Sparta Area School District

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Course Outcome Summary

Course Information: (SCANAT) Advanced Anatomy & Physiology

Description: A basic understanding of the human body is essential for all students. In today's world, medical and technological advances are growing at an incredible rate and students need to understand how this technology will impact themselves and their daily lives. Many students are going into medical and health fields, and this background information on the human body will aid them in their endeavor. Students need to be informed citizens, voting on issues that will affect them and the next generation. It is difficult to make informed decisions about medical and health issues if one does not understand the basic functioning of the body. All students would benefit from this course. Dissection will be used to make anatomical comparisons to the human body.

Instruction Level: 11-12

Total Credits: 2 (Optional Dual Credit with UW-Richland)

Prerequisites: Successful completion of Biology /Chemistry /Physics

Textbooks: Human Anatomy & Physiology, 8th Edition, Marieb, Pearson Education, 978-0805395693

Course Standards:

Content:

1. Students shall explore the organizational structures of the body from the simple (molecular) to the complex (organism) level.
2. Students shall understand the role of chemistry in body processes.
3. Students shall understand that cells are the basic, structural, and functional units of life.
4. Students shall understand the tissues (histology) of the human body.
5. Students shall describe the anatomy and physiology of the body systems.
    a. Skin and Accessory Structures (Integumentary)
    b. Skeletal
    c. Muscular
    d. Nervous
    e. Cardiovascular
    f. Respiratory
    g. Digestive
    h. Excretory
    i. Urinary and Reproductive (Urogenital)
6. Students shall demonstrate an understanding that science is a way of knowing.
7. Students shall design and safely conduct scientific inquiry.

Unit

1. **Orientation of the Human Body**
2. **Biochemistry/Cell**
3. **Histology (Tissues)**
4. **Integumentary (Skin and Accessory Structures)**
5. **Skeletal**
6. **Muscular**
7. **Nervous**
8. **Blood/Cardiovascular**
9. **Respiratory**
10. **Digestive**
11. **Urogenital (Urinary and Reproductive)**

Unit Outlines

1. Orientation of the Human Body

Standards:

- Students shall explore the organizational structures of the body from the simple (molecular) to the complex (organism) level.

Essential Question:

Students will be able to answer the following question(s):

- What is the relationship between anatomy and physiology including the major characteristics of life?
- How is the homeostasis of the body controlled?
- What are the levels of organization of the body?
- How can anatomical positional terms and body sections be applied?

Essential Knowledge:

- Distinguish between anatomy and physiology.
- Describe the anatomical position.
- Describe the three major planes of the body or of an organ.
- Identify the major body cavities and their subdivisions.
- Identify the serous membranes that line the walls and cover the organs of each body cavity and the fluid found inside each cavity.
- Describe two ways to subdivide the abdominal region.
- Identify the quadrants of the abdominopelvic cavity.
- Identify the nine abdominal regions.
- Describe the axial and appendicular regions of the body and their subdivisions.
- Use correct directional terms in the study of anatomy and physiology
- Describe the location of specific body organs
- Define and provide examples of homeostasis, negative and positive feedback systems
- Name the major body organ systems and state their major functions

- List and describe the essential functions required to maintain life
- List and explain the essential environmental factors required for sustaining life

2. Biochemistry/Cell

Standards:

- Students shall understand the role of chemistry in body processes.
- Students shall understand that cells are the basic, structural, and functional units of life.

Essential Question:

Students will be able to answer the following question(s):

- How is the physiology of matter related to the human body?
- How do the structure and function of organic molecules affect the human body?
- What are the parts of the cell and their function?

Essential Knowledge:

<u>Biochemistry</u>

- List the body's inorganic compounds and list some of their major functions
- Define pH and explain how the body maintains pH within the limits of homeostasis
- Explain the importance of water in living organisms
- Explain the importance of oxygen and carbon dioxide to living organisms
- Describe the body's major organic compound groups and describe their basic functions

<u>Cellular</u>

- List the components of the nucleus, and the basic function of each.
- Describe the structure, function and interrelationships between the endoplasmic reticulum, golgi apparatus, lysosome and secretory vesicles.
- Describe the structure and function of mitochondria.
- Describe the structure and function of the ribosome.
- Describe the structure and function of centrioles, cilia, flagella and microvilli.
- List the specialized junctions between the plasma membranes of some cells.
- Describe the role of proteins in transporting substances across the plasma membrane.

3. Histology

Standards:

- Students shall understand the tissues (histology) of the human body.

Essential Question:

Students will be able to answer the following question(s):

- How are the tissues of the body classified?
- How does the structure of the tissue influence its function and location?

Essential Knowledge:

- Identify the microscopic anatomy of body tissues
- List the four major tissue types
- Name epithelial tissues according to cell shape and arrangement
- Contrast the function and location of simple and stratified epithelia
- Distinguish between glandular epithelia classified as endocrine and exocrine
- Identify connective tissues based on appearance, location and function
- Identify muscle tissues based on appearance, location, function and nervous control
- Identify nervous tissue based on appearance, location and function
- Give examples of the locations of each tissue type in the body

4. Integumentary (Skin and the Accessory Structure)

Standards:

- Students shall describe the anatomy and physiology of the integumentary system.
- Students shall design and safely conduct scientific inquiry.

Essential Question:

Students will be able to answer the following question(s):

- What are the components of the physiological functions of the integument system?
- What are some of the associated disorders of the integument system?
- What is the effect of sunscreen on living organisms?

Essential Knowledge:

- Justify the classification of skin as both a cutaneous membrane and as an organ.
- Order the two layers of skin and the underlying region.
- Identify two main epidermal layers and describe their structure and function.
- Describe the events occurring during keratinization that produce a skin resistant to abrasion and water loss
- Explain the effects of ultraviolet radiation on the skin.
- Describe the structure and growth of hair and nails.
- Describe the glands of the skin, their secretions and the functions of these secretions, including surface film (acid mantle).
- Describe the structure of the dermis and identify the accessory structures of the dermis.
- Identify the tissue types within and the function of the subcutaneous region.
- List and explain four major functions of the skin.
- Describe how the integumentary system helps to regulate body temperature.
- Explain the way in which skin responds to injuries and repairs itself.

5. Skeletal

Standards:

- Students shall describe the anatomy and physiology of the Skeletal system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the skeletal system?
- What are associated disorders of the skeletal system?
- How is the homeostasis of the skeletal system controlled?

Essential Knowledge:

- Describe the general functions of the skeletal system.
- Classify bones according to their shapes and give examples of each.
- Describe the composition and organization of bone matrix.
- List the three types of bone cells and state the functions of each type.
- Compare the anatomy and function of compact and spongy bone.
- Explain ossification including (1) when it begins in development and (2) type types of tissue it replaces.
- Locate and identify the epiphyseal disks and explain the process of bone growth.
- Explain how and when bone remodeling occurs.
- Explain the role of bone in calcium homeostasis
- Describe the development of the skull including the location and function of fontanels.
- Describe the differences between the adult male and female skeletons.
- Identify and name the components of the axial and appendicular skeleton and their functions.
- Categorize vertebrae according to their location including cervical, thoracic, lumbar, sacral and coccygeal.
- Identify the major landmarks on individual bones of the skeleton.
- Identify three structural types of joints and relate structure to their function.
- Distinguish the functional descriptions of joints, including synarthrotic, amphiarthrotic and diarthrotic.
- Explain the structure of a typical synovial joint.

6. Muscular

Standards:

- Students shall describe the anatomy and physiology of the Muscular system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the muscular system?
- What are associated disorders of the muscular system?

Essential Knowledge:

- Describe the general characteristics and functions of muscle tissue.
- Compare the structure and function of skeletal, smooth, and cardiac muscle tissues and identify the location of each type.
- Describe the anatomy of a whole muscle

- List and explain the major functions of the muscular system
- Describe the microscopic anatomy of a muscle fiber and explain the role of actin and myosin.
- Describe the structure, location and function of a neuromuscular junction
- Describe the events of muscle cell contraction.
- Relate the origin and insertion of a muscle to its action.
- Identify the major human skeletal muscles and describe the action of each.

7. Nervous

Standards:

- Students shall describe the anatomy and physiology of the Nervous system.
- Students shall design and safely conduct scientific inquiry.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the nervous system?
- What are the disorders associated with the nervous system?
- How is the homeostasis of the nervous system controlled?
- How do the endocrine and nervous system control the human body?

Essential Knowledge:

- Describe the general functions of the nervous system
- Differentiate the structural and functional classifications of the nervous system.
- Distinguish a nerve from a neuron.
- Differentiate between the somatic and autonomic divisions based on their respective structures and functions
- Contrast the functions of the sympathetic and parasympathetic divisions of the autonomic nervous system
- Identify the parts of a neuron and correlate each part to its function in nerve impulse transmission.
- Explain the electrochemical process of a nerve impulse at the cell membrane, including polarization, depolarization and repolarization.
- Define action potential
- Describe the transmission of a nerve impulse at a synapse.
- Describe the process of a neural reflex.
- Explain how the brain and spinal cord are protected
- Identify the major regions and structures of the brain.
- Explain the role of white matter and gray matter in processing and relaying sensory and motor information
- Identify the lobes of the cerebrum
- Distinguish among the motor, sensory, and association areas of the cerebral cortex
- Describe the general functions of structures within the diencephalon including the thalamus, hypothalamus, pineal gland and pituitary gland.

- Describe the functions of structures within the brain stem including the midbrain, pons, medulla oblongata.
- Describe the functions of the cerebellum.
- Identify the principle sensory and motor pathways in the spinal cord.
- Classify nerves as sensory, motor or mixed nerves.
- Identify the cranial nerves and their functions

8. Blood/Cardiovascular

Standards:

- Students shall describe the anatomy and physiology of the Cardiovascular system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the cardiovascular system?
- What are the disorders associated with the cardiovascular system?
- How is the homeostasis of the cardiovascular system controlled?

Essential Knowledge:

<u>Blood</u>

- Describe the general characteristics and functions of blood
- Distinguish among the types and functions of the formed elements of the blood
- Describe the production, characteristics and function of erythrocytes, including site of production, life span and fate
- Explain the control of red blood cell production
- Describe the production, characteristics and function of each of the five types of leukocytes
- Describe the production, characteristics and function of thrombocytes
- Describe plasma including its composition
- Describe the normal values and significance of the following: RBC/WBC and platelet counts, hematocrit, hemoglobin, blood volume and blood pH
- Describe the basic mechanisms of hemostasis and coagulation
- Describe the basis for the ABO and Rh blood groups
- Explain the basis for blood group compatibility for transfusions

<u>Cardiovascular</u>

- Describe the location of the heart in the body
- Identify the names and locations of the major parts of the heart
- Explain the function(s) of each of the major parts of the heart
- Identify the heart valves and explain their function
- Relate the action of heart valves to heart sounds
- Name and describe the functional blood supply to the myocardium
- Trace electrical conduction through the heart and relate to the EKG
- Define systole and diastole and relate them to the cardiac cycle

- Describe control mechanisms for the heart, including nervous, hormonal, exercise and various ions
- Compare the structures and functions of arteries, capillaries and veins
- Identify the major arteries and veins of the body
- Define blood pressure and pulse
- List and briefly describe the factors that establish and affect blood pressure

9. Respiratory

Standards:

- Students shall describe the anatomy and physiology of the Respiratory system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the respiratory system?
- What are the disorders associated with the respiratory system?
- How is the homeostasis of the respiratory system controlled?

Essential Knowledge:

- Describe the general functions of the respiratory system
- Identify and name the organs of the respiratory passageway from the nasal cavity to the alveoli and describe the function of each
- Describe the protective mechanisms of the various parts of the respiratory system
- Describe the lungs and the pleural membranes within the pleural cavity
- Describe the mechanics of ventilation (pulmonary ventilation, inspiration & expiration)
- Describe the alveoli and relate their structure to their role in gas exchange
- Describe the role of surfactant within alveoli
- Describe the structures involved and the process of gas exchange from alveoli to blood (external respiration)
- Describe the transport of oxygen and carbon dioxide in blood
- Describe the structures involved and the process of gas exchange between blood and tissues (internal respiration)
- Name the parts of the brain that control and regulate ventilation
- Describe how carbon dioxide and oxygen levels in the blood affect the respiratory rate
- List and describe respiratory air volumes and capacities
- Briefly describe the process and explain the purpose of cellular respiration

10. Digestive

Standards:

- Students shall describe the anatomy and physiology of the Digestive system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the digestive system?
- What are the disorders associated with the digestive system?
- How is the homeostasis of the digestive system controlled?

Essential Knowledge:

- Describe the functions of the digestive system
- Identify and describe the general structure and organs of the alimentary canal and explain the major role of each in the digestive process
- Describe the site of production, the composition and function of gastric secretions
- Relate the location, structure and function of intestinal villi to their role in the digestive process
- Identify the accessory organs of the digestive system, including salivary glands, pancreas and liver and explain the role of each in the digestive process
- Describe the production, composition and function of exocrine pancreatic secretions.
- Describe the site of production, the composition and function of bile
- List the additional functions of the liver and the endocrine pancreas
- List the five major nutrient categories, including dietary sources and major cellular uses for each
- Describe the general mechanisms of control of the digestive system including nervous and hormonal
- Describe the mechanisms of mixing, peristalsis, swallowing, vomiting, and defecating

11. Urogenital (Urinary and Reproductive)

Standards:

- Students shall describe the anatomy and physiology of the urogenital system.

Essential Question:

Students will be able to answer the following question(s):

- What are the components and physiological mechanisms of the urogenital system?
- What are the disorders associated with the urogenital system?
- How is the homeostasis of the urogenital system controlled?

Essential Knowledge:

<u>Urinary</u>

- Describe general functions of the urinary system
- Locate and identify the organs of the urinary system
- Identify and name the gross anatomy of a cut kidney, including renal capsule, cortex, medulla, medullary pyramid, renal columns and calyces
- Identify the parts of the nephron and explain their role in urine production

- Explain the functional processes of urine formation, including filtration, reabsorption, and secretion
- Identify the normal components of urine.
- Recognize abnormal components of urine
- Describe the general structure and function of the ureters, bladder and urethra
- Compare the urethra in males and females
- Describe the role of the kidneys in maintaining fluid balance and the composition of body fluids
- Describe the action of antidiuretic hormone on the kidney

Reproductive

- Describe the general functions and common purpose of the male and female reproductive system
- Locate and identify the organs of the male reproductive system and describe the general function of each
- Locate and identify the organs of the female reproductive system and describe the general function of each
- Trace the pathway followed by a sperm from the testis out of the body
- List and explain the actions of pituitary gonadotropins on the testis
- Describe the site of testosterone production and list the actions that result from testosterone secretion
- Define oogenesis and state the end product of complete oogenesis
- Identify and name the major parts and layers of the uterus
- Define ovulation and trace the pathway of the secondary oocyte from the ovary out of the body
- List and explain the actions of pituitary gonadotropins on the ovary
- Name the major ovarian hormones and explain the way in which each controls uterine events in the female menstrual cycle
- List other actions that result from estrogen and progesterone