

MONTGOMERY COUNTY COMMUNITY COLLEGE

BIO 131

Human Anatomy and Physiology

(4-3-3)

Course Curriculum

CATALOG DESCRIPTION

The first of a two-semester course employing a systems approach to the normal structure and functioning of the human body, with pathological applications, where relevant. Emphasis will be placed on biological chemistry, cell biology, histology, and the integumentary, skeletal, muscular, and nervous systems. Appropriate, relevant laboratory experiences will be employed to supplement and/or reinforce the lecture material. Dissection of preserved animal material is required.

PREREQUISITES

Successful completion of High School Chemistry and High School Biology taken within the last five years or the College equivalents (BIO 121, CHE 121). (Instructor should attempt to verify that student has proper prerequisites.) The student should also be fluent in English.

LEARNING GOALS

Overall: To provide a foundation in anatomy and physiology for courses in Nursing and other Allied Health subjects through mastery of fact and the development of application and critical thinking skills.

Specifically:

1. To interrelate basic atomic structure of atoms to inorganic/organic molecular structure.
2. To understand the relationship of inorganic and organic molecules to cells of the human body.
3. To identify how cells form tissues, how tissue structure relates to function, and to identify tissue locations within the body.
4. To identify major tissue types, major muscles, and bones of the human body.
5. To integrate the above basic principles at the organ and organ system level, specifically for the integumentary, muscular, skeletal, and nervous, systems.

LEARNING ACTIVITIES

The course meets for six (6) hours each week. The majority of the time will be spent in lecture, the remainder in the laboratory.

Please feel free to contact any full-time A & P faculty member with concerns or questions.

SEQUENCE OF TOPICS

These outlines are intended to serve as guidelines for the minimum course content to be covered in BIO 131. Please feel free to expand upon any topics as you wish. The sequence in which systems are covered is entirely at your discretion. Along with straightforward memorization of material, understanding of physiological processes and concepts, application of knowledge and critical thinking are to be stressed.

This list of topics may be used to design your specific objectives for students in BIO 131.

I. INTRODUCTION TO ANATOMY & PHYSIOLOGY

- A. Structural/Hierarchical Levels of Body Organization
- B. Definition of Metabolism; Include Catabolism and Anabolism
- C. Definition and Examples of "Homeostasis"; Negative and Positive Feedback
- D. General Anatomic Orientation Terminology
 - 1. Anatomical position
 - 2. Portions of the body and principle body cavities, including subdivisions; with arrangement of the membranes
 - 3. Terminology to indicate the body regions and terms of orientation
 - 4. Major planes of the body
 - 5. Regions and quadrants of the abdominopelvic cavity
- E. General Overview Of The Structure, Composition, And Function Of All Body Systems
- F. Suffixes, Prefixes and Roots Used In A&P Terminology

II. REVIEW OF GENERAL CHEMISTRY; BIOCHEMISTRY

- A. Atomic Number, Atomic Mass and Isotope
- B. Symbols of the Common Atoms and Ions Used By the Human Body
- C. Atomic Structure (Bohr): Protons, Neutrons and Electrons
- D. Definitions of Molecule and Compound
- E. Ionic Bonds, Oxidation, Reduction, Ions, Cation, Anion, Ionization
- F. Non-Polar Covalent, Polar Covalent Bonds and Hydrogen Bonds

- G. Chemical Reactions: Synthesis, Decomposition, Exchange, and Reversible Chemical Reactions; Definitions of Activation Energy and Catalyst
- H. Differences between Organic and Inorganic Compounds
- I. Biological Importance and Characteristics of Water
- J. Dissociation, Acids and Bases (Include Weak and Strong), Buffers, pH Scale, Salts and Electrolytes. Include the Physiological Importance of each
- K. Definition of Molarity, Milliequivalents, and Percent Solutions (e.g., 0.9% NaCl).
- L. Structure and Function Of Carbohydrates; Include Mono-, Di-, and Polysaccharides
- M. Structure and Function Of Lipids; Include Saturated and Unsaturated Fats, Oils, Waxes, Phospholipids, Steroids, and Eicosanoids
- N. Structure and Function of: Nucleotide-based molecules: Include DNA, RNA, ATP, ADP, cAMP, NAD, FAD.
- O. Structure and Function Of Proteins; Include the Levels of Protein Structure; Definition and Importance of Denaturation
- P. Hydrolysis (Digestion) and Condensation (Dehydration Synthesis) Reactions in the Formation and Degradation of Macromolecules
- Q. Identification and Recognition (nomenclature) of all above macromolecules: polymers and monomers
- R. Enzyme Structure and Function; General Equation for an Enzyme Reaction; Induced Fit Mechanism of Enzyme Action; Include Active Site, Substrate, Ligand, Allosteric Regulation
- S. Overview of Metabolic Pathways: Definition of Aerobic and Anaerobic Respiration

III. CELL ANATOMY & PHYSIOLOGY

- A. Microscopy
 - 1. Function of the principle parts of the microscope
 - 2. Definition of magnification and resolving power
 - 3. Competency using the microscope
- B. Main Cell Structures/Regions

- C. Plasma Membranes (PM)
1. Fluid mosaic model of membrane structure
 2. Functions of the PM
 3. Selective permeability of the PM
 4. Transport across cell membrane including:
 - a. Diffusion: simple and facilitated diffusion, dialysis.
 - b. Role of electrical, chemical, and pressure gradients
 - c. Osmosis; include hypertonic, hypotonic and isotonic
 - d. Filtration with its physiological importance
 - e. Active transport; include the sodium-potassium pump, primary and secondary pumps.
 - f. Cotransport: symport and antiport
 - g. Endocytosis; include pinocytosis, phagocytosis, and receptor-mediated endocytosis
 5. Describe the physiological importance and give examples of items 4a-4g
- D. Nature and Function of Cytoplasm
- E. Structure and Function of All Membranous Organelles
- F. Structure and Function of ribosome, cytoskeleton, centrioles, MTOC
- G. Structure and Function of membranous extensions including microvilli, cilia, and flagella.
- H. Review of Cell Cycle; Include Events of G1, S, G2, Mitosis, and Cytokinesis
- I. Review of Meiosis In Terms Of Ploidy and Cell Type; Definition of Fertilization
- J. Overview of DNA Structure, Genes and Chromosomes; Include review of Chromosome (DNA) Replication
- K. Overview of the General Steps of Gene Expression/Protein Synthesis. Include Transcription, Translation, Genetic Code, mRNA, tRNA, and rRNA
- L. Definition of Cell Differentiation
- M. Brief Overview of Cancer Using Concepts in F through L above
- N. Concept of Inherited Diseases; e.g., Cystic Fibrosis

IV. HISTOLOGY

- A. Epithelial Tissue
 - 1. Morphology, function and locations of simple, stratified, pseudostratified, squamous, cuboidal, columnar, and transitional epithelium
 - 2. Glandular epithelium; comparison endocrine and exocrine glands including structure and mode of secretion.
 - 3. Cell junctions: desmosomes, hemidesmosomes, tight junctions, gap junctions.
- B. Connective Tissue: Morphology, Function and Locations of Areolar, Adipose, Collagenous, Elastic and Reticular Connective Tissues; Hyaline, Fibrous and Elastic Cartilage; Bone, Blood, and Lymph.
- C. Membranes: Mucous, Serous, Synovial, Cutaneous
- D. Muscle: Morphology, Function and Locations of Skeletal, Cardiac, and Smooth Muscle
- D. Nerve Tissue: Overview of Neurons and Glia
- E. Identification of Tissue Types in A-D from a Microscopic Slide, Diagram Or Micrograph
- F. Physiology, Signs and Symptoms of Inflammation; Wound Healing

V. INTEGUMENTARY SYSTEM

- A. General Functions
- B. Structure and Function of the Epidermis (Include the 5 Layers, in Order), Dermis, and Subcutaneous Layer
- C. Origin, Structure and Function of Hair
- D. Skin Glands: Include Sebaceous, Sudoriferous
- E. Identification of Skin and Its Accessory Organs from a Microscopic Slide, Diagram or Micrograph
- F. Thermal Regulation via the Skin; Include the Homeostatic Mechanisms which respond to Heat Gain and Loss
- G. Origin and Function of Pigmentation; Include Melanocytes and Melanin

- H. Definition/Classification of Burns by Depth; Rule of Nines
- I. Brief Description of the 3 Types of Skin Cancer; Include Causes

VI. SKELETAL SYSTEM

- A. Basic Functions
- B. Bone Classification According To Shape
- C. Macroscopic Structure of A Typical Long Bone; Include Periosteum, Epiphysis, Diaphysis, Endosteum, and Medullary Cavity; Function and Locations of Red Bone Marrow and Yellow Bone Marrow
- D. Comparison of Compact and Spongy Bone; Include Location of Both
- E. Microscopic Structure of Bone; Include Osteon (Haversian System), Osteoblast, Osteocyte, Osteoclast, Lamellae, Osteonic Canal, Canaliculi, Volkmann's Canal; Include Function of Each Component and Identify Each From a Diagram or Slide
- F. Inorganic and Organic Composition and Functions of Osseous Tissue
- G. Mechanism of Intramembranous and Endochondral Ossification
- H. Structure, Ossification, and Function of Epiphyseal Plate
- I. Role of Growth Hormone, Parathyroid Hormone, Calcitonin and Sex Hormones in Bone Growth and Development
- J. Wolff's Law: Bone Growth in Response to Stress
- K. Bone Fractures and Repair; Include Simple, Compound, Traumatic (Include Types), and Pathological Fractures
- L. Definition of Rickets, Osteomalacia, Osteoporosis and Osteomyelitis
- M. Definition of Kyphosis, Lordosis, and Scoliosis
- N. Description of the 2 Main Subdivisions of the Skeleton; Include the Primary Subdivisions of Each

- O. Bone Anatomy: Identification of the Following on Articulated or Disarticulated Bones. Use the following as a General Guideline.

1. Axial skeleton

- a. frontal
- b. parietal
- c. temporal; include external auditory meatus, mastoid process, zygomatic process, styloid process, carotid foramen, jugular foramen
- d. occipital; include foramen magnum, occipital condyles
- e. sphenoid; include sella turcica, greater & lesser wings, pterygoid processes
- f. ethmoid; include cribriform plate, perpendicular plates, crista galli, conchae
- g. inferior nasal conchae
- h. sutures; include lambdoidal, squamosal, sagittal, coronal
- i. wormian/sutural bones
- j. fontanel; include frontal (anterior), occipital (posterior), mastoidal, sphenoidal
- k. maxilla; include infraorbital foramen, palatine process
- l. palatine
- m. zygomatic; include temporal process, zygomatic arch
- n. vomer
- o. lacrimal
- p. nasal
- q. mandible; include body, ramus, mandibular condyle, coronoid process, mental foramen, alveolar processes
- r. hyoid
- s. sternum; include manubrium, body, xiphoid process
- t. ribs; include true, false, and floating with head and tubercle
- u. vertebrae; distinguish atlas, axis, thoracic, cervical, and lumbar with the following bony markings: body, vertebral foramen, transverse process, spinous process, superior articulating process, inferior articulating process, pedicle, lamina, transverse foramen (C), facet for rib tubercle (T), facet for head of rib (T)
- v. sacrum; include sacral foramen, sacral canal, sacral promontory
- w. coccyx

2. Appendicular skeleton

- a. clavicle; include sternal end, scapular (acromial) end
- b. scapula; include spine, glenoid fossa, coracoid process, acromion process

- c. humerus; include head, anatomical neck, surgical neck, greater and lesser tubercles, intertubercular groove, deltoid tuberosity, coronoid fossa, olecranon fossa, trochlea, capitulum, lateral and medial epicondyles
- d. radius; include head, radial tuberosity, styloid process
- e. ulna, include coronoid process, olecranon process, styloid process, trochlear notch
- f. carpals
- g. metacarpals
- h. phalanges; include proximal, middle & distal with proper numbering/names
- i. os coxae; include ilium (with anterior superior iliac spine, iliac crest, sacroiliac joint), ischium (with ischial spine, ischial tuberosity), pubis (with pubic symphysis), acetabulum, obturator foramen; distinguish sexes
- j. femur; include head, neck, fovea capitus, greater and lesser trochanters, medial and lateral condyles, medial and lateral epicondyles, linea aspera
- k. patella
- l. tibia; include anterior crest, medial and lateral condyles, medial malleolus, tibial tuberosity
- m. fibula; include lateral malleolus
- n. tarsals; include talus, calcaneus
- o. metatarsals
- p. phalanges; include proximal, middle, distal with proper numbering/names

VII. JOINTS

- A. Distinguish the Three Main Types of Joints Based on Functional (Synarthrosis, Amphiarthrosis, Diarthrosis) and Structural (Fibrous, Cartilaginous and Synovial) Classification
- B. Synarthroses with examples
- C. Amphiarthroses with examples
- D. Structure Of A Synovial (Diarthrotic) Joint; Include Bursae, Menisci, Synovial fluid, Ligaments. Classify as Hinge, Ball and Socket, Saddle, Gliding, Pivot, Ellipsoid/Condylod.
- E. Description of Cartilage, Tendons and Ligaments
- F. Body/Joint Movements; Include Flexion, Extension, Hyperextension, Abduction, Adduction, Circumduction, Rotation, Pronation, Supination, Inversion, Eversion, Protraction, Retraction, Elevation, Depression, Dorsiflexion and Plantar Flexion

- G. Anatomy of The Knee Joint; Include Structures specified in D.
- H. Overview of Shoulder and Hip Joints as Time Permits.
- I. Brief Description of Bursitis, Sprain, Dislocation, Ankylosis, and the Various Types of Arthritis

VIII. MUSCULAR SYSTEM

- A. Types of Muscle Tissue - Distinguish Between Skeletal, Visceral, and Cardiac with respect to: Location, Structure, Arrangement, Innervation
- B. Skeletal Muscle
 - 1. Characteristics including: excitability, contractility, extensibility, elasticity
 - 2. Functions including: movement, maintenance of posture, heat generation
- C. Hierarchy of Skeletal Muscle Structure from Gross to Submicroscopic, including: Origin, Insertion, Fascia and Mysia, Fasciculi, Cells, Myofibrils, Sarcomeres with Markings, Filaments
- D. Microstructure of Muscle Cell (Fiber) Including Sarcolemma, T-Tubule, Sarcoplasmic Reticulum, Triad, Sarcoplasm, Mitochondria, Nuclei, Anatomy And Arrangement/Composition Of Thick And Thin Filaments (Actin, Myosin, Tropomyosin, Troponin And Thin Filament Activation by Ca^{++}). Use Models and Slides
- E. Motor Unit - Define and Describe Structure and Function
 - 1. All-or-none principle
 - 2. Graded strength and recruitment
- F. Myoneural Junction - Describe Anatomy and Physiology Including ACh, AChE, Synaptic Cleft, ACh Receptor, Motor End Plate
- G. Physiology of Contraction Beginning With Receipt of a Threshold Stimulus by Motor Neuron through Relaxation of Muscle. Include Role of Stimulus, Ca^{++} , Ach, AChE, Ion Gates (Chemical, Voltage Dependent and Independent) Depolarization, Reverse Polarization, Repolarization, Na/K Pumps, Sarcoplasmic Reticulum, Ca-ATP/Calsequestrin and Thick and Thin Filament Interactions, Refractory Period
- H. Define And Describe Simple Twitch (Latent, Contraction, Relaxation Phases), Incomplete Tetany, Wave Summation. Include Myograms of Each
- I. Describe Several Factors Controlling Strength and Duration of a Contraction

- J. Compare Red, White, Pink Fibers With Regard To: Myoglobin Content, Glycogen Storage, Speed, Endurance, Energy Source, Strength, Diameter, Mitochondria, Sarcoplasmic Reticulum, Number of Myofibrils
- K. Muscle Energetics
1. Role of glucose and fatty acids as fuels
 2. ATP as immediate source
 3. Glycogen - glucose - ATP system
 4. Phosphagen System - creatine phosphate's role
 5. Aerobic and anerobic glycolysis, lactic acid generation
- L. Muscle Fatigue: Definition and Causes of.
- M. Misc. Define and Describe: Origin, Insertion, Agonist (Prime Mover), Synergist, Antagonist, Tonus (Posture), Flaccidity, Atrophy, Hypertrophy, Isotonic and Isometric Contractions
- N. Identify Locations On Models And Functions Of Human Muscles. Mink Muscle Dissection
1. Muscles of facial expression including Epicranius, Orbicularis oculi, Buccinator, Orbicularis oris, Zygomaticus, Platysma
 2. Muscles of mastication including Masseter, Temporalis, medial pterygoid, lateral pterygoid
 3. Muscles moving head including Sternocleidomastoid, Capitis group (splenius, semispinalis, longissimus)
 4. Muscles that move the pectoral girdle including Trapezius, Serratus anterior, Rhomboideus major, Pectoralis minor, Levator scapulae
 5. Muscles that move the upper arm including Coracobrachialis, Teres major, Pectoralis major, Latissimus dorsi, Supraspinatus, Subscapularis, Deltoid, Infraspinatus, Teres minor
 6. Muscles that move the forearm including Biceps brachii, Triceps brachii, Brachialis, Brachioradialis, Supinator, Pronator teres, Pronator quadratus
 7. Muscles of the abdominal wall including External oblique, Internal oblique, Rectus abdominis, Transversus abdominus
 8. Muscles acting on thigh including Gluteus maximus, Gluteus medius and minimus, Tensor fasciae latae, iliopsoas (iliacus and psoas major), Gracilis, Adductor magnus and longus
 9. Muscles that move the lower leg including Hamstrings (semitendinosus, semimembranosus, and biceps femoris), Sartorius, Quadriceps femoris (Rectus femoris, Vastus lateralis, Vastus intermedius, Vastus medialis)
 10. Muscles that move the ankle, foot and toes including Tibialis anterior, Fibularis (Peroneus) tertius, Gastrocnemius, Soleus, Tibialis posterior, Fibularis (Peroneus) longus

IX. NERVOUS TISSUE

- A. General Functions
- B. Divisions and Subdivisions of Nervous System
 - 1. CNS - brain and cord
 - 2. PNS - SNS, ANS, and ENS
- C. Nervous Histology
 - 1. Neuroglia - Describe structure and function of 4 CNS (astrocytes, ependyma, oligodendria, microglia and 1 PNS glia (Schwann cells)
 - 2. Neuronal classification by structure (number of processes), direction of impulse transmission, function, effect on effectors, using diagrams
- D. Anatomy of a Unipolar, Bipolar, Multipolar Neuron. Compare With Sensory and Motorneurons. (Include Structure and Function of: Dendrites, Receptors, Perikaryon, Nucleus, Nissl Substance, Axon Hillock, Axon, Collateral Axons, Neurilemma, Myelin Sheath, Telodendria, Synaptic Knobs And Vesicles). Distinguish Between Axonal And Axoplasmic Transport. (Use Models, See Histology Slides)
- E. Define: Ganglion, Nucleus, Tract and Nerve
- F. Ionic Basis For RMP Including: Role Of Na/K Pump, Na/K/Cation Permeabilities, Gated Channels Including Chemically/Ionically/ Voltage Regulated Types.
- G. Describe Graded Potentials, Including EPSP, IPSP, Temporal and Spatial Summation, Facilitation, Inhibition
- H. Action Potential Generation
 - 1. Multidirectional from point of stimulation
 - 2. Events occurring surrounding generation of an Action Potential including stimulus, threshold, depolarization, reverse polarization, absolute and relative refractory periods, repolarization, spatial and temporal summation, all-or-none
- I. Synaptic Transmission
 - 1. Unidirectional
 - 2. Reception
 - 3. Transmission - generation of an action potential
 - 4. Integration as a function of the postsynaptic membrane
 - 5. Effection - examples of effectors and responses; include factors influencing intensity and duration of response

- J. Compare Continuous and Saltatory Conduction With Regard To Presence or Absence of Myelin, Extent of Myelinization
- K. Comparisons of types A, B, C neurons by axon diameter, speed, structure, myelination, and by location
- L. Circuit Patterns Including, Convergence, Divergence, Reverberating, Parallel-After-Discharge.
- M. Reflexes
 - 1. Distinguish between autonomic and somatic, monosynaptic, polysynaptic, ipsilateral, contralateral. Comment on diagnostic importance
 - 2. Diagram/explain role of cord, receptors and neurons in Knee Jerk reflex and crossed extensor reflex

X. CENTRAL NERVOUS SYSTEM - BRAIN AND SPINAL CORD

- A. Major Subdivisions and Development of Forebrain (Cerebrum and Diencephalon), Midbrain, Hindbrain (Pons, Medulla and Cerebellum). Identify/Define "Brainstem" (Use Models and Sheep Brain Dissection)
- B. Structures Protecting Brain and Cord with Locations Including Muscle, Bone, Meninges (Dura, Arachnoid, Pia and Appropriate Spaces), CSF
- C. Functions, Formation, Flow, Locations, Reabsorption of CSF, Including Ventricular System, Role of Choroid Plexuses and Arachnoid Villi. Define Hydrocephalus
- D. Anatomy of Spinal Cord in C.S. And L.S. (Models)
 - 1. Cross sectional anatomy including gray matter, horns, white matter, median sulcus/fissure, central canal, gray commissure, columns, tracts (fasciculi), meninges
 - 2. Longitudinal sectional anatomy including origination and ending at L-2, conus medullaris, cervical and lumbar enlargements, meninges (filum terminale, epidural, and subarachnoid spaces), cauda equina, ascending and descending tracts
 - 3. Clinical significance and safety of using L-3, L-4 as site for lumbar puncture, spinal anesthesia, vs. spinal analgesia (location of agent infiltration)
- E. Functions of Spinal Cord - Control Of Reflex Activity and Communication To/From Brain and From/To Body. Include Major Motor (Pyramidal and ExtraPyramidal) and Major Sensory Tracts.

- F. Locate On Model and Diagram and Provide Major Structure and Functions Of: Medulla, Pons, Cerebellum, Midbrain, Thalamus, Epithalamus, Hypothalamus, Posterior Pituitary, and Cerebrum Including Hemispheres, Lobes. Comment on Right vs. Left Hemisphere Specialization.
- G. Miscellaneous Brain Structures and Their Functions Including Basal Nuclei (Role of Dopamine, Parkinsonism and H. Chorea), RAS, Limbic System
- H. Control of Voluntary and Involuntary Movement and Posture Including Roles of Pyramidal And Extrapyramidal Centers; Sig. Of Precentral Gyrus of Cerebrum, Medullary Decussation, Cerebellum and Basal Nuclei. Identify Major Pyramidal and Extrapyramidal Tracts
- I. Sensory Areas in Parietal, Occipital, and Temporal lobes including Primary Sensory Cortex and Association Areas in various regions of the cortex
- J. Define Neural Tube Defects, Spina Bifida, Anencephaly, (link to folic deficiency in first trimester)

XI. PERIPHERAL NERVOUS SYSTEM

- A. Cranial Nerves Including Origin, Order, Names, Functions and Identify Which Are Sensory, Motor, Mixed
- B. Spinal Nerves
 - 1. 31 pairs (8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal pair)
 - 2. Anatomy from model/diagram including formation and origination from fusion of dorsal and ventral roots, major rami (dorsal, ventral and rami communicantes) and functions
 - 3. Define plexus; identify 5 major plexuses (Cervical, Brachial, Lumbar, Sacral and Coccygeal) and major nerves (Phrenics, radial, median and ulnar nerves, femoral, sciatic) originating from each; identify which spinal nerves do not form plexuses
 - 4. Dermatomes and their significance (excl. C-1)
- C. Distinguish Between Somatic and Autonomic Effectors
- D. Distinguish Between Cholinergic and Adrenergic Neurons As To Transmitter, Types Of Neurons Employing Each, Examples Of Major Effectors Responding To Each, And Receptor Types (Muscarinic And Nicotinic Cholinergic Receptors And Alpha And Beta Adrenergic Receptors, Subtypes And Their Responses)

- E. Comparisons between Somatic and Autonomic (Parasympathetic And Sympathetic Branches) With Regard To:
1. Functions - voluntary movement vs. "rest and digest" vs. "fight-or-flight"
 2. Origination - outflow from CNS by location; include thoraco-lumbar in sympathetic vs. cranio-sacral for parasympathetic
 3. Number of neurons to effectors - type, structure and size of pre and postganglionic motor neuron(s) in SNS and ANS; include chain ganglia, terminal ganglia
 4. Transmitters used, receptors stimulated, extent of divergence, duration of effects
 5. Compare and contrast the effects of sympathetic and parasympathetic stimuli on pupil of eye, salivary glands, airway, heart, GI tract, blood vessel diameter, sweat glands, genitalia.
 6. Comment on the role of dual innervation, commenting on exceptions

XII. GENERAL AND SPECIAL SENSES (as time permits)

- A. Sensation
1. Sensory receptors; include classification based on location and mechanism of stimulation
 2. Sensory adaptation
- B. Overview of General/Somatic Senses; Include Tactile, Thermoreceptive, Pain, And Proprioceptive Sensations
- C. Special Senses
1. Eye
 - a. anatomy; include the palpebra, conjunctiva, lacrimal glands, extrinsic muscles, fibrous tunic (include cornea, sclera), uvea (include choroid coat, ciliary body, iris, pupil) and retina (include rods, cones, etc., macula lutea, fovea centralis, optic disk), lens, eye cavities and humors, etc.
 - b. physiology; include processes and structures involved, accommodation, photoreception, nerve pathway to brain, stereoscopic vision, etc.
 2. Ear
 - a. anatomy; include the external (include pinna and external auditory meatus, etc.), middle (include auditory ossicles, Eustachian tube, etc.) and inner (include cochlea, organ of Corti, semicircular canals, cranial nerve VII, etc.) ear, tympanic membrane, oval window, round window, etc.
 - b. physiology of hearing; include processes and structures involved, pathway of nerve impulse to the brain, etc.
 3. Overview of olfaction and gustation; include structures, physiology, cranial nerves, etc.

LEARNING MATERIALS

Required Textbooks – *Principles of Human Anatomy & Physiology* – Tortora & Grabowski, Wiley Publishers.

LABORATORY:

Required Laboratory Manual – *Human A&P Lab Manual* – Elaine Marieb, Pearson Custom Publishing.

Laboratory Topics – Microscopy, histology and the skeletal, muscular and nervous systems

This course is consistent with Montgomery County Community College's mission on educational goals.

COURSE APPROVAL DATE: Unknown

PREPARED BY: Albert A. Baccari, Associate Professor of Biological Sciences

DATE: March 26, 1998

REVISED BY: Christopher Harendza, Associate Professor and Coordinator of Biology

DATE: March 23, 2004

Marie Richard-Yates, Instructor of Biological Sciences and Maire McShane, Assistant Professor of Biological Sciences

DATE: October, 2004