Curriculum Development
In the Fairfield Public Schools

FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

HUMAN ANATOMY & PHYSIOLOGY
STRUCTURE 30

Board of Education Approved 05/22/2007

HUMAN ANATOMY & PHYSIOLOGY – STRUCTURE 30

Statement of Purpose

Science education promotes essential understandings of the natural world and nurtures students' abilities to apply scientific knowledge to make informed and logical judgments about personal and societal issues. As such, this education requires that the fundamental approach to science be a creative and logical process for investigating, reasoning, critiquing and communicating about ideas, not just a static body of facts to be memorized. Understanding the interconnections between science and technology and their shared impact on the environment and societal issues is essential for all students.

This elective course provides an introductory treatment of the structure and function of the human body for students who have already completed a first course in general biology. This knowledge is critical for students when making personal decisions that affect their health and the health of their families.

Audience

Grade 11 and 12

Prerequisites

Successful completion of four (4) credits of science including Biology.

Design and Description

This second-year course in biology emphasizes the workings of the human body. The course is offered in the fall semester and meets six (6) periods per week including one double lab period. This course provides an introductory treatment of the structure and function of the human body for the following topics: anatomical terminology; tissues; skeletal system; muscular system; nervous system; special senses; and endocrine system. Each topic is approached from simple to increasingly complex levels, where an understanding of concepts is emphasized rather than mere memorization. Students are encouraged to work both independently and in cooperative groups within the lab/classroom with teacher guidance.

Course Objectives

Students will be able to:

- define the principle of complementarities in anatomy and physiology.
- sequence the levels of structural organization that make up the human body.
- analyze the major functions of each organ system predict the importance of homeostasis in maintaining normal life.
- compare and contrast carbohydrates, lipids, proteins, and nucleic acids in terms of their building blocks, structures, and functions in the body.
- define the four major tissue types, their chief subcategories, and their locations throughout the body.
- identify the functions of the skin.
- analyze the functions of each type of membrane – cutaneous, mucous, serous and synovial.
- define the function of melanin and its role in skin color determination.

- summarize the characteristics of different types of skin cancer.
- define the relative functions of the major regions of the skeleton.
- compare and contrast the structure of the four bone classes and provide examples of each class.
- identify the five functions of bone.
- compare and contrast the histology of compact and spongy bone.
- analyze the chemical composition of bone and the relative advantages conferred by its organic and inorganic components.
- trace the process of bone remodeling including the role of osteoblasts, osteocytes and osteoclasts.
- analyze common disorders that affect the skeletal system.
- trace the development of the skull and face from fetal life through adulthood.
- discuss the importance of the spinal curvatures and intervertebral discs in normal and abnormal physiology.
- classify joints structurally and functionally.
- compare and contrast tendons and ligaments.
- illustrate the common body movements relative to the joints at which those movements occur.
- identify the symptoms and problems associated with each of the most common joint injuries.
- compare and contrast the common types of arthritis.
- compare and contrast the basic types of muscle tissue.
- diagram the gross structure of a skeletal muscle.
- analyze the sliding filament mechanism of muscle contraction.
- differentiate between isotonic and isometric contractions.
- summarize ways in which ATP is regenerated during muscle activity.
- distinguish between fast twitch and slow twitch muscle fibers.
- compare and contrast the effects of aerobic exercise and resistance exercise on muscles.
- identify the causes of atrofication.
- categorize the structural and functional divisions of the nervous system.
- classify neurons structurally and functionally.
- trace the events that lead to the generation of a nerve impulse and its conduction from one neuron to another.
- distinguish between excitatory and inhibitory postsynaptic transmission.
- identify several classes of neurotransmitter.
- summarize the functions of the major regions of the cerebral hemispheres, diencephalon, brain stem and cerebellum.
- summarize how meninges, cerebrospinal fluid, and the blood-brain barrier protect the CNS.
- differentiate between the sympathetic and parasympathetic divisions of the ANS.
- define the “fight/flight” response and the resumption to the resting state.
- analyze the causes, signs, and consequences of some of the accidental and congenital conditions affecting the nervous system.

- trace the pathway of light through the eye to the retina and explain how light is focused for close and distant vision.
- outline how sound waves are translated into nerve impulses that distinguish pitch.
- articulate the role of the semicircular canals and the vestibule in maintaining balance.
- trace the changes that occur in the sensory system with age.
- relate the anatomical and physiological changes that occur in the development of such disorders like: cataracts, glaucoma, macular degeneration, myopia, hyperopia and the like.
- differentiate between sensorineural deafness and conduction deafness.

Skill Objectives

Students will:

- diagram the correct anatomical planes and positions of the body.
- diagram major body cavities.
- identify the tissues of the body by looking at prepared slides under a microscope.
- diagram how the various transport processes account for the directional movements of specific substances across the plasma membrane.
- identify the following skin structures: epidermis, dermis, hair follicle, sebaceous gland and sweat gland.
- point out the major bones of the human skeleton.
- differentiate the areas that contain the axial and the appendicular skeleton.
- draw the general structure of the vertebral column.
- identify components of the male vs. female skeleton.
- identify types of joints using models.
- identify arthritis using models/diagrams.
- use models to identify location of each type of muscle.
- identify the action, origin and insertion of selected major muscle groups in the body.
- use models to identify different regions of the brain, CNS, and ANS.
- classify general sensory receptors by structure, stimulus detected, and body location.
- identify the location, structure, and function of the olfactory and gustatory receptors.

Biology Enrichment Standards

Cell Biology

The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

Cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

The nervous system mediates communication between different parts of the body and the body's interactions with the environment.

Feedback loops in the nervous and endocrine systems regulate conditions in the body.

The neurons transmit electrochemical impulses.

Sensory neurons, interneurons and motor neurons all have a role in sensation, thought and response.

Actin, myosin, Ca2 and ATP have a role in the cellular and molecular basis of muscle contraction.

Organisms have a variety of mechanisms to combat disease.

The skin provides nonspecific defenses against infection.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the various ways the parts of the human body can be identified?
- What are the major components of the human body?
- What are the various ways the parts of the human body can be identified?
- What are the major components of the human body?
- What role does our skin play in our health?
- How is skin color determined?
- What are some disorders of the skin?
- What are the types of bone in the human body?
- How is bone made?
- What are some common problems with the skeleton?
- How do our joints work?
- What are the different types of joints?
- What are some common joint problems?
- What are the different types of muscles?
- Can we control all of our muscles?
- How do muscles help us move?
- What are the types of nerves?
- What do nerves do?
- How do nerves communicate?
- How do our senses send our brain information?

UNITS of STUDY

Unit 1: An Orientation to the Human Body

Biology Enrichment Standards

Cell Biology

The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

Cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the various ways the parts of the human body can be identified?
- What are the major components of the human body?

Core Topics

- Levels of structural organization
- Major organ systems
- Tissue types and locations

Unit Objectives

Students will be able to:

- define the principle of complementarities in anatomy and physiology.
- sequence the levels of structural organization that make up the human body.
- analyze the major functions of each organ system predict the importance of homeostasis in maintaining normal life.
- compare and contrast carbohydrates, lipids, proteins, and nucleic acids in terms of their building blocks, structures, and functions in the body.

Skill Objectives

Students will:

- diagram the correct anatomical planes and positions of the body.
- diagram major body cavities.

Sample Assessment

Utilization of directional terms in identification of major organs of the body

Pacing

2 weeks

Unit 2: Histology – Body Tissues

Biology Enrichment Standards

Cell Biology

The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.

Cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the various ways the parts of the human body can be identified?
- What are the major components of the human body?

Core Topics

- Tissue types and locations

Unit Objective

Students will be able to:

- define the four major tissue types, their chief subcategories, and their locations throughout the body.

Skill Objectives

Students will:

- identify the tissues of the body by looking at prepared slides under a microscope.
- diagram how the various transport processes account for the directional movements of specific substances across the plasma membrane.

Sample Assessment

Tissue identification practical exam

Pacing

2 weeks

Unit 3: Integumentary System

Biology Enrichment Standards
Physiology
Organisms have a variety of mechanisms to combat disease.

The skin provides nonspecific defenses against infection.

Essential Question
- How are organisms structured to ensure efficiency and survival?

Focus Questions
- What role does our skin play in our health?
- How is skin color determined?
- What are some disorders of the skin?

Core Topics
- Skin's protective characteristics
- Types of body membranes
- Skin cancer
- Burns

Unit Objectives
Students will be able to:
- identify the functions of the skin.
- analyze the functions of each type of membrane – cutaneous, mucous, serous and synovial.
- define the function of melanin and its role in skin color determination.
- summarize the characteristics of different types of skin cancer.

Skill Objectives
Students will:
- identify the following skin structures: epidermis, dermis, hair follicle, sebaceous gland and sweat gland.

Sample Assessment
Identification of skin layers and accessory structures

Pacing
2 weeks

Unit 4: The Skeletal System

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

Actin, myosin, Ca^{+2} and ATP have a role in the cellular and molecular basis of muscle contraction.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the types of bone in the human body?
- How is bone made?
- What are some common problems with the skeleton?

Core Topics

- Four bone types
- Functions of bone
- Bone formation
- Bone disorders

Unit Objectives

Students will be able to:

- define the relative functions of the major regions of the skeleton.
- compare and contrast the structure of the four bone classes and provide examples of each class.
- identify the five functions of bone.
- compare and contrast the histology of compact and spongy bone.
- analyze the chemical composition of bone and the relative advantages conferred by its organic and inorganic components.
- trace the process of bone remodeling including the role of osteoblasts, osteocytes and osteoclasts.
- analyze common disorders that affect the skeletal system.
- trace the development of the skull and face from fetal life through adulthood.
- discuss the importance of the spinal curvatures and intervertebral discs in normal and abnormal physiology.

Skill Objectives

Students will:

- point out the major bones of the human skeleton.
- differentiate the areas that contain the axial and the appendicular skeleton.

- draw the general structure of the vertebral column.
- identify components of the male vs. female skeleton.

Sample Assessment
Bones, Bones, Bones

Pacing
2 weeks

Unit 5: Articulations

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

Actin, myosin, Ca^{+2} and ATP have a role in the cellular and molecular basis of muscle contraction.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- How do our joints work?
- What are the different types of joints?
- What are some common joint problems?

Core Topics

- Types of joints
- Connective tissues
- Disorders of joints

Unit Objectives

Students will be able to:

- classify joints structurally and functionally.
- compare and contrast tendons and ligaments.
- illustrate the common body movements relative to the joints at which those movements occur.
- identify the symptoms and problems associated with each of the most common joint injuries.
- compare and contrast the common types of arthritis.

Skill Objectives

Students will:

- identify types of joints using models.
- identify arthritis using models/diagrams.

Sample Assessment

Dissection and identification of structures of a large joint (eg. Beef flank)

Pacing

2 weeks

Unit 6: Muscular System

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

Actin, myosin, Ca^{+2} and ATP have a role in the cellular and molecular basis of muscle contraction.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the different types of muscles?
- Can we control all of our muscles?
- How do muscles help us move?

Core Topics

- Types of muscle
- Mechanisms of muscle contraction
- Energy for muscle movement
- Muscle atrophy

Unit Objectives

Students will be able to:

- compare and contrast the basic types of muscle tissue.
- diagram the gross structure of a skeletal muscle.
- analyze the sliding filament mechanism of muscle contraction.
- differentiate between isotonic and isometric contractions.
- summarize ways in which ATP is regenerated during muscle activity.
- distinguish between fast twitch and slow twitch muscle fibers.
- compare and contrast the effects of aerobic exercise and resistance exercise on muscles.
- identify the causes of atrofication.

Skill Objectives

Students will:

- use models to identify location of each type of muscle.
- identify the action, origin and insertion of selected major muscle groups in the body.

Sample Assessment

Muscle identification test including location, insertion, origin and action

Pacing
3 weeks

Unit 7: Nervous System

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

The nervous system mediates communication between different parts of the body and the body's interactions with the environment.

Feedback loops in the nervous and endocrine systems regulate conditions in the body.

The neurons transmit electrochemical impulses.

Sensory neurons, interneurons and motor neurons all have a role in sensation, thought and response.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- What are the types of nerves?
- What do nerves do?
- How do nerves communicate?

Core Topics

- Generation of nerve impulses
- Parts of the brain
- Central nervous system vs. Autonomic nervous system
- Disorders of the nervous system

Unit Objectives

Students will be able to:

- categorize the structural and functional divisions of the nervous system.
- classify neurons structurally and functionally.
- trace the events that lead to the generation of a nerve impulse and its conduction from one neuron to another.
- distinguish between excitatory and inhibitory postsynaptic transmission.
- identify several classes of neurotransmitter.
- summarize the functions of the major regions of the cerebral hemispheres, diencephalon, brain stem and cerebellum.
- summarize how meninges, cerebrospinal fluid, and the blood-brain barrier protect the CNS.
- differentiate between the sympathetic and parasympathetic divisions of the ANS.

- define the “fight/flight” response and the resumption to the resting state.
- analyze the causes, signs, and consequences of some of the accidental and congenital conditions affecting the nervous system.

Skill Objective

Students will:

- use models to identify different regions of the brain, CNS, and ANS.

Sample Assessment

Cranial Nerves lab

Pacing

2 weeks

Unit 8: The Sensory System

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

Sensory neurons, interneurons and motor neurons all have a role in sensation, thought and response.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How do our senses send our brain information?

Core Topics

- major sensory organs
- mechanisms of communication through nerves
- disorders of the senses

Unit Objectives

Students will be able to:

- trace the pathway of light through the eye to the retina and explain how light is focused for close and distant vision.
- outline how sound waves are translated into nerve impulses that distinguish pitch.
- articulate the role of the semicircular canals and the vestibule in maintaining balance.
- trace the changes that occur in the sensory system with age.
- relate the anatomical and physiological changes that occur in the development of such disorders like: cataracts, glaucoma, macular degeneration, myopia, hyperopia and the like.
- differentiate between sensorineural deafness and conduction deafness.

Skill Objectives

Students will:

- classify general sensory receptors by structure, stimulus detected, and body location.
- identify the location, structure, and function of the olfactory and gustatory receptors.

Sample Assessment

Sense activity lab

Pacing

2 weeks

Unit 9: First Aid Training
(optional unit based on teacher certification through Red Cross)

Students may be offered the opportunity to attain certification through the American Red Cross in First Aid if the teacher is a certified Red Cross Instructor.

Pacing
1 week