

BIO-1221: ANATOMY AND PHYSIOLOGY FOR DIAGNOSTIC MEDICAL IMAGING

Cuyahoga Community College

Viewing: BIO-1221 : Anatomy and Physiology for Diagnostic Medical Imaging

Board of Trustees:

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Academic Term:

Fall 2024

Subject Code

BIO - Biology

Course Number:

1221

Title:

Anatomy and Physiology for Diagnostic Medical Imaging

Catalog Description:

Basic understanding of cells, tissues, organs, and body systems. Examination of their function based on their relationship to diagnostic medical imaging examinations. Particular emphasis placed on the skeletal system and the radiographic appearance of anatomical structures.

Credit Hour(s):

4

Lecture Hour(s):

3

Lab Hour(s):

3

Requisites

Prerequisite and Corequisite

MA-1020 Medical Terminology I or concurrent enrollment.

Outcomes

Course Outcome(s):

Use anatomical terms of position, direction, and movement to describe the human body and its parts in the anatomical position.

Objective(s):

- a. Describe the human body in anatomical position.
- b. Discuss the basics of anatomical nomenclature.
- c. Identify common planes of section through the human body and its parts.
- d. Identify the body cavities, their structural limits, functions, and contents.
- e. Identify specific surface landmarks.

Course Outcome(s):

Use appropriate scientific terminology to describe the chemical components of the human body.

Objective(s):

- a. Describe the structural and functional organization of the cell membrane.
- b. List and briefly describe the different mechanisms of transmembrane transport.
- c. Differentiate between active and passive transport mechanisms.

- d. Describe the cytoplasm.
- e. Identify the major cellular organelles and briefly describe their functions in the cell.
- f. Briefly explain the process of gene expression including RNA and protein synthesis.
- g. Describe nuclear and cellular reproduction in somatic and gamete-producing cells.
- h. Briefly explain the consequences of abnormal nuclear and cellular reproduction in both somatic and gamete-producing cells.

Course Outcome(s):

Explain the essentials of human metabolism.

Objective(s):

- a. Define anabolism and catabolism.
- b. Briefly explain the function of enzymes and their role in metabolism.
- c. Briefly describe the metabolism of carbohydrates, lipids, and proteins.
- d. Explain homeostatic regulation and the roles of negative and positive feedback in maintaining the body.

Course Outcome(s):

Describe the structural and functional organization of the human body from the tissue through organ system levels.

Objective(s):

- a. Identify and describe the four primary tissue types, the functional characteristics of each and give examples of their location within the human body.
- b. Identify the organ systems, their constituent organs, and their main functions in the human body.
- c. Understand the role of radiographic contrast media in the visualization of body tissues and organs.

Course Outcome(s):

Using appropriate anatomical terms for direction and orientation, identify and describe the components of the human skeleton, their individual features and their relationships to one another and other anatomical structures.

Objective(s):

- a. Summarize the functions of the skeletal system.
- b. Describe the structural organization of osseous tissue.
- c. Describe the process of bone development and growth.
- d. State the classifications and markings of bones.
- e. Identify and locate all of the bones of the human skeleton including all processes, projections, depressions, and openings.
- f. Be able to distinguish lefts from rights for selected disarticulated bones.
- g. Distinguish between the axial and appendicular divisions of the skeleton and identify the bones of each division and specific bony landmarks.
- h. Differentiate between primary and secondary curves of the spine.
 - i. Identify anatomy on radiographic images of all of the bones in human skeleton including all processes, projections, depressions, and openings.
 - j. List and define the structural and functional joint classifications.
- k. Label different types of articulations.
 - l. Compare the types, locations and movements permitted by the different types of articulations.
- m. Apply the appropriate structural and functional classifications to specific joints in the body.
- n. Describe common movements at joints in reference to anatomical planes.

Course Outcome(s):

Describe the structural and functional organization of the muscular system.

Objective(s):

- a. State the function of each of the three types of muscle tissue.
- b. Name and locate the major muscles of the body.

Course Outcome(s):

Demonstrate basic knowledge of the central and peripheral nervous systems.

Objective(s):

- a. Differentiate between the structure and function of the different types of nerve cells.
- b. Label the parts of a neuron.
- c. State the functions of a neuron.
- d. List the different types of neuroglia and know their function.
- e. State the structure of the brain and the relationship of its component parts.
- f. Describe brain functions.
- g. List the meninges and describe the function of each.
- h. Outline how cerebrospinal fluid forms, circulates and functions.
 - i. Identify interventricular foramen, cerebral aqueduct, and the ventricles of the brain.
 - j. Describe the structure and function of the spinal cord.
- k. Determine the distribution and function of the cranial and spinal nerves.
 - l. List 12 pair of cranial nerves including the function of each.
- m. Distinguish between sympathetic nervous system and parasympathetic nervous system.
- n. Summarize the structure and function of components that comprise the autonomic nervous system.

Course Outcome(s):

Apply knowledge of the sensory system to understand the human body.

Objective(s):

- a. Describe the structures and functions of the components that comprise the human eye and ear.
- b. List the component body parts involved in the senses of smell and taste.
- c. List the somatic senses.

Course Outcome(s):

Apply knowledge of the endocrine system to understand the human body.

Objective(s):

- a. Define endocrine.
- b. Describe the characteristics and functions of the components that comprise the endocrine system.
- c. Distinguish between an endocrine and an exocrine gland.
- d. Know the homeostatic control of endocrine system.

Course Outcome(s):

Apply knowledge of the digestive system to understand the human body.

Objective(s):

- a. Label the four quadrants and nine regions of the abdomen including organs contained in each.
- b. Describe the hard and soft palates.
- c. Describe the structure and function of the tongue.
- d. Identify the structure, function, and locations of the salivary glands.
- e. Describe the composition and characteristics of the primary organs of the digestive system.
- f. Describe the function(s) of each primary organ of the digestive system.
- g. Differentiate between the layers of tissue that comprise the esophagus, stomach, small intestine, large intestine, and rectum.
- h. Differentiate between peritoneum, omentum and mesentery.
 - i. List and label the accessory organs of the digestive system and describe their function.
 - j. Identify the secretions and function of each accessory organ of the digestive system.
- k. List in order the steps of digestion and explain the purpose of digestion.
 - l. List the digestive processes that occur in the body.

- m. Locate any abdominal organ with the aid of palpable landmarks.
- n. Identify specific anatomy on radiographic images to include the following esophagus, stomach, small intestine, large intestine, and rectum.

Course Outcome(s):

Apply knowledge of the cardiovascular system to understand the human body.

Objective(s):

- a. Describe the composition and characteristics of blood.
- b. List the types of blood cells and state their functions.
- c. Differentiate between blood plasma and serum.
- d. Outline the clotting mechanism.
- e. List the blood types.
- f. Explain the term Rh factor.
- g. Explain the antigen/antibody relationship and its use in blood typing.
- h. Label the structures of the human heart.
 - i. Trace the flow of blood from the superior and inferior vena cava through the heart to the aorta.
 - j. Describe the flow of blood through the body and identify the main vessels.
- k. Label and identify major arteries and veins and their branches according to portion of the body which they supply.
 - l. Describe the structure and function of arteries, veins, and capillaries.
- m. Differentiate between arterial blood in systemic circulation and arterial blood in pulmonary circulation.
- n. Differentiate systemic, portal, and pulmonary circulation.
- o. State the significance of systolic and diastolic pressures.
- p. Correlate electrocardiogram (ECG) tracings to a normal cardiac rhythm.

Course Outcome(s):

Apply knowledge of lymphatic system to understand the human body.

Objective(s):

- a. List and identify the lymphatic vessels, lymphatic organs, and lymphatic tissue components of lymphatic system.
- b. Describe the formation and characteristics of lymph.
- c. State the function of lymphatic system.
- d. Outline the major pathways of lymphatic circulation.
- e. Differentiate between nonspecific defenses and specific immunity.
- f. Explain antibody production and function.
- g. List the different types and functions of T- and B-cells and explain their functions.
- h. Differentiate between passive and active immunity.

Course Outcome(s):

Apply knowledge of respiratory system to understand the human body.

Objective(s):

- a. Name the divisions of the thorax and their contents.
- b. Label the components of the respiratory system.
- c. Describe the physiology and regulation of respiration.
- d. Identify specific anatomy on radiographic images to include the mediastinum, trachea, heart, lungs, and diaphragm.

Course Outcome(s):

Apply knowledge of urinary system to understand the human body.

Objective(s):

- a. Label the parts of the kidneys, ureters, bladder, and urethra.
- b. Describe the function of each organ of the urinary system.
- c. Describe the composition and function of urine.
- d. Explain micturition.
- e. Identify specific anatomy on radiographic images to include kidneys, ureters, and bladder.

Course Outcome(s):

Apply knowledge of reproductive system to understand the human body.

Objective(s):

- a. Label the anatomy of the internal and external male and female reproductive organs.
- b. Analyze the function of each of the male and female reproductive organs.
- c. Trace the pathway of a sperm from its origin as it transits to the exterior.
- d. Explain reproductive physiology as it relates to the ovarian, cycle, menstrual cycle, aging, and menopause.

Course Outcome(s):

Demonstrate knowledge of sectional anatomy in relation to the human body.

Objective(s):

- a. Identify the major anatomical structures found within the head and neck.
- b. Identify the major anatomical structures located in the thorax.
- c. Identify the major anatomical structures located within the abdomen.
- d. Identify specific anatomy on radiographic images.

Methods of Evaluation:

- a. Quizzes
- b. Written examinations
- c. Practical examinations including Radiographic Image Evaluation

Course Content Outline:

- a. Anatomical Nomenclature
 - i. Directional references
 1. Anterior/posterior
 2. Ventral/dorsal
 3. Medial/lateral
 4. Superior/inferior
 5. Proximal/distal
 6. Cephalad/caudad
 - ii. Body planes
 1. Median/midsagittal
 2. Sagittal
 3. Coronal
 4. Transverse
 5. Longitudinal
 - iii. Body cavities – structural limits, function, contents
 1. Cranial
 2. Thoracic
 3. Abdominal/pelvic
- b. Chemical Composition
 - i. Atoms
 - ii. Chemical bonds
 - iii. Inorganic compounds

1. Acids
2. Bases
3. Salts
4. Water
- iv. Organic compounds
 1. Carbohydrates
 2. Lipids
 3. Proteins
 4. Nucleotides
 - a. DNA
 - b. RNA
- c. Cell Structure and Genetic Control
 - i. Cell membrane
 1. Chemistry
 2. Structure
 3. Physiology
 4. Transport processes
 - a. Diffusion
 - b. Osmosis
 - c. Filtration
 - d. Active transport and physiological pumps
 - e. Phagocytosis and pinocytosis
 - ii. Cytoplasm
 - iii. Organelles
 1. Nucleus
 2. Ribosomes
 3. Endoplasmic reticulum
 4. Golgi complex
 5. Mitochondria
 6. Lysosomes
 7. Peroxisomes
 8. Cytoskeleton
 9. Centrosome and centrioles
 10. Flagella and cilia
 - iv. Gene action
 1. Protein synthesis
 2. Nucleic acid (RNA/DNA) synthesis
 3. Transcription
 4. Translation
 - v. Cell reproduction
 1. Mitosis
 2. Meiosis
 - vi. Aberration and abnormal cell division
- d. Metabolism
 - i. Anabolism
 - ii. Catabolism
 - iii. Enzymes and metabolism
 - iv. Carbohydrate metabolism
 - v. Lipid metabolism
 - vi. Protein metabolism
 - vii. Regulation and homeostasis
- e. Tissues
 - i. Types of tissue
 1. Epithelial
 2. Connective
 3. Muscle
 4. Nerve

- ii. Tissue repair
- iii. Role of radiographic contrast media in the visualization of anatomical structures
- f. Skeletal System
 - i. Osseous tissue
 - 1. Structural organization
 - a. Medullary cavity/marrow
 - b. Compact bone
 - c. Cancellous bone
 - d. Periosteum
 - e. Cartilage
 - 2. Development and growth
 - a. Pysis
 - b. Diaphysis
 - c. Epiphyseal line
 - d. Metaphysis
 - 3. Classification and markings
 - 4. Long
 - 5. Short
 - 6. Flat
 - 7. Irregular
 - 8. Processes and bony projections
 - 9. Depressions and openings
 - ii. Divisions
 - 1. Axial
 - a. Skull
 - b. Hyoid bone
 - c. Vertebral column
 - d. Thorax
 - 2. Appendicular
 - a. Pectoral girdle
 - b. Upper extremities
 - c. Pelvic girdle
 - d. Lower extremities
 - 3. Sesamoids
 - 4. Functions
 - iii. Radiographic appearance of bones to include all processes, projections, depressions, and openings
 - iv. Articulations
 - 1. Types
 - a. Synarthroses, fibrosis
 - b. Amphiarthroses, cartilaginous
 - c. Diarthroses, synovial
 - 2. Movement
- g. Muscular System
 - i. Types and characteristics
 - 1. Smooth
 - 2. Cardiac
 - 3. Skeletal
 - ii. Functions
- h. Nervous System
 - i. Neural tissue – structure and function
 - 1. Neurons
 - 2. Neuroglia
 - ii. Central nervous system – structure and function
 - 1. Brain and cranial nerves
 - 2. Spinal cord
 - iii. Peripheral nervous system – structure and function
 - 1. Sympathetic nerves
 - 2. Parasympathetic nerves
- i. Sensory System

- i. General senses
 - 1. Nociperception
 - 2. Chemoreception
 - 3. Thermoreception
 - 4. Mechanoreception
- ii. Special senses – structure, function
 - 1. Vision
 - 2. Hearing and equilibrium
 - 3. Olfaction
 - 4. Gustation
 - 5. Tactile
- j. Endocrine System
 - i. Primary organs - structure, function, and location
 - ii. Homeostatic control
 - iii. Endocrine tissue and related hormones
 - 1. Pituitary (hypophysis) gland
 - 2. Pineal gland
 - 3. Thyroid gland
 - 4. Parathyroid gland
 - 5. Adrenal (suprarenal) glands
 - 6. Heart and kidneys
 - 7. Digestive system
 - 8. Pancreas
 - 9. Testes
 - 10. Ovaries
 - 11. Thymus
 - 12. Placenta
- k. Digestive System
 - i. Primary organs – structure, function, and location
 - 1. Oral cavity
 - 2. Esophagus
 - 3. Stomach
 - 4. Small intestine
 - 5. Large intestine
 - 6. Rectum
 - ii. Accessory organs – structure, function, and location
 - 1. Salivary glands
 - 2. Pancreas
 - 3. Liver
 - 4. Gallbladder
 - iii. Digestive processes
 - 1. Ingestion
 - 2. Peristalsis
 - 3. Segmentation
 - 4. Digestion
 - 5. Absorption
 - 6. Defecation
 - iv. Radiographic appearance of primary digestive structures
- l. Cardiovascular System
 - i. Blood
 - 1. Composition
 - 2. Clotting system
 - 3. Hemopoiesis
 - 4. Function
 - ii. Heart and vessels
 - 1. Anatomy
 - 2. Function
 - iii. Electrocardiogram (ECG) tracings correlated to normal cardiac rhythm
- m. Lymphatic System and Immunity

- i. Lymphatic system
 - 1. Lymph vessels
 - 2. Lymphatic organs
 - a. Thymus
 - b. Lymph nodes
 - c. Spleen
 - 3. Lymphatic tissue
 - a. Tonsils
 - b. Peyer's patches
- ii. Immune system
 - 1. Nonspecific defenses
 - a. Physical barriers
 - b. Leukocytes
 - c. Immunological surveillance
 - 2. B-cell response
 - a. Production
 - b. Types of immunoglobulins
 - c. Function
 - d. Regulation of B-cell response
 - 3. T-cell response
 - a. Production
 - b. Types
 - c. Function
 - d. Regulation of T-cell response
 - 4. Passive and active immunity
- n. Respiratory System
 - i. Components, structure, and function
 - 1. Nose and sinus cavities
 - 2. Pharynx
 - 3. Larynx
 - 4. Trachea
 - 5. Bronchi
 - 6. Lungs
 - 7. Thorax
 - ii. Physiology
 - 1. Pulmonary ventilation
 - 2. Alveolar gas exchange
 - 3. Transport of blood gases
 - 4. Tissue gas exchange
 - 5. Control and regulation of respiration
 - iii. Radiographic appearance of primary structures in the thorax
- o. Urinary System
 - i. Components, structure, and function
 - 1. Kidneys
 - 2. Ureters
 - 3. Bladder
 - 4. Urethra
 - ii. Urine
 - 1. Physical characteristics
 - 2. Chemical composition
 - iii. Micturition
 - iv. Radiographic appearance of primary urinary structures
- p. Reproductive System
 - i. Male – structure, function, and location
 - 1. External organs
 - 2. Internal organs
 - ii. Female – structure, function, and location

1. External organs
2. Internal organs
3. Mammary glands
- iii. Reproductive physiology
 1. Ovarian cycle
 2. Menstrual cycle
 3. Aging and menopause
- q. Introduction to Sectional Anatomy
 - i. Structures and locations
 - ii. Head/neck
 1. Brain
 2. Cranium
 3. Major vessels
 - iii. Thorax
 1. Mediastinum
 2. Lung
 3. Heart
 4. Airway
 5. Major vessels
 - iv. Abdomen
 1. Liver
 2. Biliary
 3. Spleen
 4. Pancreas
 5. Kidneys and ureters
 6. Peritoneum
 7. Retroperitoneum
 8. Gastrointestinal (GI) tract
 9. Major vessels
 - v. Radiographic appearance of primary structures in the head/neck, thorax, and abdomen

Resources

Greathouse, Joanne S. *Delmar's Radiographic Positioning Procedure*. New York: Delmar Publishers, 1998.

Welsh, Charles, et. al. *Holes Essentials of Human Anatomy and Physiology*. 16th ed. New York: WCB/McGraw-Hill, 2021.

Snider, Philip. *Laboratory Manual for Holes Essentials of A & P*. 16th. McGraw Hill, 2022.

Wicke, Lothar. *Atlas of Radiologic Anatomy*. 7th ed. Baltimore: Williams & Williams, 2004.

Long, B.W., Hall Rollins, J., Curtis, T. *Merrill's Atlas of Radiographic Positions and Radiologic Procedures*. 15th edition. St. Louis: Elsevier Mosby, 2022.

McCann, Stephanie (illustrator). *Anatomy Coloring Book*. Kaplan Test Prep, 2019.

Resources Other

Ryan, Stephanie, McNicholas, Michelle, et. al. *Anatomy for Diagnostic Imaging*, 3rd Edition, 2010

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