LEARNING OBJECTIVES

NOTE: Please review the objectives for both the lecture and lab in preparation for lecture exams. Although lab questions will not be on the lecture exams, many of the objectives overlap, and reviewing lab material that you have practical experience with may assist your understanding of lecture material.

ORGANIZATION OF THE HUMAN BODY

Lecture/Discussion:

1. Define anatomy and physiology, and describe the differences in the approaches and techniques used in these sciences.
2. List and describe the major characteristics of life, including homeostasis and the mechanisms to maintain this set of conditions.
3. Outline the 5 principle levels of organizational complexity in the human body.
4. Describe the structure of biological membranes and the movement of materials across cell membranes based on their physical and chemical properties.
5. Differentiate between the various types of intercellular junctions, providing examples in human tissues.
6. Describe the roles of specific organic and inorganic substances in biological systems.
7. Explain the role of enzymes in cellular metabolism and the factors that affect enzyme function.
8. Explain where genetic information is stored, replicated and used in the synthesis of proteins.
9. Describe the general functions of each organ system. Differentiate between boundary and non-boundary organs.
10. Briefly describe the morphogenesis and differentiation of the 3 human embryonic germ layers, and list the tissue specializations (histology) which develop from these germ layers.
11. Describe the locations of the major body cavities (dorsal and ventral); describe the bilayer organization of the serous membranes in the ventral cavities, and describe the organs associated with each cavity.

Laboratory:

1. Recognize and define the terms used to describe relative positions, body sections, body regions, and normal and pathological states in human health.
2. Describe the locations of the major body cavities; describe the bilayer organization of the membranes and describe the organs associated with each cavity.
3. Recognize and describe the anatomical and physiological characteristics, locations and functions of epithelial, connective, muscular, and nervous tissues.
4. Be able to answer the questions posed in the histology guides in the lab manual, eg. which tissues have a good blood supply and which have a poor blood supply, and why?
5. Distinguish between various intercellular substances, including basement membrane, matrix, and various cell-to-cell junctions.
6. Describe the structure and function of glandular epithelium, and differentiate between exocrine, endocrine and heterocrine glands.
THE INTEGUMENTARY SYSTEM

Lecture/Discussion:

1. Describe the basic structure and function of a multicellular membrane; and differentiate in structure and function between serous, mucus, synovial and cutaneous membranes, using examples.
2. Describe the structure and function of the various layers, tissues, and accessory organs of the skin, including glands, hair, and nails.

Laboratory:

1. Identify the layers of epithelium and the structure & function of accessory organs of the skin.
2. Describe the general characteristics of the blood circulatory path supplying the skin.

THE SKELETAL SYSTEM & JOINTS

Lecture/Discussion:

1. Describe the macroscopic and microscopic structure of a typical long bone, and list the functions of each feature, including some of the features specific to diarthrotic joints.
2. Distinguish between intramembranous and endochondral bone formation, and explain how bones grow and develop. Give examples.
3. Describe the effects of sunlight, nutrition, hormonal secretions, and exercise on the skeleton, along with the roles of osteoblasts and osteoclasts in the constant remodeling of bone.
4. Differentiate between the organic and inorganic constituents of bone in their production and the characteristics they bring to living bone.
5. Describe some of the diseases discussed in class which affect the skeleton and joints.
6. Describe how a typical long bone grows in length and diameter, and some of the other normal age-related changes in the skeleton.
7. Describe the normal process in the repair of fractures.

Laboratory:

1. Distinguish between the axial and appendicular skeleton; identify the bones and bony landmarks listed in the lab handout.
2. Identify the anatomy of a typical diarthrotic joint. Be able to name the bones that articulate at particular joints.
3. Explain how joints may be classified (3) either according to the type of movement and/or the type of tissue connections associated with the bone junction.
4. Name and describe the major types of movements at joints.
5. Recognize and name the class of lever (I, II, or III) for a particular movement of the skeleton. Identify the muscle that is producing the movement at that joint (see also: Muscular System).
6. Differentiate between the organic and inorganic constituents of bone in their production and the characteristics they bring to living bone.
7. Describe the macroscopic and microscopic structure of a typical long bone, and list the functions of each feature.
THE MUSCULAR SYSTEM

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Describe the special characteristics of muscle tissue, in general.
2. Describe the structure and function of connective tissue components in skeletal muscles.
3. Compare the microscopic anatomy and functions of the three types of muscle tissue cells.
4. Define a motor unit and describe the function of the neuromuscular (myoneural) junction.
5. Distinguish between the responses called all-or-none (Action Potentials) and graded (End-plate Potentials) following neuronal stimulation at the motor end-plate.
6. Briefly describe the sequence of chemical and physical events which lead to muscle contraction and relaxation.
7. Explain how energy is supplied to the muscle fiber contraction mechanism, how oxygen debt develops, and how a muscle may become fatigued.
8. Compare the different effects of aerobic and anaerobic training on skeletal muscle.
9. Explain the role of enzymes in cellular metabolism and the factors that affect enzyme function.
10. Differentiate between aerobic and anaerobic cellular metabolism, between anabolic and catabolic reactions, and explain how several reactions can form a metabolic pathway.
11. List the four subpathways of aerobic respiration and where they occur in the cell; list the reactants and products of aerobic respiration, and describe how and in which subpathway each product is generated.
12. Describe the location of the reactions of anaerobic cell metabolism; list the reactants and the products.
13. Describe the catabolic pathway for a molecule of protein, lipid, and glycogen as each is hydrolyzed to produce ATP.

Laboratory:

Upon completion of this unit, the student will be able to
1. Identify on A.D.A.M. figures and on human models the muscles listed in the lab handout.
2. Recognize the origin and insertion of individual skeletal muscles and describe the actions produced by contraction of each muscle.
4. Describe the microscopic anatomy of the 3 muscle types, and answer questions about each such as: Which type of muscle is under voluntary control...involuntary?… Why are there striations on skeletal muscle and cardiac muscle, and not on smooth muscle fibers?

THE NERVOUS SYSTEM

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Describe the cellular specializations of a multipolar neuron.
2. Describe the classifications of neurons and neuroglia according to structure and function.
3. Describe the events that lead to the conduction of a nerve impulse.
4. Define neurotransmitter and threshold; list examples of excitatory and inhibitory neurotransmitters.
5. Describe the anatomical and functional differences between myelinated and unmyelinated nerve fibers; compare conduction of an impulse along these fibers.
6. Describe the structure and function of the coverings of the CNS.
7. Describe the structure of the spinal cord and its major functions, including spinal reflexes.
8. Name the major parts of the brain, describe their embryonic development, and describe the functions of each.
9. Describe the location and functions of motor, sensory, and association areas of the cerebral cortex.
10. Briefly discuss the reflex centers in the pons and medulla.
11. Describe the anatomy of the ventricles, and the formation, circulation, and function of cerebrospinal fluid.
12. Describe the structure of the blood-brain barrier and its regulatory function.
13. Describe the functional classification of nerves.
14. Relate neurotransmitter substances, membrane receptors and dual innervation of visceral organs to the normal function of the Autonomic Nervous System.

**Laboratory:**

Upon completion of this unit, the student will be able to
1. Describe 2-neuronal, 3-neuronal, and higher order reflex arcs.
2. Identify the cells and tissues of the CNS, PNS, eye, ear and tongue listed in the histology lab handout.
3. Identify the features of the brain (including identification and functions of the cranial nerves) and eye listed in the lab manual/handouts, and studied during your dissection of the sheep brain.
4. Identify the features of the eye listed in the lab manual/handouts, and studied during your dissection of the beef eye.
5. Visualize and describe the fundus of the eye using an ophthalmoscope.
6. Examine the external ear and tympanic membrane using an otoscope.
7. Identify the 12 pairs of cranial nerves, and list their major functions.
8. Describe the functional unit for the senses of smell, taste, vision, hearing, and equilibrium, and the important features of the stimulus to which each receptor may respond.
9. Describe the anatomy of the ear and explain the function of each feature.
10. Describe the anatomy of the eye and explain the function of each feature.
11. Explain how light is refracted by the anatomical features of the eye.

**THE ENDOCRINE SYSTEM**

**Lecture/Discussion:**

Upon completion of this unit, the student will be able to
1. Explain the three basic mechanisms that control endocrine secretions.
2. Discuss how hormonal secretions are transported, and how they are regulated by negative feedback mechanisms.
3. Name and describe the locations of the major endocrine glands of the body, list the hormones they secrete, and the action of each hormone.
4. Explain how the hypothalamus regulates hypophyseal secretions, with examples.
5. Describe the direct nervous regulation of the adrenal medulla.

**Laboratory:**

Upon completion of this unit, the student will be able to
1. Identify and describe the histologic organization of the principle endocrine glands.
2. Identify the locations of the principle endocrine glands, and name at least one endocrine product from each endocrine cell/gland.
THE DIGESTIVE SYSTEM

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Name the locations of the specializations of the alimentary canal and of the accessory organs to digestion, and briefly explain how these structures work to carry out the 5 major functions of the digestive system.
2. Describe the tissue organization in the wall of the alimentary canal, and describe the specializations related to function in the different regions along its length.
3. Briefly explain how digestive reflexes and hormones function to control digestive movements and secretions.
4. Describe the basic mechanism of peristalsis, relating the anatomy of GI musculature to this function.
5. Describe the normal composition of saliva and bile.
6. Discuss the structure and function of the liver and pancreas.

Laboratory:

Upon completion of this unit, the student will be able to
1. Identify the divisions, subdivisions of the alimentary canal and accessory organs of the digestive system listed on the lab handout.
2. Identify the histologic organization of each specialization of the alimentary canal and accessory organ assigned in the lab handout.

THE CARDIOVASCULAR SYSTEM AND BLOOD

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Describe the anatomy of the heart and trace the pathway of blood through the heart and coronary circulation.
2. Discuss the cardiac cycle, the cardiac conduction system (including the special features of cardiac muscle), and the regulation of cardiac function.
3. Describe the mechanisms that aid in returning venous blood to the heart.
4. Compare and contrast the tissue construction of arteries, veins and capillaries.
5. Discuss the forces involved in the exchange of materials between capillaries and the interstitial (tissue) fluid.
6. Describe the general characteristics of the formed elements of blood and blood plasma, and discuss the major functions of each.
7. Describe the homeostatic regulation of RBC production to maintain oxygen carrying capacity.

Laboratory:

Upon completion of this unit the student will be able to
1. Differentiate on the basis of histologic differences between arteries, veins and capillaries, and relate their structure to function.
2. Identify and describe the functions of the organs of the cardiovascular system, including those blood vessels and features of the heart listed in the lab assignment, and those features identified in your dissection of the sheep heart.
THE LYMPHATIC SYSTEM AND IMMUNITY

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Describe the structure and function of organs of the lymphatic system.
2. Describe the physiological processes involved in tissue fluid formation and return, including the roles of lymphatic capillaries and lymph nodes/nodules.
3. Explain the function of lymph, the normal circulation of lymph, and the possible causes of edema.
4. List the cells that are involved in specific and non-specific immunity, and their general functions in immune mechanisms.
5. Describe the composition and functions of the reticuloendothelial system (mononuclear phagocytic system).

Laboratory:

1. Recognize and describe the normal structure and function of a lymph node.

THE RESPIRATORY SYSTEM

Lecture/Discussion:

Upon completion of this unit the student will be able to
1. Describe the embryonic development, location and general functions of each of the organs of the respiratory system.
2. Describe the structure and function of the pleural membrane, including the importance of surface tension to the mechanics of breathing.
3. Explain the normal mechanics of inspiration and expiration.
4. Describe the structure and function of the respiratory membrane.
5. Discuss the location and function of the respiratory centers in the regulation of breathing, and the various factors that affect these control centers.

Laboratory:

Upon completion of this unit the student will be able to
1. Identify the oro-, naso-, and laryngopharynx.
2. Identify the microscopic and macroscopic features of the respiratory system described in lab handouts and demonstrated on the models and fresh pig pluck.

THE URINARY SYSTEM

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Describe the anatomy and physiology of the organs of the urinary system, and the blood circulatory path through the kidney.
2. Describe the functional unit of the kidney, and explain the 3 major steps in the production of urine and the basic mechanisms by which they occur.
3. Contrast the functions of the lungs, integument, kidneys, and alimentary canal as excretory organs.
Laboratory:

Upon completion of this unit, the student will be able to
1. Identify and describe the locations of the kidneys and other organs of the urinary system.
2. Describe the histology of the organs of the urinary system.
3. Dissect a mammalian kidney and identify the gross anatomical features listed in the lab handout.

THE REPRODUCTIVE SYSTEMS

Lecture/Discussion:

Upon completion of this unit, the student will be able to
1. Compare the embryological development, and describe the normal anatomy and physiology of male and female reproductive systems.
2. Compare the processes of oogenesis and spermatogenesis.
3. Describe the major events and hormonal changes that occur during the female menstrual cycle.
4. Briefly compare the hormonal regulation of gametogenesis and the acquisition of secondary sexual characteristics in males and females.

Laboratory:

Upon completion of this unit, the student will be able to
1. Identify and describe the locations of the organs of the female and male reproductive systems.
2. Describe the histologic organization of the testes and ovaries.