

BSC 2085 and BSC 2085L

Anatomy and Physiology I and Lab

Course Description

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| BSC 2085 | Anatomy and Physiology I | (3) P |
| BSC 2085L | Anatomy and Physiology I Lab | (1) P |

This course is intended for nursing and allied health students requiring a two-semester anatomy and physiology sequence. This integrated course presents cell morphology and function, biochemistry, histology of tissues and embryology. The organ systems covered are integumentary, skeletal, muscular, and nervous systems. This sequence meets the needs of numerous students including all pre-nursing students (bridge/generic ASN and BSN majors) and students who intend to articulate to an upper division health science program such as Health and Human Performance and Pharmacy majors.

Suggested Prerequisite: HSC 2531.

Co-requisite: BSC 2085L must be taken concomitant with BSC 2085.

Rationale

This course is offered to introduce students to crucial concepts in anatomy and physiology and how they apply to contemporary life, health and wellness. The course covers a broad range of basic biological and physiological concepts in the context of the human body. Many of these concepts provide a basis for understanding the relationships between structure and function from the chemical to organismal levels. Accordingly, this course and its laboratory component use a unifying theme of homeostasis and systemic interrelationships in order to better understand the ramifications of illness and disease.

This course and its laboratory component support the mission of the College to enrich the lives of our students and community and it supports the mission of Sciences for Health Programs, which is to prepare students to succeed in the difficult Nursing and Allied Health Programs and to make reasonable health and wellness decisions for, not only themselves and their families, but future patients as well.

Impact Assessment

BSC 2085 is designed as an anatomy and physiology class for health sciences majors. Understanding the human body is the gateway to appreciating the relationship between lifestyle and many of the prevalent illnesses seen today. Students begin to understand the complexities of their bodies. This serves as a broad foundation for learning and applying more advanced, difficult information that they will encounter in the higher level program courses.

General Education Learning Outcome

Understand scientific concepts and reasoning and analyze and interpret various types of data.

SF Scientific Reasoning Critical Attributes

- Deductive and inductive inferences,
- Controlling variables,
- Use of the scientific method (gather, analyze, and synthesize data relevant to a problem),
- Application of a model to a new situation,

- Interpretations based on fundamental theories,
- Interpretation of data in both tabular and graphical form, and
- Application of specialized knowledge to a different or larger context.

Broad Course Objectives

The following fundamental content and process goals, as developed by the HAPS Curriculum and Instruction Committee, form the unifying foundation for all topics in anatomy and physiology and are to be emphasized throughout Anatomy and Physiology I and II. They are directly linked to the learning outcomes written by the HAPS Curriculum & Instruction Committee.

Develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and physiology.

- Recognize the anatomical structures and explain the physiological functions of body systems.
- Recognize and explain the principle of homeostasis and the use of feedback loops to control physiological systems in the human body.
- Use anatomical knowledge to predict physiological consequences, and use knowledge of function to predict the features of anatomical structures.
- Recognize and explain the interrelationships within and between anatomical and physiological systems of the human body.
- Synthesize ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.
- Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system.
- Interpret graphs of anatomical and physiological data.

Course Outline with Specific Objectives

The successful student should be able to master the skills and activities listed under each major topic heading.

Human Body

1. Define anatomy and physiology and explain how they complement each other.
2. Describe each level of structural organization that make up the human body and explain the relationships of all the levels.
3. List the organ systems of the body, the major organs of each system, and the principal functions of each system.
4. Define homeostasis and explain its importance in living organisms. Explain the role of the nervous and endocrine systems in controlling homeostasis.
5. Describe positive and negative feedback, and describe how these processes help to maintain homeostasis. Provide examples of both positive and negative feedback mechanisms. Also, provide examples of homeostatic imbalances.
6. Define the anatomical position and explain its importance.
7. Describe body directions, regions and planes, using proper anatomical terminology listed in the lab manual.
8. Identify body cavities listed in the lab manual and list the major organs in each.
9. Name the serous membranes and note their common function.
10. Name the four quadrants of the abdominopelvic cavity and list the organs contained therein.

Chemical Level

General Chemistry:

1. Define matter and energy. List the three states of matter. Describe forms of energy.
2. Define chemical element. List the four elements that form the bulk of the body's matter.
3. Define atom, atomic weight, atomic number, mass number, and isotope.
4. List the three types of subatomic particles. Give their relative masses, charges, and position in the atom.
5. Define molecule and chemical compound.
6. Define solution, solvent, solute, colloid, and suspension.
7. Differentiate between ionic, nonpolar covalent, polar covalent, and hydrogen bonds.
8. Define and describe catabolic and anabolic reactions of metabolism. Explain why chemical reactions in the body are often irreversible.
9. Explain how several factors affect chemical reaction rates. Describe the properties of enzymes.

Biological Chemistry (Inorganic):

10. Describe the properties of water that make it essential to life.
11. Define acid, base, salt, and electrolytes. Relate these to the concept of pH of body fluids.
12. Discuss the role of buffers in the body and give examples.

Biological Chemistry (Organic):

13. Describe the building blocks, general structure, and biological functions of these organic compounds:
Carbohydrates – monosaccharides, disaccharides, polysaccharides
Lipids – triglycerides, phospholipids, cholesterol, steroid
Protein
Nucleotides and Nucleic Acids
Give examples of compounds in each category.
14. Describe the roles of proteins in the body; give examples of proteins in the various roles.
15. Discuss the functions of enzymes, and explain how the structure of an enzyme is essential to enzyme function.
16. Explain the role of ATP in cellular metabolism.

Cell

1. Describe the basic structure of the cell: cell membrane, cellular organelles, cytoplasm, and nucleus. Define "ICF" and "ECF".
2. Describe the chemical composition of the cell membrane and the various roles of protein components and phospholipid bilayer.
3. Describe the variety and differing functions of intercellular junctions, including: desmosomes, gap junctions, and tight junctions.
4. Describe structure and role of microvilli.
5. Relate cell membrane structure to active and passive transport mechanisms. Describe and differentiate between simple and facilitated diffusion, osmosis, filtration, and active transport and vesicular transport (endocytosis and exocytosis).
6. Explain the importance of particles (solutes) in solution in the movement of fluid into and out of cells.
7. Define tonicity and the effects of isotonic, hypertonic, and hypotonic media on cells.
8. Discuss structure and function of mitochondria.
9. Discuss the structure and function of ribosomes, rough and smooth endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes, and secretory vesicles.
10. Identify the structure and functions of cilia, flagella, centrioles, and cytoskeleton.

11. Describe the structure and functions of nucleus, nuclear membrane and nucleolus.
12. Define chromatin and chromosomes.
13. Describe phases of the cell cycle and each phase of mitosis.
14. Describe the process of DNA replication; explain what is meant by “semi-conservative” replication.
15. Define gene, codon, and anticodon.
16. Describe the process of protein synthesis, beginning with transcription and ending with translation.

Tissues

1. General:
 - a. Define tissue.
 - b. Identify the basic characteristics of the four tissue types.
2. Epithelial tissue:
 - a. Describe the general characteristics of epithelial tissue
 - b. Describe the structural classification of epithelial tissue.
 - c. Name and describe the types of epithelia and give examples.
 - d. Describe the structure of glandular epithelium; compare and contrast endocrine and exocrine glands and give examples.
3. Connective tissue:
 - a. Describe the general characteristics of connective tissue – its cells and matrix.
 - b. Describe the classes of connective tissue, noting their functions and locations.
4. Muscle:
 - a. Describe the general features of muscle tissue.
 - b. Compare and contrast the three types of muscle tissue in terms of structure, function, and location.
5. Nervous tissue:
 - a. Describe the function and locations of nervous tissue.
 - b. List and describe the two main cell types in nervous tissue in terms of structure and function.
6. Describe tissue repair.

Integumentary

1. Describe the specific tissue types that make up the epidermis, dermis, and hypodermis. Be able to identify them on a diagram.
2. Relate functions of the skin to specific skin components.
3. Describe cell types and strata of the epidermis.
4. Describe the factors that contribute to skin color and how changes may reflect homeostatic imbalance.
5. Describe the parts of the hair follicle and explain how hair forms. Describe the function of the piloerector muscles.
6. Briefly describe the structure and function of nails.
7. Describe the location and function of different types of sweat glands – apocrine and eccrine sweat, ceruminous, and mammary).
8. Describe the location and functions of sebaceous glands.

Skeletal System

1. Describe the general functions of the skeletal system.

2. Classify bones as belonging to the axial or the appendicular skeleton.
3. Describe specific cells and histology of spongy and compact bone, including structures of the osteon.
4. Discuss the organic and inorganic components of bone tissue.
5. Describe the functions and locations of red and yellow marrow of bone. Briefly describe hematopoiesis.
6. Compare the structural classes of bones and provide examples of each.
7. Describe the anatomy of a typical long bone.
8. Compare and contrast intramembranous and endochondral ossification. Give examples.
9. Explain the growth of a long bone in length and width.
10. Discuss homeostasis of bone, including the role of hormones and diet (vitamins, minerals, protein).
11. Describe fracture repair and bone remodeling.
12. Describe the anatomic differences between the male and female pelvis and relate these to functional differences.
13. Describe the structures and functions of the paranasal sinuses.

Articulations

1. Define joint or articulation.
2. Describe the criteria used to classify joints both structurally and functionally, and give examples of each type in the body.
3. Identify the anatomical and functional characteristics of a synovial joint, including factors that help to make synovial joints stable.
4. Describe structure, functions, and examples of bursae, tendon sheaths, and menisci associated with synovial joints.
5. Describe the common types of joint movements.
6. Describe the subtypes of synovial joints and give an example of each.

Muscular System

1. List the functions of the muscular system.
2. Describe the gross anatomy of a typical skeletal muscle, including its connective tissue coverings and attachments to bone. Differentiate between origin and insertion of a muscle.
3. Describe the microscopic anatomy of a skeletal muscle fiber, including myofibrils and specialized organelles.
4. Describe the structure and banding of a sarcomere, detailing the relationship of thick myofilaments (myosin) to thin myofilaments (actin).
5. Describe the sliding filament mechanism of skeletal muscle fiber contraction.
6. Describe the neuromuscular junction and the process of excitation-contraction coupling.
7. Define a motor unit and describe recruitment of units in muscle response.
8. Describe muscle twitch and its three phases. Define treppe and tetanus.
9. Differentiate between isometric and isotonic contractions.
10. Define aerobic and anaerobic metabolism and the role of creatine phosphate and myoglobin.
11. Define prime movers, antagonists, synergists, and fixators. Identify how each promotes normal muscle function.

Nervous System

Fundamentals of the Nervous System

1. Describe the basic functions of the nervous system.
2. Explain the structural organization and functional divisions of the nervous system.
3. Name the types of neuroglia and give their function.

4. Describe the anatomical structures of the neuron and relate each structure to a physiological role.
5. Describe the structural and functional classification of neurons and their location in the body.
6. Define nerve and describe its general structure, including its connective tissue coverings.
7. Distinguish between sensory, motor, and mixed nerves. Differentiate a nerve from a neuron.
8. Define and describe resting membrane potential with special referral to voltage-gated and chemical-gated channels, pumps and ionic gradients.
9. Compare graded and action potential. Explain how AP's are propagated along a neuron. Explain the significance of the refractory period.
10. Define and contrast saltatory and continuous conduction.
11. Describe the structures of the synapse and explain how transmission occurs across it. Identify different types of synapses and their locations. Distinguish between excitatory and inhibitory neurotransmitters, giving examples. Explain postsynaptic potential.

Central Nervous System: The Brain and Spinal Cord

Peripheral Nervous System: Cranial and Spinal Nerves

1. Give an overview of the major regions of the brain. Differentiate gray matter and white matter as to structure and function.
2. Describe the cerebrum with its major lobes, fissures, and major functional areas (1ry motor...)
3. Identify the ventricles of the brain and their locations.
4. Describe the diencephalon and name its subdivisions. Discuss the importance of the hypothalamus.
5. Discuss the limbic system and the reticular activating system and the function of each.
6. Identify the three major regions of the brainstem and note the general functions for each region.
7. Describe cerebellar structure and function.
8. Describe the structure of meninges, the blood brain barrier and explain how they protect the CNS.
9. Describe how CSF is formed and follow its circulatory path.
10. Name the 12 pairs of cranial nerves and describe their general function.
11. Describe the gross and microscopic structure of the spinal cord.
12. Distinguish between the dorsal and ventral roots of the spinal nerves
13. Define reflex and explain the components of a reflex arc
14. Define plexus, name the four major plexuses and a representative nerve for each.
15. Define sensory receptor and give some examples of cutaneous and visceral receptors.

Autonomic Nervous System

1. Describe the functions of the autonomic nervous system (ANS).
2. Compare and contrast the two divisions with regards to region, neurotransmitter, and major role.
3. Distinguish between cholinergic and adrenergic receptors of the ANS.
4. Describe the effects of the sympathetic and parasympathetic divisions on the following organs: heart, blood vessels, digestive and urinary organs, bronchial smooth muscles, and blood vessels in skeletal muscles.
5. Describe the adrenal gland and its hormonal secretions in conjunction with the sympathetic nervous system.
6. Discuss the role of the hypothalamus and cerebral cortex in control over the ANS functions.

Special Senses

1. Describe the location and structure of taste and olfactory receptors. Explain how these receptors are activated and name the cranial nerves associated with each sense.
2. Describe the anatomy and function of the accessory structures of the eye.
3. Describe the anatomy and function of the three tunics of the eyeball and the refractory media of the eye.

4. Trace the pathway of light through the eye to the retina and explain how light is focused for distant and close vision.
5. Compare and contrast the role of rods and cones.
6. Trace the pathway of impulses from the retina to the cortical lobe associated with vision.
7. Describe the structure and general functions of the outer, middle, and inner ear.
8. Explain how the equilibrium organs of the semilunar canals and vestibule help maintain dynamic and static equilibrium.
9. Trace the sound conduction to the inner ear and from there till it reaches the cortical lobe associated with hearing and equilibrium.

Evaluation

A minimum of 70% of the assessment materials administered in this course will be given in a proctored environment in which the student does not have access to any reference materials.

BSC 2085L: exams, quizzes and assignments

20% - Departmental lab practical midterm and final exams

5% - Quizzes and assignments

This contributes 25% to the total BSC 2085 course grade.

BSC 2085:

20% - Departmental comprehensive final exam

3-5 unit exams

Quizzes, assignments