, physiological experimentation, data collection, out-of-class projects, and appropriate library research.

Course Objectives:

At the conclusion of the course the student should be able to:

1. Understand basic anatomical and physiological terminology
2. Correlate the histology, anatomy, and physiology of each body system
3. Understand the principles of anatomy and physiology of the integumentary, skeletal, muscular, and nervous systems, and special senses
4. Integrate and understand the interrelationships between the integumentary, skeletal, muscular, and nervous systems and of the special senses
5. Understand the basic physiological principles of homeostasis and biological feedback
6. Demonstrate the following laboratory skills:
  - a. proper use of scientific equipment
  - b. collection of data from physiological experiments, analysis of results, and formulation of conclusions, using the Scientific Method
  - c. dissection of a representative mammal and correlation with the anatomy of the human
  - d. proper articulation of the human skeleton
  - e. use of the A.D.A.M. computer program to identify human skeletal muscles and to study and understand their origins, actions, and insertions
7. Use of the Interactive Physiology computer program to understand the principles of skeletal muscle and nerve physiology
8. Research applicable references from the library to be included in formal laboratory reports and course assignments
9. Discuss current medical, ethical and controversial issues, think creatively, and be able to examine points and counterpoints of such issues
10. Be aware of the contributions of scientists from various cultures and countries which led to the current knowledge in the field of anatomy and physiology

## COURSE OUTLINE

- I. Introduction of the Human Body (3 hours)
    - A. Introduction
      - 1. Definitions
        - a. Anatomy
          - (1) gross
          - (2) microscopic
            - i. cytology
            - ii. histology
            - iii. developmental
      - 2. Levels of Organization: chemical through organism
      - 3. Survey of Body Systems and their Structure and Function
      - 4. Homeostasis and Feedback Mechanisms: Brief Introduction
    - B. Body Terms and Organization (1 to 1 ½ hours) (in lab)
      - 1. Anatomical Position
      - 2. Surface Anatomy
      - 3. Directional Terms
      - 4. Anatomical Planes
      - 5. Body Cavities
        - a. Dorsal
          - (1) cranial
          - (2) spinal
        - b. Ventral
          - (1) thoracic
        - c. Pleural
        - d. Pericardial
        - e. Mediastinal
          - (1) abdominopelvic
      - 6. Abdominopelvic Regions
        - a. Hypochondriac
        - b. Epigastric
        - c. Lumbar
        - d. Hypogastric
        - e. Iliac
        - f. Umbilical
      - 7. Abdominopelvic Quadrants
- II. Cellular Transport (3 hours)
  - A. Cell Membrane Structure and Function
    - 1. Fluid Mosaic Model
      - a. Phospholipids
      - b. Proteins
        - (1) integral
        - (2) peripheral
      - c. Cholesterol
      - d. Pores (gates, channels)
      - e. Semipermeability
      - f. Charge on membrane (resting membrane potential)

2. Membrane Transport: General Characteristics (3 hours)
  - a. Factors that Affect Movement Across Cell Membrane
    - (1) size of molecule (molecular weight)
    - (2) solubility in lipid
    - (3) charge on ion or molecule and on the membrane
    - (4) carrier molecules
3. Passive Transport Mechanisms
  - a. Diffusion
    - (1) simple
    - (2) facilitated
    - (3) filtration
    - (4) dialysis
  - b. Osmosis
    - (1) osmotic pressure
    - (2) solution, solute, solvent (definitions)
    - (3) solutions: hypotonic, hypertonic, isotonic
4. Active Transport Mechanisms
  - a. Sodium-Potassium Exchange Pump
  - b. Endocytosis
    - (1) phagocytosis
    - (2) pinocytosis
    - (3) receptor-mediated
    - (4) cotransport, countertransport, symtransport
  - c. Exocytosis
    - (1) excretion
    - (2) secretion

### III. Tissue Level of Organization (3 hours)

- A. Embryonic Tissues: Mesenchyme, Muroid
- B. Adult Tissues
  1. Epithelium
    - a. General Characteristics and Functions
    - b. Functions: Structural vs. Glandular Epithelium
    - c. Types of Epithelium and Locations
      - (1) simple: squamous, cuboidal, columnar, pseudostratified, ciliated; goblet cells
      - (2) stratified: squamous, cuboidal, columnar
  2. Connective Tissue
    - a. General Characteristics and Functions
    - b. Types and Locations
      - (1) loose: muroid, mesenchyme, areolar, reticular, adipose
      - (2) dense: regular, irregular
      - (3) specialized connective tissue: cartilage, bone, blood
  3. Muscular Tissue: Skeletal, Smooth, Cardiac; Location and Function
  4. Nervous Tissue: Neurons, Neuroglia; Location and Function
- C. Membranes
  1. Definition and Classification as Organs
  2. Definition and Location of each Type: Mucous, Serous, Synovial, and Cutaneous

- IV. Integumentary System (3 hours)
  - A. Functions and Structure of the System
  - B. Skin Structure and Function
    - 1. Epidermis
    - 2. Dermis
    - 3. Hypodermis
  - C. Accessory Organs of the Skin
    - 1. Hair
    - 2. Nails
    - 3. Glands: Sudoriferous, Sebaceous, Ceruminous
  
- V. Skeletal System (3 hours)
  - A. Structure of Organs and Functions of the System
  - B. Histology of Cartilage: Hyaline, Elastic, Fibrous
  - C. Structure of a Typical Long Bone: Gross and Histological Detail
  - D. Histology of Bone (Osteous) Tissue
    - 1. Osseous vs. Osteoid
    - 2. Compact vs. Cancellous
    - 3. Blood and Nerve Supply of Osseous Tissue
  - E. Bone Formation (Osteogenesis)
    - 1. Endochondral
    - 2. Intramembranous
  - F. Physiology of Bone
    - 1. Function of Calcium
    - 2. Hormonal Regulation of Calcium, Phosphorus
    - 3. Factors Affecting Normal Bone Growth and Remodelling
  - G. Survey of Bones (in laboratory)
    - 1. Axial Skeleton
    - 2. Appendicular Skeleton
    - 3. Fetal Skull and Fontanelles
    - 4. Male vs. Female Skeleton
    - 5. Primary and Secondary Curves of Vertebral Column (Normal Curves and Abnormalities)
    - 6. Fetal vs. Adult Skeleton
  
- VI. Articulations (3 hours)
  - A. Definition of an Arthrosis and General Functions
  - B. Classification, Definitions, Location, Types of Movement (Non-Axial, Monaxial, Biaxial, Triaxial)
    - 1. Synarthroses
      - a. Suture
      - b. Syndesmosis
      - c. Synostosis
      - d. Gomphosis
    - 2. Amphiarthroses
      - a. Synchrondrosis
      - b. Symphysis

3. Diarthroses
  - a. Saddle
  - b. Ball and Socket
  - c. Gliding
  - d. Hinge
  - e. Pivot
  - f. Ellipsoidal
- C. Joint Movements: Definitions and Examples
  1. Flexion/Extension
  2. Abduction/Adduction
  3. Rotation
  4. Circumduction
  5. Gliding (Plane Movement)
  6. Dorsiflexion/Plantar Flexion
  7. Protraction/Retraction
  8. Supination/Pronation

## VII. Nervous System (12 hours)

- A. Organs and General Functions of the System
- B. Divisions
  1. Central (CNS)
    - a. Brain
    - b. Spinal Cord
  2. Peripheral (PNS)
    - a. Cranial Nerves, Spinal Nerves
    - b. Somatic, Autonomic N.S.
- C. Nervous Tissue
  1. Histology
    - a. Neuroglia: CNS-Astrocytes, Microglia, Oligodendrocytes, Ependymal Cells, PNS-Schwann Cells, Satellite Cells
    - b. Neuron
      - (1) Structure and Function
      - (2) Classification
        - i. by number of cytoplasmic extensions: uni, bi, multi, pseudouni-polar
        - ii. by function: sensory, motor, interneuron
  2. Physiology
    - a. Nerve Impulse
      - (1) Membrane Potential
      - (2) Sodium – Potassium Exchange Pump
      - (3) Stimulus, Depolarization, Repolarization
      - (4) Propagation of Action Potential
        - i. saltatory (discontinuous)
        - ii. continuous
      - (5) Threshold (minimal) Level vs. Subthreshold (subliminal) Level Stimulus

- (6) All-Or-None Theory
  - i. synaptic transmission
  - ii. chemical neurotransmitters and their functions
  - iii. excitatory vs. inhibitory neurotransmitters
  - iv. factors affecting rate of impulse transmission and propagation: axon diameter, amount of myelination
- D. Spinal Cord and Spinal Nerves
  - 1. Gross Structure, Functions, Location
  - 2. Protective Coverings
    - a. Vertebral Canal
    - b. Meninges: Dura, Arachnoid, Pia Mater
    - c. Denticulate Ligaments
    - d. Adipose
  - 3. Cross Sectional Structure
    - a. Gray Matter (Horns): Location, Contents
    - b. White Matter (Tracts): Location, Contents
  - 4. Functions of Spinal cord
    - a. Pathways (Tracts): Ascending and Descending
    - b. Reflex Integration Center
  - 5. Reflex Arc: Definition and Function
    - a. Parts of a Reflex Arc and Function of Each
    - b. Types of Reflexes
      - (1) Monosynaptic, Polysynaptic
      - (2) Contralateral, Ipsilateral
    - c. Examples of Reflexes: Somatic, Autonomic
  - 6. Spinal Nerves
    - a. Definition, Location, Number
    - b. Spinal Meninges
    - c. Spinal Nerve Plexuses: Cervical, Brachial, Lumbar, Sacral
- E. Brain
  - 1. Protective Coverings: Skull, Cranial Meninges
  - 2. Medulla Oblongata
    - a. Structure, Location
    - b. Functions
      - (1) Vital Reflex Center
      - (2) Non-Vital Reflex Center
      - (3) Origin of Cranial Nerves IX-XII
      - (4) Tracts: Ascending and Descending: Decussation of Pyramids
  - 3. Pons Varolii
    - a. Structure, Location
    - b. Functions
      - (1) Tracts
      - (2) Origin of Cranial Nerves V-VIII
      - (3) Respiratory Centers
  - 4. Midbrain
    - a. Location, Structure

- b. Functions
    - (1) Corpora Quadrigemina (Tegmentum)
    - (2) Red Nucleus
    - (3) Origin of Cranial Nerves III-IV
    - (4) Substantia Nigra
- 5. Thalamus
  - a. Location, Structure
  - b. Functions
    - (1) Sensory Relay Center
    - (2) Sensory Information Interpretation
- 6. Hypothalamus
  - a. Location, Structure, Connection to Hypophysis
  - b. Functions
    - (1) Endocrine Secretion: Control of Pituitary
    - (2) Thermoregulation
    - (3) Hunger, Thirst, Sex Drive
    - (4) Limbic System: Emotions
    - (5) Autonomic N.S. Control
    - (6) Homeostasis
- 7. Cerebrum
  - a. Location, Structural Features
    - (1) Gyri
    - (2) Sulci
    - (3) Fissures
    - (4) Lobes - 5
    - (5) Hemispheres, R and L
    - (6) White Matter
      - i. projection fibers
      - ii. association fibers
      - iii. commissural fibers
    - (7) Gray Matter
      - i. cerebral cortex
      - ii. basal (cerebral) nuclei (basal ganglia)
      - iii. function of lobes: frontal, parietal, temporal, occipital, insula
- 8. Cerebellum
  - a. Location, Structure
  - b. Functions
- 9. Limbic System
  - a. Location, Structure
  - b. Functions
- 10. Reticular Formation
  - a. Location, Structure
  - b. Functions
- 11. Cranial Nerves
  - a. Location, Structure, Number of Pairs, Names and Numbers
  - b. Functions of Each: Sensory, Motor, Both

12. Cerebrospinal Fluid
  - a. Site of Formation: Choroid Plexus
  - b. Circulation and Return to Blood Circulation: Arachnoid Villi
  - c. Functions
  - d. Contents
13. Vascular Supply of the Brain
  - a. Circle of Willis
  - b. Blood-Brain Barrier
  - c. Veins, Venous Sinuses
- G. Autonomic Nervous System
  1. Divisions: Sympathetic, Parasympathetic
  2. Comparison of Sympathetic and Parasympathetic Divisions
    - a. Locations
    - b. Neurotransmitters
    - c. Functions

## VIII. Muscular System (3 hours)

- A. Characteristics of Muscular Tissue
  1. Irritability
  2. Contractility
  3. Elasticity
  4. Extensibility
- B. Function of Muscles
  1. Movements: Locomotion, Constriction – Dilation, Movement of Hair and Skin
  2. Maintenance of Posture and Equilibrium
  3. Heat Production
- C. Types of Muscle: Histology, Anatomy, Physiology
  1. Skeletal (Striated)
  2. Visceral (Smooth or Non-Striated)
  3. Cardiac (Striated)
  4. Voluntary or Involuntary
- D. Skeletal Muscle Structure
  1. Parts of a Muscle Cell
    - a. Sarcolemma
    - b. Sarcoplasm
    - c. Sarcoplasmic Reticulum
    - d. Transverse Tubules (T-Tubules)
    - e. Triads
    - f. Myofibrils
    - g. Myofilaments: Actin, Myosin, Troponin, Tropomyosin
  2. Skeletal Muscle Function
    - a. Sarcomere and Function, A, I, H, Z bands
    - b. Sliding Filament Theory
  3. Connective Tissue Coverings
    - a. Endomysium
    - b. Perimysium
    - c. Epimysium

4. Connective Tissue Organs Associated with Muscles
    - a. Fasciae
    - b. Aponeuroses
    - c. Tendons
  - E. Skeletal Muscle Physiology
    1. Elements of Contraction
      - a. T-Tubules
      - b. Sarcoplasmic Reticulum
      - c. Calcium
      - d. Protein Myofilaments
    2. All-Or-None Theory
      - a. Threshold (Liminal) Stimulus
      - b. Subthreshold (Subliminal) Stimulus
    3. Muscle Twitch: Definition and Phases
      - a. Latent Period
      - b. Contracton Phase
      - c. Relaxation Phase
      - d. Refractory Period: Absolute, Relative
    4. Cellular Respiration: Definition, Location, Function
    5. Tetanus: Complete, Incomplete
    6. Treppe
    7. Contraction Types
      - a. Isotonic
      - b. Isometric
    8. Energy for Contraction: Aerobic and Anerobic Pathways
      - a. ATP
      - b. Creatine
      - c. Glycogen
      - d. Oxygen Debt
      - e. Fatigue
      - f. Lactic Acid
  - F. Cardiac Muscle Physiology (General)
  - G. Visceral (Smooth) Muscle Physiology (General)
  - H. Survey of Muscles (Covered in Detail in Laboratory)
    1. Methods Used to Name
    2. Origins, Insertions, Actions, Locations
    3. Agonists, Antagonists, Synergists
- IX. Special Senses (in laboratory)
- A. Eye (1 hour)
    1. Structure, Location, Protective Coverings
    2. Accessory Structures: Glands, Fluids, Hairs, Ducts
    3. Physiology of Vision: Visual Pathway
      - a. Image Formation, Retina, Macula Lutea, Fovea Centralis
      - b. Refraction and Accommodation
      - c. Pupillary Reflex
      - d. Convergence
      - e. Photoreceptors: Rods, Cones, Chemical Reactions

B. Ear (1 hour)

1. Structure of the Ear
  - a. External: External Auditory (Acoustic) Meatus, Ceruminous Glands, Vibrissae
  - b. Middle: Ossicles, Eustachian (Tympanopharyngeal) Tube
  - c. Inner: Cochlea, Oval and Round Windows, Scala Tympani, Vestibule, Fluids
2. Transmission of Sound Waves: Tympanic Membrane, Ossicles, Cochlear Fluid
3. Neural Mechanism of Hearing: Auditory Pathway
4. Equilibrium: Semicircular Canals, Bony and Membraneous Labyrinths, Otoliths and Hair Cells