I. Catalog Information

BIOL 40A  Human Anatomy and Physiology  5 Unit(s)

Prerequisite: Satisfactory score on the Biology 40A Placement Test or Chemistry 1A or Chemistry 50 or Chemistry 30A with a grade of C or better.
Advisory: English Writing 1A or English as a Second Language 5.

(Formerly Biology 47A.)

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

An introduction to the disciplines of anatomy and physiology. Basic principles of human anatomy and physiology as exemplified in the study of cell chemistry, cell biology, histology and the integumentary, skeletal, and muscular systems with emphasis on homeostatic mechanisms.

II. Course Objectives

A. Investigate and critique the major historical events that have influenced the definition and advancement of current anatomical and physiological specialties and principles.
B. Examine and critique the role of the scientific method in the study of anatomy and physiology as it relates to organizing information, evaluating evidence and drawing logical conclusions.
C. Examine fundamental anatomical and physiological principles, anatomical terminology, the progression of structural levels of organization, and describe the feedback mechanisms that produce homeostasis of varied human systems.
D. Investigate the chemical basis of life with an emphasis on the synthesis, structure, and function of organic molecules and evaluate their role in normal human physiological functions, nutrition, and biochemical bases of disease processes.
E. Investigate the cellular basis of life and relate cytology to clinical and scientific aspects of normal cell functioning, aging, and disease processes.
F. Examine the tissue level of organization of humans and interpret the role of tissues in human systems. Compare and contrast the location, organization, and function of human tissues.
G. Investigate the structure and function of the integumentary system and relate variations in this system's components to normal function, immunity, and maintenance of homeostasis.
H. Analyze the composition, structure and functions of bone, cartilage, tendons, and ligaments. Examine and name the major bones and articulations of the axial and appendicular skeleton. Correlate the structure and function of bone and joint articulations to issues of nutrition, disease, aging, stress, gender, and race.
I. Analyze the composition, structure and functions of various muscle tissues. Describe excitation-contraction coupling and contraction process. Describe selected disorders of the muscle system.

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. Investigate and critique the major historical events that have influenced the definition and advancement of current anatomical and physiological specialties and principles.
   1. Examine the contributions of select scientists from the Greek and Roman period.
   2. Explore the Arab influence on the development of anatomy and physiology.
   3. Investigate the contributions of scientist from the 15th through the 21st centuries, including women scientists and scientists of different racial and ethnic backgrounds.
B. Examine and critique the role of the scientific method in the study of anatomy and physiology as it relates to organizing information, evaluating evidence and drawing logical conclusions.

1. Identify steps involved in forming and testing a hypothesis.
2. Recognize the need for repeatability and avoiding bias in scientific studies.
3. Discuss differences between Western and Eastern Medicine as they relate to differing views of the organization/function of the human body.
4. Discuss the added use of holistic approaches and nontraditional health care practitioners in the late 20th and 21st century.
5. Employ the scientific method when performing lab experiments.

C. Examine fundamental anatomical and physiological principles, anatomical terminology, the progression of structural levels of organization, and describe the feedback mechanisms that produce homeostasis of varied human systems.

1. Define major terms related to the study of the anatomy and physiology and their sub-disciplines.
2. Examine levels of morphologic and functional organization and the concept of homeostasis and its role in maintaining physiological limits.
3. Identify and study relevant basic anatomical concepts, including "the anatomical position," regional and directional terms, planes and sections, body cavities, abdominopelvic quadrants and regions and the role of these in anatomical study.
4. Describe and contrast imaging techniques used to visualize normal and pathological tissues.

D. Investigate the chemical basis of life with an emphasis on the synthesis, structure, and function of organic molecules and evaluate their role in normal human physiological functions, nutrition, and biochemical bases of disease processes.

1. Identify the biochemical nature of organic compounds in life processes including carbohydrates, lipids, proteins, nucleic acids, adenosine and related phosphates.
2. Define, recognize, and apply different categories of chemical reactions such as synthesis, decomposition, anabolic, catabolic, dehydration synthesis, hydrolysis, and reversible reactions.
3. Understand the concepts of osmosis and tonicity and relate these concepts to fluid exchanges across body compartments.
4. Examine enzymatic structure and function and relate enzymatic abnormalities to dysfunction in human cells, tissues, organs, and/or body systems.

E. Investigate the cellular basis of life and relate cytology to clinical and scientific aspects of normal cell functioning, aging, and disease processes.

1. Describe and relate cell membrane structure to movement of materials across the membrane via such passive and active transport mechanisms as diffusion, osmosis, filtration, facilitated transport, endocytosis, and exocytosis.
2. Recognize and describe the role of selected cell organelles in performing specialized cell functions.
3. Summarize how genes code for proteins and consequent cell/tissue function via the processes of transcription and translation.
4. List and describe the ordered steps and purposes of mitosis.
5. Discuss normal genetic/chromosomal control mechanisms of cell replication.
6. Discuss how alterations of normal chromosomal controls on cellular replication can be related to cancer development; also determine how modification of these alterations is and potentially will be used to treat cancers and other disorders of aging.

F. Examine the tissue level of organization of humans and interpret the role of tissues in human systems. Compare and contrast the location, organization, and function of human tissues.

1. Describe the characteristics of the four major subtypes of tissue and state their embryologgical origins.
2. Identify and characterize the structure, function and location of varied subtypes of epithelial tissues.
3. Identify and characterize the structure, function and location of varied subtypes of connective tissues.
4. Identify and characterize the structure, function and location of varied subtypes of muscle tissues.
5. Identify and characterize the structure, function and location of varied subtypes of nervous tissues.

G. Investigate the structure and function of the integumentary system and relate variations in this system's components to normal function, immunity, and maintenance of homeostasis.

1. Describe the sublayers of skin with regards to their histological composition and overall function.
2. Discuss the various glands and accessory structures found in skin and describe their structure and function.
3. Discuss normal processes associated with skin remodelling (i.e. replication and apoptosis) as well as wound healing.
mechanisms.

4. Describe how melanin and/or various disorders contribute to skin color; discuss variations in melanin content among people of different racial origin. Discuss melanin's protective functions.

5. Describe the major functions of skin such as protection, immunity, thermo-regulation, sensory reception, etc.

6. Describe various skin disorders and relate these disorders to alterations in normal structure and function of the skin.

**H.** Analyze the composition, structure and functions of bone, cartilage, tendons, and ligaments. Examine and name the major bones and articulations of the axial and appendicular skeleton. Correlate the structure and function of bone and joint articulations to issues of nutrition, disease, aging, stress, gender, and race.

1. Describe the histological features and formation processes of compact and spongy bone; describe bone's role in calcium and phosphate homeostasis.

2. Identify the bones and selected bony landmarks which comprise the axial skeleton and relate specifics of their structure to such systematic functions as protection, blood cell formation, movement, and support.

3. Identify the bones and selected bony landmarks which comprise the appendicular skeleton and relate specifics of their structure to such systematic functions as protection, blood cell formation, movement, and support.

4. Discuss both structural and functional classifications of joints. Identify representative examples of these classes. Discuss histological features of synovial joints and how they relate to articular function/dysfunction.

5. Discuss how bone remodeling occurs, hormonal controls on this process and how this process relates to homeostasis.

6. Give examples of skeletal system disorders that are related to aging, gender, race, and selected metabolic disorders; describe how some of these disorders can be prevented.

7. Describe skeletal system variations related to age, gender and race.

**I.** Analyze the composition, structure and functions of various muscle tissues. Describe excitation-contraction coupling and contraction process. Describe selected disorders of the muscle system.

1. Compare and contrast the structure and function of skeletal, cardiac, and smooth muscles. Give body locations for each of these subtypes.

2. Describe structural details of the neuromuscular junction; describe how nerve action potentials generate muscle action potentials. Discuss disorders of the neuromuscular junction including neurotransmitter and/or receptor disorders.

3. Describe the process by which a muscle action potential causes a muscle contraction with an emphasis on intracellular muscle structure and function. Conceptualize details of the sarcomere and its sub-units and relate these to the contraction process.

4. Evaluate and contrast how muscles employ aerobic vs anaerobic respiration to fuel their activities and relate differences to varying muscle fiber types.

5. Identify selected axial and appendicular skeletal muscles on muscle torsos and/or figures. Describe the anatomical movements produced by these muscles/muscle groups.

6. List causes, signs and symptoms, and treatments for selected muscle disorders. Describe how muscle atrophy associated with immobilization and/or aging can be prevented. Discuss muscle mass differences between males and females.

**VI. Assignments**

**A.** Reading assignments from text and other pertinent materials

**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 lecture tests and quizzes
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
   2. Instructor Selected/Designed Laboratory Manual (see supporting references)

B. Examples of Supporting Texts and References

X. Lab Topics
A.
   1. Anatomical Terms/Directions
   2. Microscope
   3. The cell: anatomy and division
   4. Histology
   5. Integumentary System
   6. Overview of skeleton: classification and structure of bones and cartilage
   7. Axial Skeleton
   8. Appendicular Skeleton
   9. Articulations and body movements
   10. Microscopic anatomy and organization of muscular system
   11. Gross anatomy of muscular system