Curriculum Development
In the Fairfield Public Schools

FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

HUMAN ANATOMY & PHYSIOLOGY
MAINTENANCE 30

Board of Education Approved 05/22/2007

HUMAN ANATOMY & PHYSIOLOGY – MAINTENANCE 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

Prerequisite

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 spring 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, metabolism and nutrition, the digestive and respiratory systems, the cardiovascular and immune systems, and the excretory 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. A major research paper in which students analyze their own diets with regard to established RDA's is required.

Course Objectives

Students will be able to:

- trace the pathway of blood throughout the body as it passes through the four chambers of the human heart.
- identify the heart valves and describe their location, function, and mechanism of operation.
- trace the conduction pathway of the heart and describe the events of cardiac muscle contraction that results.
- outline the timing and events of the cardiac cycle (systole and diastole).
- compare and contrast the structure and function of arteries, veins, and capillaries.
- define vasoconstriction and vasodilation as they regulate blood flow into capillary beds.

- identify fetal vascular modifications, or “fetal shunts,” and describe their function before birth.
- distinguish cardiovascular-related disorders, including their symptoms, prevention, and control.
- outline the composition, physical characteristics, and functions of whole blood.
- differentiate among the functions of each of the formed elements of blood and plasma.
- differentiate between fetal and adult hemoglobin.
- relate the basis for a transfusion reaction based upon ABO and Rh blood groups.
- outline the mechanism of blood-clotting and some factors that may affect clotting time.
- analyze the importance of blood testing as a diagnostic tool.
- identify blood-related disorders, including their symptoms, prevention, and control.
- relate the function of the lymphatic system to the cardiovascular and immune systems.
- relate the distribution of lymph nodes and vessels to the point of entry of foreign bodies.
- define the composition of lymph and explain its formation and transport through lymph nodes and lymph organs.
- summarize the body’s three lines of defense against pathogens
- compare and contrast the development and function of T-lymphocytes and B-lymphocytes.
- analyze the structure of an antibody in terms of genetic recombination.
- distinguish between active and passive immunity as well as between natural and artificial immunity.
- compare immunodeficiencies, allergies, and autoimmune diseases.
- define the structure and function of each respiratory organ.
- differentiate among cellular respiration, external respiration, internal respiration, pulmonary ventilation, expiration, and inspiration.
- trace how the respiratory muscles can cause volume changes that lead to air flow into and out of the lungs.
- summarize the process of gas exchanges in the lungs and tissues by applying the gas laws.
- compare and contrast how oxygen and carbon dioxide are transported in the blood.
- compare the causes and consequences of chronic bronchitis, emphysema, asthma, and lung cancer.
- summarize the overall function of the digestive system and differentiate between organs of the alimentary canal and accessory digestive organs.
- differentiate between mechanical/physical digestion and chemical digestion and where each process occurs in the alimentary canal.
- outline the general activities of each digestive system organ.
- differentiate between deciduous and permanent teeth

- outline the mechanisms of chewing, swallowing, choking, peristalsis, absorption, vomiting, and defecation.
- define the composition, origin, and activity of each of the major digestive juices.
- define the function of the villus in normal and abnormal digestive processes.
- identify digestion-related disorders, including their symptoms, prevention, and control.
- identify the six major nutrient categories, noting the important dietary sources, energy content, and principle cellular uses of each.
- define enzyme, metabolism, anabolism, and catabolism.
- analyze the importance of energy balance and basal metabolic rate (BMR) Distinguish between fat- and water-soluble vitamins and describe consequences of their deficit or excess.
- summarize the need for protein synthesis in body cells and the supply of dietary amino acids from complete and incomplete proteins.
- compare and contrast saturated and unsaturated fatty acids and the consequences of their deficit or excess.
- differentiate between LDLs and HDLs relative to their structures and major roles in the body.
- identify the following regions of a longitudinal section of the kidney: hilus, cortex, medulla, medullary pyramids, calyces, pelvis, and renal columns.
- trace the process of urine formation, identifying the areas of the nephron that are responsible for filtration, reabsorption, and secretion.
- trace the blood supply through the kidney and describe the changes in its composition along the way.
- analyze the role of antidiuretic hormone (ADH) in the maintenance of water homeostasis.

Skill Objectives

Students will:

- analyze ECG result to determine normal and abnormal rhythms.
- measure systolic and diastolic pressure using a sphygmomanometer.
- perform a complete blood count using prepared blood smears.
- analyze a complete blood count.
- identify the organs forming the respiratory passageway from the nasal cavity to the alveoli of the lungs.
- use a spirometer to measure tidal volume, expiratory reserve volume and vital capacity.

Biology 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.

Most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

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 complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Digestion includes the secretion of stomach acid, digestive enzymes (amylases, proteases, nucleases, lipases) and bile salts into the digestion system.

The kidneys have a homeostatic role in the removal of nitrogenous wastes from the blood.

The liver has a homeostatic role in detoxification and keeping the blood glucose balance.

Organisms have a variety of mechanisms to combat disease.

Antibodies have a role in the body's response to infection.

Vaccination protects an individual from infectious diseases.

There are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.

An individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.

Phagocytes, B-lymphocytes and T-lymphocytes have a role in the immune system.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- How do our bodies provide oxygen and nutrients to all cells?
- How does blood deliver materials through the cardiovascular system?
- How does our body protect itself from foreign invaders?
- How do internal cells exchange vital gases with the environment?
- How can the human digestive system be viewed as a "disassembly line"?
- Where does the energy for our bodies come from?
- How does the urinary system function as the body's sanitation system?

UNITS of STUDY

Unit 1: The Cardiovascular System

Biology 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 complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Questions

- How do our bodies provide oxygen and nutrients to all cells?

Core Topics

- Heart valves and chambers
- Electric impulses in the heart
- Structure/function of arteries, veins and capillaries
- Fetal shunts
- Cardiac disorders

Unit Objectives

Students will be able to:

- trace the pathway of blood throughout the body as it passes through the four chambers of the human heart.
- identify the heart valves and describe their location, function, and mechanism of operation.
- trace the conduction pathway of the heart and describe the events of cardiac muscle contraction that results.
- outline the timing and events of the cardiac cycle (systole and diastole).
- compare and contrast the structure and function of arteries, veins, and capillaries.
- define vasoconstriction and vasodilation as they regulate blood flow into capillary beds.
- identify fetal vascular modifications, or "fetal shunts," and describe their function before birth.
- distinguish cardiovascular-related disorders, including their symptoms, prevention, and control.

Skill Objectives

Students will:

- analyze ECG result to determine normal and abnormal rhythms.

- measure systolic and diastolic pressure using a sphygmomanometer.

Sample Assessment
Parts of the circulatory system and their functions

Pacing
3 weeks

Unit 2: Blood

Biology 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 complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How does blood deliver materials through the cardiovascular system?

Core Topics

- Blood components
- Blood types
- Clotting mechanisms
- Blood disorders

Unit Objectives

Students will be able to:

- outline the composition, physical characteristics, and functions of whole blood.
- differentiate among the functions of each of the formed elements of blood and plasma.
- differentiate between fetal and adult hemoglobin.
- relate the basis for a transfusion reaction based upon ABO and Rh blood groups.
- outline the mechanism of blood-clotting and some factors that may affect clotting time.
- analyze the importance of blood testing as a diagnostic tool.
- identify blood-related disorders, including their symptoms, prevention, and control.

Skill Objective

Students will:

- perform a complete blood count using prepared blood smears.

Sample Assessment

Identify blood type and determine cross-reactions between blood types

Pacing

2 weeks

Unit 3: The Lymphatic System and Immunity

Biology Standards

Physiology

Organisms have a variety of mechanisms to combat disease.

Antibodies have a role in the body's response to infection.

Vaccination protects an individual from infectious diseases.

There are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.

An individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.

Phagocytes, B-lymphocytes and T-lymphocytes have a role in the immune system.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How does our body protect itself from foreign invaders?

Core Topics

- Components of the lymphatic system
- Immune cells
- Types of immunity
- Vaccination

Unit Objectives

Students will be able to:

- relate the function of the lymphatic system to the cardiovascular and immune systems.
- relate the distribution of lymph nodes and vessels to the point of entry of foreign bodies.
- define the composition of lymph and explain its formation and transport through lymph nodes and lymph organs.
- summarize the body's three lines of defense against pathogens
- compare and contrast the development and function of T-lymphocytes and B-lymphocytes.
- analyze the structure of an antibody in terms of genetic recombination.
- distinguish between active and passive immunity as well as between natural and artificial immunity.

- compare immunodeficiencies, allergies, and autoimmune diseases.

Skill Objective
Students will:
- analyze a complete blood count.

Sample Assessment
Genetics of antibody diversity

Pacing
2.5 weeks

Unit 4: The Respiratory System

Biology 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 complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How do internal cells exchange vital gases with the environment?

Core Topics

- Respiratory organ structure and function
- Types of respiration
- Pressure/volume relationships in breathing
- Gas transport
- Respiratory disorders

Unit Objectives

Students will be able to:

- define the structure and function of each respiratory organ.
- differentiate among cellular respiration, external respiration, internal respiration, pulmonary ventilation, expiration, and inspiration.
- trace how the respiratory muscles can cause volume changes that lead to air flow into and out of the lungs.
- summarize the process of gas exchanges in the lungs and tissues by applying the gas laws.
- compare and contrast how oxygen and carbon dioxide are transported in the blood.
- compare the causes and consequences of chronic bronchitis, emphysema, asthma, and lung cancer.

Skill Objectives

Students will:

- identify the organs forming the respiratory passageway from the nasal cavity to the alveoli of the lungs.
- use a spirometer to measure tidal volume, expiratory reserve volume and vital capacity.

Sample Assessment

Role of carbon dioxide

Pacing
2 weeks

Unit 5: The Digestive System

Biology 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.

Digestion includes the secretion of stomach acid, digestive enzymes (amylases, proteases, nucleases, lipases) and bile salts into the digestion system.

The liver has a homeostatic role in detoxification and keeping the blood glucose balance.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How can the human digestive system be viewed as a "disassembly line"?

Core Topics

- Digestive system components
- Mechanical vs. chemical digestion
- Digestive juices
- Digestive disorders

Unit Objectives

Students will be able to:

- summarize the overall function of the digestive system and differentiate between organs of the alimentary canal and accessory digestive organs.
- differentiate between mechanical/physical digestion and chemical digestion and where each process occurs in the alimentary canal.
- outline the general activities of each digestive system organ.
- differentiate between deciduous and permanent teeth
- outline the mechanisms of chewing, swallowing, choking, peristalsis, absorption, vomiting, and defecation.
- define the composition, origin, and activity of each of the major digestive juices.
- define the function of the villus in normal and abnormal digestive processes.
- identify digestion-related disorders, including their symptoms, prevention, and control.

Sample Assessment

Enzymatic breakdown of nutrients

Pacing

2.5 weeks

Unit 6: Nutrition and Metabolism

Biology 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.

Most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- Where does the energy for our bodies come from?

Core Topics

- Major nutrient types
- BMR
- Building blocks of protein synthesis

Unit Objectives

Students will be able to:

- identify the six major nutrient categories, noting the important dietary sources, energy content, and principle cellular uses of each.
- define enzyme, metabolism, anabolism, and catabolism.
- analyze the importance of energy balance and basal metabolic rate (BMR) Distinguish between fat- and water-soluble vitamins and describe consequences of their deficit or excess.
- summarize the need for protein synthesis in body cells and the supply of dietary amino acids from complete and incomplete proteins.
- compare and contrast saturated and unsaturated fatty acids and the consequences of their deficit or excess.
- differentiate between LDLs and HDLs relative to their structures and major roles in the body.

Skill Objective

Students will:

- compare their personal nutritional needs with their actual nutritional intake.

Sample Assessment

Food nutrients testing

Pacing

2 weeks

Unit 7: Excretory System

Biology 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 kidneys have a homeostatic role in the removal of nitrogenous wastes from the blood.

Essential Question

- How are organisms structured to ensure efficiency and survival?

Focus Question

- How does the urinary system function as the body's sanitation system?

Core Topics

- Kidney structure
- Waste removal through urine formation
- Water homeostasis

Unit Objectives

Students will be able to:

- identify the following regions of a longitudinal section of the kidney: hilus, cortex, medulla, medullary pyramids, calyces, pelvis, and renal columns.
- trace the process of urine formation, identifying the areas of the nephron that are responsible for filtration, reabsorption, and secretion.
- trace the blood supply through the kidney and describe the changes in its composition along the way.
- analyze the role of antidiuretic hormone (ADH) in the maintenance of water homeostasis.

Skill Objectives

Students will:

- illustrate the gross anatomy of the kidneys, ureters, urinary bladder, and urethra.
- diagnose normal and abnormal simulated urine samples.

Sample Assessment

Urinalysis lab

Pacing

1 week

Unit 8: CPR and AED 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 CPR if the teacher is a certified Red Cross Instructor.

Pacing

1 week