



Degree Applicable  
Effective Quarter: Fall 2008

## I. Catalog Information

**BIOL 40B**

**Human Anatomy and Physiology**

**5 Unit(s)**

Prerequisite: Biology 40A with a grade of C or better.

(Formerly Biology 47B.)

Four hours lecture, three hours laboratory, one additional hour to be arranged in the Science Center Resource Center.

Study of the nervous, circulatory, and respiratory systems.

## II. Course Objectives

- A. Compare and contrast the regulatory mechanisms of nervous and endocrine systems.
- B. Examine the microscopic anatomy of nervous tissue and investigate the function of neurons and neuroglia.
- C. Categorize the structures of the nervous system into central or peripheral divisions and summarize the characteristics of each division.
- D. Describe, compare, and contrast selected aspects of neurophysiology.
- E. Examine and describe the gross and microscopic anatomy of the spinal cord, spinal ganglia, spinal nerves, and spinal meninges.
- F. Analyze the role of the spinal cord and spinal nerves in information transfer.
- G. Identify and compare the structure and functions of the major brain regions and cranial nerves.
- H. Investigate the following with regards to brain anatomy and function: formation and circulation of CSF, blood-brain barrier, cerebral circulation and metabolism.
- I. Map the functional areas of the cerebral cortex and describe their functions.
- J. Examine and contrast the actions of representative neurotransmitters.
- K. Describe anatomical and physiological aspects of several of the special senses.
- L. Compare and contrast the somatic and autonomic nervous systems and investigate the control of visceral function by the sympathetic and parasympathetic branches of the ANS (autonomic nervous system).
- M. Examine and describe the organization of the cardiovascular system and its contributions to homeostasis.
- N. Examine and recognize the components and characteristics of blood and describe the homeostatic functions of blood components.
- O. Examine and describe the gross and microscopic anatomy of the heart.
- P. Investigate cardiac physiology; define and discuss cardiac output and the factors affecting cardiac output.
- Q. Examine the morphology of the blood vessels and relate morphology to function; investigate the physics of circulation and the control of blood pressure and blood flow.
- R. Identify and name the principal arteries, veins, and circulatory routes.
- S. Identify, examine and describe the gross and microscopic anatomy of the respiratory tract.
- T. Analyze the physiology and regulation of ventilation and gas exchange.

## III. Essential Student Materials

None

## IV. Essential College Facilities

Lecture - Audiovisual equipment (including: computer, slide, overhead, and videotape projectors)

Laboratory - Models, microscopes, prepared slides, preserved specimens, assorted laboratory instruments, glassware, and equipment

Adjunct - Computers and software, meeting space for tutorial and study groups

## V. Expanded Description: Content and Form

- A. Compare and contrast the regulatory mechanisms of nervous and endocrine systems.
  1. Define homeostasis and illustrate the principles involved by giving examples of homeostasis in action.
  2. Describe and contrast the components and effects of negative and positive feedback systems, using examples to clarify understanding.
  3. Compare and contrast neural and endocrine control of homeostasis with emphasis on mechanisms of action, target tissues and processes controlled.
- B. Examine the microscopic anatomy of nervous tissue and investigate the function of neurons and neuroglia.
  1. View and distinguish the histological aspects of neurons, neuroglia, nerves, ganglia, and synapses
  2. Identify and compare the structure, function, and location of unipolar, bipolar, and multipolar neurons.
  3. List and compare the structural and functional aspects of varied neuroglial cells.
  4. Describe the process and effects of myelination.
  5. Relate nervous tissue pathology to selected neurological diseases.
  6. Describe the regenerative capabilities of nervous tissues.
- C. Categorize the structures of the nervous system into central or peripheral divisions and summarize the characteristics of each division.
  1. Identify and contrast the structures included within and the functions of the central nervous system vs the peripheral nervous system.
  2. Identify and contrast the structures included in and the functions of the somatic nervous system vs the autonomic nervous system.
  3. Identify and contrast the structural components and functions of the sensory vs the motor nervous systems.
  4. Identify and contrast the structural components and functions of the sympathetic vs the parasympathetic nervous systems.
- D. Describe, compare, and contrast selected aspects of neurophysiology.
  1. Describe the generation and maintenance of resting membrane potentials in nervous tissue and identify the role of the Na-K pump in this process.
  2. Describe the generation, characteristics, and names of graded potentials affecting nervous tissues.
  3. Describe the steps involved in generation and propagation of action potentials.
  4. Describe the electrical and biochemical events involved in synaptic transmission and the influence of selected diseases in interrupting or propagating these processes.
- E. Examine and describe the gross and microscopic anatomy of the spinal cord, spinal ganglia, spinal nerves, and spinal meninges.
  1. Identify and examine the gross structures associated with the spinal cord and nerves including but not limited to regions of the spinal cord, coverings of the spinal cord and nerves, spinal nerve roots and divisions, dorsal root ganglia, cauda equina, and other selected structures.
  2. Identify structures described in #1 above in cross-sectional views.
  3. Distinguish between gray and white matter in the spinal cord with regards to content and function.
- F. Analyze the role of the spinal cord and spinal nerves in information transfer.
  1. Name and locate major spinal somato-sensory and motor tracts; describe the information carried by each tract.
  2. List the components and purposes of spinal reflexes.
  3. Describe the histological and clinical features of selected spinal cord and/or spinal nerve pathologies.
- G. Identify and compare the structure and functions of the major brain regions and cranial nerves.
  1. Locate and identify from pictures and anatomical models, the four major lobes of the cerebral cortex and describe the major function(s) of each lobe; identify major tracts originating or ending in the cerebral cortex.
  2. Identify the location and overall function of the following brainstem regions: medulla, pons, midbrain; identify the location and function of selected nuclei and tracts within these structures.
  3. Identify the location of the thalamus, hypothalamus, and epithalamus within the diencephalon; discuss the functions of the above brain regions and identify and discuss the functions of selected contained nuclei and tracts lying within these structures.

4. Describe the unique anatomical features and location of the cerebellum; identify lobes, nuclei and tracts within the cerebellum.
  5. Identify the location and function of the limbic system, the reticular activating system, and the basal nuclei.
  6. Name and describe the function of the cranial nerves.
  7. Identify and name the major gyri and sulci of the cerebral cortex.
  8. Describe and identify the 3 meningeal coverings of the brain.
- H.** Investigate the following with regards to brain anatomy and function: formation and circulation of CSF, blood-brain barrier, cerebral circulation and metabolism.
1. Describe the formation, function, and circulation pattern of cerebrospinal fluid. Relate abnormalities of cerebrospinal fluid to selected pathologies.
  2. Discuss arterial supply to the brain, including significant arteries, their locations and junctions; identify deficits involved in interruption of these arteries via cerebral vascular accidents. Discuss venous and sinus drainage of the brain.
  3. Define the role of neuroglia in forming the blood brain barrier and describe how the blood brain barrier protects the brain.
- I.** Map the functional areas of the cerebral cortex and describe their functions.
1. Discuss sensori-motor functions that are influenced by brain lateralization.
  2. Identify and locate primary motor, sensory, and integrative areas of the cerebral cortex, and their roles in movement, sensation, integration, and behavior.
- J.** Examine and contrast the actions of representative neurotransmitters.
1. Categorize major neurotransmitters as being inhibitory or excitatory.
  2. Describe the role of neurotransmitters in synaptic relay of neural information.
  3. Relate neurotransmitter deficits/alterations to selected sensory, motor, and/or behavioral pathologies.
- K.** Describe anatomical and physiological aspects of several of the special senses.
1. Distinguish the various types of sensory receptors and their functions.
  2. Evaluate the general senses with a review of their somatic sensory pathways.
  3. Study the special senses with a review of their sensory pathways.
- L.** Compare and contrast the somatic and autonomic nervous systems and investigate the control of visceral function by the sympathetic and parasympathetic branches of the ANS (autonomic nervous system).
1. Compare and contrast the somatic and autonomic nervous systems
  2. Examine the anatomy of the autonomic and somatic pathways.
  3. Recognize the different target organs and various neurotransmitters.
  4. Study the phenomenon of dual innervation and responses of target organs.
  5. Evaluate the effects of various drugs on the ANS.
- M.** Examine and describe the organization of the cardiovascular system and its contributions to homeostasis.
1. Evaluate the general schematic of the cardiovascular system (CVS).
  2. Study the hydraulics of the CVS.
- N.** Examine and recognize the components and characteristics of blood and describe the homeostatic functions of blood components.
1. Review the components and physical characteristics of blood.
  2. Recognize the different blood cells - their histology, functions, and hematopoiesis.
  3. Describe vascular spasm and formation of platelet plugs.
  4. Define coagulation and map the events of the clotting cascade.
  5. Discuss hematological testing and its applications.
  6. Study selected hematological disorders - inherited, nutritional, racial, and gender based occurrences.
- O.** Examine and describe the gross and microscopic anatomy of the heart.
1. Study the gross anatomy of the heart.
  2. Examine blood flow through the heart.

3. Evaluate coronary circulation.
  4. Examine coronary artery disease - prevalence and risk factors associated with nutritional status, age, gender, and race.
- P.** Investigate cardiac physiology; define and discuss cardiac output and the factors affecting cardiac output.
1. Examine the conduction system of the heart and its various components.
  2. Study the physiology of cardiac muscle contraction.
  3. Examine electrocardiograms and study their relevance.
  4. Examine the cardiac cycle and its events.
  5. Evaluate factors affecting cardiac output.
  6. Examine the regulation of stroke volume and heart rate.
  7. Examine cardiovascular health and pathology: with descriptions and risk factors associated with nutritional status, age, gender, socioeconomic status and race.
- Q.** Examine the morphology of the blood vessels and relate morphology to function; investigate the physics of circulation and the control of blood pressure and blood flow.
1. Study the histological and gross anatomy of blood vessels.
  2. Evaluate the role of the various vessels in the vascular tree.
  3. Investigate vascular pathology.
  4. Analyze the distribution and velocity of blood flow.
  5. Categorize factors determining blood pressure.
  6. Investigate the regulation of blood pressure.
  7. Study blood pressure and the risk and pathology of hypertension - prevalence and risk factors.
- R.** Identify and name the principal arteries, veins, and circulatory routes.
1. Recognize the major vessels of the systemic circuit.
  2. Recognize the major vessels of the pulmonary circuit.
  3. Map the portal systems and study their significance.
- S.** Identify, examine and describe the gross and microscopic anatomy of the respiratory tract.
1. Examine an overview of the organization and functions of the respiratory system.
  2. Examine the histological and gross anatomy of the organs of the respiratory tree.
- T.** Analyze the physiology and regulation of ventilation and gas exchange.
1. Describe the physiology and mechanics of ventilation.
  2. Recognize the physics and chemistry of gas transport and exchange; oxygen dissociation curves.
  3. Analyze neural and local control of respiration.
  4. Evaluate respiratory volumes and capacities and their clinical significances.
  5. Discuss selected pulmonary diseases - cigarettes and other risk factors.

## **VI. Assignments**

- A.** Reading assignments from text, lab manual, and other pertinent material
- B.** Writing assignments: Laboratory reports and summaries, scientific journal article summaries, critical thinking assignments
- C.** Collaborative learning exercises such as analysis of case studies, completion of investigative activities, and games designed to reinforce course content and allow for the application of subject matter

## **VII. Methods of Instruction**

Lecture and visual aids  
 Discussion of assigned reading  
 Problem solving  
 In-class exploration of Internet sites  
 In-class quiz and examination review  
 Homework  
 Collaborative learning and small group exercises

Laboratory data collection, analysis, and write-up  
Other: Quizzes, tests, written assignments in lecture and/or lab

### VIII. Methods of Evaluating Objectives

- A. Objective tests with written components
- B. Laboratory quizzes
- C. Practical exams
- D. Critical thinking assignments such as analysis of case studies and completion of investigative questions designed to reinforce course content and allow for the application of subject matter

### IX. Texts and Supporting References

#### A. Examples of Primary Texts and References

1. Tortora, Gerard and Derrickson, Bryan. "Principles of Anatomy and Physiology" (11th Edition). Hoboken, New Jersey: John Wiley & Sons, Inc., 2006.
2. Instructor Selected/Designed Laboratory Manual (see supporting references).

#### B. Examples of Supporting Texts and References

1. Alberts, Bruce, et al., "Molecular Biology of the Cell", (4th Ed.). New York, NY: Garland Publishing, Inc., 2002.
2. Allen, Connie and Harper, Valerie. "Laboratory Manual for Anatomy and Physiology" (2nd Edition). Hoboken, New Jersey: John Wiley & Sons, Inc. 2005
3. Brunton, Laurence et. al "The Pharmacological Basis of Therapeutics", (11th Ed) Columbus, Ohio: McGraw-Hill Professional 2006.
4. Goldsby, Richard A., et al. "Kuby Immunology", (6th Ed.). New York: W.H. Freeman and Co., 2006.
5. Gray, Henry, (ed). "Gray's Anatomy of the Human Body", (30th Ed.).
6. Guyton, Arthur C. M.D. and Hall, J "Textbook of Medical Physiology", (11th Ed.) Philadelphia: W.B. Saunders Co., 2005.
7. Kumar M.D., Vinay et. al. " Pathologic Basis Of Disease" (7th Ed). Philadelphia: W.B. Saunders Co. 2004
8. Marieb, Elaine. "Anatomy and Physiology Coloring Workbook" (8th Edition). San Francisco: Pearson/Benjamin Cummings, 2006.
9. Marieb, Elaine. "Human Anatomy and Physiology Laboratory Manual" (7th Edition). San Francisco: Pearson/Benjamin Cummings, 2005.
10. Marieb, Elaine and Hoehn, K. "Human Anatomy and Physiology" (7th Ed.). San Francisco: Pearson/Benjamin Cummings, 2007.
11. Nelson, David and Cox, Michael. " Principles of Biochemistry", (4th Ed.). New York: W.H. Freeman, 2004.
12. Sackheim, George R., Denise Lehman. "Chemistry for the Health Sciences", 7th Ed., McMillan, 1994.
13. Schneider, Roy, et. al. "Anatomy & Physiology Revealed, Version 2.0 CD-ROM". Toledo, Ohio: McGraw-Hill, 2007.
14. Sherwood, Lauralee. "Human Physiology: From Cells to Systems", (4th Ed.). Australia: Brooks/Cole. 2001.
15. Tierney, Lawrence M.D., et al. "Current Medical Diagnosis and Treatment" (10th Edition). Connecticut: Appleton and Lange, 2002.

### X. Lab Topics

1. Histology and physiology of nervous tissue.
2. Gross anatomy and physiology of brain and cranial nerves
3. Gross anatomy and physiology of spinal cord, spinal nerves and autonomic nervous system
4. Anatomy and physiology of special senses
5. Composition of blood and selected hematologic tests
6. Anatomy of the heart, auscultation and conduction systems
7. Anatomy of blood vessels, blood pressure and pulse determination
8. Anatomy and physiology of respiratory system; respiratory volumes and spirometry