Course Description

Students examine the interactions of human body systems as they explore identity, power, movement, protection, and homeostasis. Students design experiments, investigate the structures and functions of the human body, and use data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration. Exploring science in action, students build organs and tissues on a skeletal manikin, work through interesting real world cases and often play the roles of biomedical professionals to solve medical mysteries. This course is designed for 10th, 11th, 12th grade students.

Scope And Sequence

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<td>1. English Language Arts within Science and Technology Content</td>
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Course Rationale

Throughout Human Body Systems, students acquire strong teamwork and communication practices, and develop organizational, critical-thinking, and problem-solving skills. Along the way students investigate a variety of careers in biomedical sciences. This course complements traditional science courses and can serve as the foundation for STEM-centered of specialized academies. The course is designed to prepare students to pursue a post-secondary education and careers in the biomedical sciences.

Enduring Understandings

1. The human body is made up of complex systems functioning together to maintain homeostasis.
2. Communication between body systems is crucial to maintaining homeostasis.
3. The human body is powered by the food we consume, the water that we drink and the air that we breathe.
4. The body uses high energy molecules such as a creatine phosphate, glycogen and glucose to supply ATP to working muscle.
5. Human body systems work together to defend against disease and injury and to maintain health and wellness.

Course Details

Unit: Identity

Duration: 3 Week(s)

Unit Overview

This unit focuses on identifying functions and anatomical organizations of humans.

Enduring Understandings

1. Similarities in function and anatomical organization allow for unity and identification of humans from other species.

Essential Questions

How do similarities in function and anatomical organization allow for unity and identification of humans from other species?

Example Assessment Items

Using a model diagram the relationship between multiple human body systems.

Analyze bones through manipulation to determine a person's age, gender, age and ethnicity.

Using gel electrophoresis and analyze the resulting restriction fragment length polymorphisms (RFLPs) to link a missing person with skeletal remains.
Description
1. The human body is made up of complex systems functioning together to maintain homeostasis.
2. Similarities in function and overall anatomical organization unite and identify all humans.
3. Directional terms describe the position of anatomical structures in relation to other structures or locations in the body and regional terms specify specific anatomical landmarks on the body.

Learning Targets
The student will research interesting facts about the human body and identify the systems and structures involved in these facts.
The student will display information about human body systems using graphic organizers.
The student will diagram the relationship between multiple human body systems.
The student will design a visual system that demonstrates correct use of directional and regional terms.

Topic: Identity: Tissues  Duration: 6 Day(s)

Description
1. The structure and distribution of tissues in the body contribute to human identity.
2. A tissue is a group of similar cells designed to carry out a specific function.
3. The 206 bones of the human skeletal system protect the body’s internal organs while allowing for movement and great range of mobility.
4. The specific structure of bone reveals information about a person’s gender, stature, age and ethnicity.

Learning Targets
The student will view prepared slides of human tissue and compare and contrast the structure and function of various types.
The student will build muscles and fat of the face on a skeletal model to explore personal identity.
The student will identify and locate bones of the human skeletal system.
The student will analyze bones to determine a person’s gender, age, stature and ethnicity.
The student will derive a mathematical equation to determine height of an individual using the length of long bone.

Topic: Identity: Molecules and Cells  Duration: 5 Day(s)

Description
1. Cells contain chromosomes, structures that house genes and ultimately code for traits.
2. Human DNA is a unique code of over three billion base pairs that provides a genetic blueprint of an individual.
3. Restriction enzymes recognize and cut specific sequences in DNA.
4. Gel electrophoresis separates DNA fragments based on size and is used in Restriction Fragment Length Polymorphism (RFLP) analysis.
5. Both physical characteristics and behavioral characteristics can be used to confirm or authenticate identity.

Learning Targets
The student will digest DNA samples using two different restriction enzymes.
The student will run gel electrophoresis and analyze the resulting restriction fragment length polymorphisms (RFLPs) to link a missing person with skeletal remains.
The student will evaluate current technology used to verify and protect identity and design a biometrics plan specific to a real-world situation.
The student will read an interview with a forensic anthropologist and write an interview with a DNA analyst.

Unit: Communication  Duration: 4 Week(s)
HS Human Body Systems
Science
Grade(s) 10th - 12th, 1 Credit
Elective Course

Unit Overview
This unit address how the human body communicates with itself and the outside world.

Enduring Understandings
1. The brain receives stimuli from the outside world, interprets this information and generates an appropriate response.
2. Human body systems depend upon electricity as a means of sending messages between and within systems.
3. The endocrine system uses hormones to signal and communicate information to the rest of the body.

Essential Questions
How does the brain receive stimuli from the outside world, interpret that information and generate appropriate responses?

How do human body systems use electricity to send messages between and within systems?

How does the endocrine system signal and communicate information to the rest of the body?

Example Assessment Items
Design a "brain map" that links regions of the brain with specific human actions, emotions, personality traits or functions.
Produce a flow chart that outlines what goes on in the body from an initial stimulus to a response.
Analyze physical symptoms of a patient and relate these symptoms to errors in chemical communication.

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<thead>
<tr>
<th>Topic: The Brain</th>
<th>Duration: 4 Day(s)</th>
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<tbody>
<tr>
<td>Description</td>
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<tr>
<td>1. Communication between body systems is crucial to maintaining homeostasis.</td>
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<tr>
<td>2. The two main subdivisions of the nervous system are the central nervous system (CNS), brain and spinal cord, and the peripheral nervous system (PNS), all nervous tissues outside the brain and spinal cord.</td>
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<tr>
<td>3. The brain receives stimuli from the outside world, interprets this information and generates an appropriate response.</td>
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<td>4. Each region within the brain helps control and regulate specific functions in the body.</td>
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<table>
<thead>
<tr>
<th>Learning Targets</th>
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<tbody>
<tr>
<td>The student will identify types of communication that occur inside the human body.</td>
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<tr>
<td>The student will build components of the central nervous system on a skeletal model.</td>
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<td>The student will identify major regions of the human brain.</td>
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<tr>
<td>The student will design a &quot;brain map&quot; that links regions of the brain with specific human actions, emotions, personality traits or functions.</td>
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<td>The student will investigate the history of brain mapping technology, including the mapping of the motor cortex and the language centers of the brain.</td>
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<thead>
<tr>
<th>Topic: Electrical Communication</th>
<th>Duration: 7 Day(s)</th>
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<tr>
<td>Description</td>
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<tr>
<td>1. Human body systems depend upon electricity as a means of sending messages between and within systems.</td>
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<tr>
<td>2. The nervous system relies on specialized cells called neurons to pass signals to and from the brain and spinal cord.</td>
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<td>3. Neurons convey information using electrical and chemical signals.</td>
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<td>4. An action potential is an electrical signal that is generated by the movement of ions across the cell membrane of a neuron.</td>
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<td>5. The body’s reaction time to reflex and voluntary actions is related to the degree of processing in the nervous system.</td>
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<td>6. Errors in electrical communication can impact homeostasis in the human body.</td>
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<tr>
<th>Learning Targets</th>
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<tr>
<td>The student will construct a 3D, labeled model of a neuron.</td>
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<tr>
<td>The student will produce a flow chart that outlines what goes on in the body from an initial stimulus to a response.</td>
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<tr>
<td>The student will use an interactive website to manipulate ions in a membrane and generate an action potential in a neuron.</td>
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<td>The student will complete a laboratory investigation using data acquisition software and probes to explore reflexes in the human body.</td>
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<td>The student will design an experiment to test factors that could impact reaction time.</td>
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<td>The student will analyze a case study, relate disease to an error in communication and create a presentation of findings.</td>
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<tr>
<td>The student will use models from activities in the unit to demonstrate how an error in communication occurs and affects the function of other body systems.</td>
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<th>Topic: Chemical Communication</th>
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Course Summary
Park Hill, MO
04/21/2015 01:46 PM
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HS Human Body Systems

Science

Description
1. The endocrine system helps the body communicate through the use of chemical signals called hormones.
2. Hormones interact with receptors on the cell membrane or inside the cell to bring about change in a target organ.
3. Endocrine glands secrete substances directly into the bloodstream while exocrine glands secrete their products through ducts into body cavities.
4. Hormones help maintain homeostasis through feedback loops.
5. A hormone imbalance can lead to disease or dysfunction.

Learning Targets
The student will produce a concept map for the endocrine system.
The student will design a feedback loop that shows how the body maintains proper blood glucose levels.
The student will create an evidence board with a team and use this board to solve a medical mystery.
The student will analyze physical symptoms of a patient and relate these symptoms to errors in chemical communication.

Topic: Communication with the Outside World

Description
1. The human eye converts light into a stream of nerve signals to be interpreted by the brain.
2. The structures within the human eye work to focus and process light.
3. The eye allows perception of color, depth, brightness, and optical illusions.
4. Problems with focusing light in the eye can be corrected with lenses.
5. Errors in the structure and function of the eye can lead to minor problems in acuity or debilitating disease and dysfunction.

Learning Targets
The student will dissect a cow eye to observe key structures.
The student will diagram the path of light as it enters the eyes and travels to the brain for processing.
The student will evaluate visual perception by testing depth perception, peripheral vision, color vision, and visual acuity.
The student will use a model of the human eye to simulate normal vision, as well as myopia and hyperopia.
The student will experiment with lenses to correct problems in vision.
The student will edit digital images to show how the world looks to people with various eye conditions or simulate vision disorders using modified glasses.
The student will write a reflection about what life would be like with a vision disease or disorder.
The student will design an informative handout that explains the tests and procedures in an eye exam.
The student will research careers in the field of vision.

Unit: Power

Unit Overview
This unit identifies how the body uses food, water, and oxygen to generate power for the organism.

Enduring Understandings
1. Many body systems work to create, process and distribute the body's main resources.
2. Specific enzymes digest biological molecules along the gastrointestinal tract.
3. Oxygen is essential for human life because it is necessary for the production of energy.

Essential Questions
How does the human body work to create, process and distribute the body's main resources?
How do specific enzymes digest biological molecules along the gastrointestinal tract?
Why is oxygen essential for human life and necessary for the production of energy?

Example Assessment Items
Create a chart comparing the role food, water, and oxygen play in the human body.
Estimate how long the human body can last without key resources and compare the estimate to survival.
Assess overall dietary health by preparing a detailed nutrition report for a fictional client.
Analyze data collected using an oxygen sensor to determine the change in oxygen concentration of inhaled vs. exhaled air.

Topic: Introduction to Power

Duration: 1 Day(s)
Description
1. The human body is powered by the food we consume, the water that we drink and the air that we breathe.
2. Many human body systems work to create, process and distribute the body's main resources – food, water and oxygen.
3. Factors unique to the person, such as age, weight, and overall health affect the body's ability to utilize biological resources and maintain homeostasis.
4. Factors in the environment, such as climate or temperature, affect the body's ability to utilize biological resources and maintain homeostasis.

Learning Targets
The student will create a chart comparing the role food, water and oxygen play in the human body.
The student will list the body systems that create, process, and distribute food, water and oxygen.
The student will estimate how long the human body can last without key resources and compare this estimate to a survival "rule".
The student will write a disclaimer that explains how factors in the environment and how characteristics of the individual affect the ability to conserve energy.

Topic: Food
Duration: 6 Day(s)

Description
1. The digestive system consists of the gastrointestinal tract and the accessory digestive organs which function together to chemically and mechanically digest food, absorb water and nutrients, and remove wastes.
2. Specific enzymes digest carbohydrates, fats and proteins at sites along the digestive tract.
3. The energy provided by ingested food must be balanced against the energy expended by the body, or a weight change will occur.
4. Factors such as temperature, pH, and enzyme and substrate concentration affect the rate of an enzyme-catalyzed reaction.
5. When a process in the body requires energy, ATP is broken down to liberate energy stored in its chemical bonds.

Learning Targets
The student will design and build a model of the human digestive system.
The student will outline what happens to a bite of food as it travels down the digestive tract.
The student will design and carry out a laboratory experiment investigating the impact environmental changes can have on enzyme function.
The student will analyze diet by comparing energy inputs and outputs.
The student will assess overall dietary health by preparing a detailed nutrition report for a fictional client.
The student will complete an Internet investigation to learn about the structure and function of ATP.

Topic: Oxygen
Duration: 4 Day(s)

Description
1. Oxygen is essential for human life because it is necessary for the production of ATP, the primary source of cellular energy.
2. The structure of the lungs and the close association between the lungs and the vessels of the cardiovascular system facilitate the transport of oxygen to all cells in the body.
3. The transfer of oxygen and carbon dioxide molecules between the lungs, bloodstream, and cells is by simple diffusion and is dependent on concentration gradients.
4. During normal breathing, a healthy individual is using only a small percentage of the total capacity of his or her lungs.
5. The efficiency of oxygen removal from the air is dependent on the physical conditioning of the individual; during and after exercise the concentration of oxygen removed from the air is increased compared to when the individual is at rest.
6. Various diseases or medical conditions can affect lung capacity and efficiency.

Learning Targets
The student will use data acquisition software to measure lung capacity and absorption of oxygen from air.
The student will analyze data collected using a spirometer to determine tidal volume, vital capacity, and minute volume.
The student will analyze data collected using an oxygen sensor to determine the change in oxygen concentration of inhaled air versus exhaled air.
The student will explore careers related to lung function by writing a resume for a respiratory therapist.

Topic: Water
Duration: 5 Day(s)
Description
1. The urinary system helps maintain homeostasis in the body by filtering the blood, regulating water and electrolyte concentration, maintaining the pH balance of the blood and ridding the body of liquid waste called urine.
2. The nephron is the structural and functional unit of the kidney.
3. Through filtration, reabsorption, and secretion, the nephron assists in maintaining normal values of water, electrolytes, pH, and blood pressure in the body.
4. The hormones aldosterone and antidiuretic hormone (ADH) both help regulate the amount of water in the kidney.
5. Malfunctions in the body can be identified through noticeable changes in the composition of urine and these changes can be detected through urinalysis. i.e. body; however, they each work by a different mechanism.

Learning Targets
The student will build the organs of the urinary system on a skeletal model.
The student will complete a dissection to explore the anatomy of the kidney.
The student will create a "map" of the kidney that shows the path of urine formation.
The student will use appropriate Internet sources to investigate the role of hormones in maintaining a water balance in the body.
The student will add glands, hormones, and target organs that are involved in water balance to a graphic organizer, to feedback loops, as well as to a skeletal model.
The student will analyze the urine of four fictional patients to diagnose disease and dysfunction in other human body systems.

Unit: Movement
Unit Overview
The human body has systems for locomotion as well as internal movement of materials.

Enduring Understandings
The skeletal system works with the muscular system to move the human body.
The heart pumps blood to the lungs to pick up oxygen and to the body to deliver this oxygen.

Essential Questions
How do the skeletal system and muscular system work together to move the human body?

How does the heart pump blood to the lungs to pick up oxygen and to the body to deliver that oxygen?

Example Assessment Items
Build simple arm muscles on a skeletal model to illustrate the rules of muscle structure and action.
Describe how the structures of arteries, veins, and capillaries relate directly to the function of each vessel.

Use research techniques to investigate the reaction to body systems to moderate and intense exercise.

Topic: Joints and Motion
Duration: 2 Day(s)

Description
1. The skeletal system works with the muscular system to move the human body.
2. A joint is the location at which two or more bones connect, allowing movement and providing support to the human skeleton.
3. Joints can be classified by either their structure or their function.
4. Synovial joints, freely moveable joints, allow both gross and precise movements of the appendicular skeleton.
5. Range of motion describes a joint's possible movements as well as provides a measure of overall flexibility at a joint.

Learning Targets
The student will use appropriate Internet research techniques to obtain information about the different types of synovial joints.
The student will dissect and manipulate a cow elbow to learn about joint anatomy and motion.
The student will demonstrate terms that describe the types of movement possible at a joint and match range of motion photographs to specific actions.
The student will measure range of motion of human joints using a goniometer.

Topic: Muscles
Duration: 8 Day(s)
### HS Human Body Systems

#### Grade(s) 10th - 12th, 1 Credit

**Elective Course**

### Description

1. Through contraction and relaxation, the three different types of muscle tissue - skeletal, cardiac, and smooth - produce body movements, stabilize body position, move substances within the body and regulate heat.
2. The structure of the muscle and attachment of this muscle to bone directly relates to the function of each skeletal muscle.
3. Muscles are composed of units called sarcomeres, which contract and shorten when exposed to electrical stimuli.
4. Calcium ions and ATP play a role in the contraction of muscle fibers.
5. Neurons are packed together in wiring called nerves, and these nerves take electrical messages from the brain to muscle.

### Learning Targets

The student will use proper microscope technique to examine the different types of muscle tissue.

The student will construct a spaghetti muscle to investigate muscle structure.

The student will build simple arm muscles on a skeletal model to illustrate the rules of muscle structure and action.

The student will sculpt a muscle group on a skeletal model.

The student will identify the action of "mystery muscles" by observing muscle structure.

The student will test the effect of varying solutions of ATP on the contraction of muscle tissue.

The student will build nerve roots and nerves on a skeletal model.

### Topic: Blood Flow

**Duration:** 6 Day(s)

#### Description

1. Cardiac and smooth muscle play a role in the movement of blood around the human body.
2. The heart pumps blood to the lungs to pick up oxygen and to the body to deliver this oxygen.
3. The structure of arteries, veins, and capillaries relates directly to the function of each vessel and to the amount of pressure exerted on the vessel walls.
4. Veins contain valves that prevent the backflow of blood.
5. Changes in cardiac output, the amount of blood that is pumped out by the ventricles per minute, often signal diseases of the heart and these changes can impact the function of other body systems.
6. Increased blood pressure in vessels can indicate possible blockages and these blockages can interrupt blood flow to an organ or limb.
7. Lifestyle choices, such as poor diet and smoking, can lead to the development of blood flow disorders.

#### Learning Targets

The student will trace blood flow in pulmonary and systemic circulation by creating a graphic organizer of the heart.

The student will compare and contrast the structure of arteries, veins and capillaries.

The student will design a way to explain the formation of varicose veins.

The student will build a heart and circulatory routes on a skeletal model.

The student will analyze a four-part case that looks at the effects of smoking on circulation and blood pressure.

### Topic: Energy and Motion: Exercise Physiology

**Duration:** 5 Day(s)

#### Description

1. The body uses high energy molecules such as creatine phosphate, glycogen and glucose to supply ATP to working muscle.
2. Exercise requires the coordinated effort of many human body systems, including the nervous system, the muscular system, the skeletal system, the cardiovascular system, and the respiratory system.
3. Performance-enhancing drugs may initially produce noticeable changes in athletic performance, but come with serious health risks.
4. An athlete training for an intense physical event needs to consider diet, exercise, hydration, and injury prevention as well as track his or her progress and modify the plan to meet the demands of exercise.

#### Learning Targets

The student will use appropriate Internet research techniques to investigate the reaction of the body systems to moderate and intense exercise.

The student will create a timeline of the body's response to the stages of exercise.

The student will complete a laboratory investigation using data acquisition software and probes to explore muscle fatigue.

The student will design a comprehensive training plan for an athlete training for a particular event.

The student will present a detailed training plan to the perspective client.
Unit: Protection  
Duration: 2 Week(s)

**Unit Overview**
The human body has a built-in protection system both internally and externally.

**Enduring Understandings**
The skin is a dynamic organ that functions in protection of the human body.
Bone is a living tissue that can adapt and change to fit the needs of the person.
The lymphatic and immune system help protect the body against specific invaders.

**Essential Questions**
How do functions of the skin provide protection for the human body?
How does bone adapt and change to fit the needs of an individual?
How does lymphatic and immune system help protect the body against specific invaders?

**Example Assessment Items**
Design a 3-D model of human skin displaying tissue layers and accessory organs.
Analyze bone breaks shown in x-rays and match the images with descriptions of the injuries.
Draw diagrams of the stages of bone healing after injury.
Use information presented in a computer animation to create a flow chart of immune response to a common cold.

<table>
<thead>
<tr>
<th>Topic: The Skin</th>
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1. The skin is composed of two main layers, the epidermis and the dermis, and contains accessory organs such as sweat glands and hair follicles.
2. The skin is a dynamic organ that functions in protection, temperature regulation, sensation, excretion and absorption in the human body.
3. Burn damage to skin can impact numerous body functions and body systems.
4. Both the body’s ability to sense pain and to suppress pain help protect the human body from injury and death.

**Learning Targets**
The student will design and build a 3-D model of human skin displaying tissue layers and accessory organs.
The student will model and describe how damage to skin through burns can affect both the functions of the skin and other body systems.
The student will write diary entries that describe the role of various treatment methods and biomedical professionals in the care and rehabilitation of burn victims.
The student will outline what happens inside the body when a person feels pain.

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<tr>
<th>Topic: Bones</th>
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1. Bones provide clues to human identity, assist muscles with movement of the body, and protect the internal organs from damage and injury.
2. Bone is a living connective tissue composed of cells and protein fibers wrapped in hard mineral salts that can adapt and change to fit the needs of the person.
3. Osteoclasts and osteoblasts are specialized bone cells that function to break down old bone tissue and replace it with new.
4. Damage to bone, through a sprain or a fracture, can impact the function of other body organs and systems.
5. Bone is constantly being broken down and reformed through the process of bone remodeling.

**Learning Targets**
The student will dissect a section of long bone and draw a detailed diagram of relevant anatomy.
The student will use proper microscope technique to view prepared slides of compact and spongy bone.
The student will use appropriate Internet research techniques to obtain information about the different types of bone fractures.
The student will analyze bone breaks shown in X-rays and match the images with descriptions of the injuries.
The student will write an advertisement for a job opening for X-ray technician.
The student will produce a feedback loop that illustrates how the body maintains a calcium balance.
The student will draw diagrams of the stages of bone healing after injury.

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<th>Topic: Lymph and Blood Cells</th>
<th>Duration: 8 Day(s)</th>
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**Description**
1. The lymphatic and immune system functions to drain and distribute fluid in the body as well as protect the human body against specific invaders.
2. Antibodies are proteins found in the blood or lymph that seek out and bind to specific antigens.
3. A type of white blood cells called B lymphocytes is responsible for the production of antibodies and has the ability to remember invaders once they have entered the body.
4. Many organ systems as well as other cells, tissues, organs and secretions play a role in protecting the human body.

**Learning Targets**
The student will use appropriate Internet research techniques to obtain information about the structure and function of the lymphatic and immune system.
The student will build lymph vessels and nodes on a skeletal model.
The student will analyze simulated blood samples to determine blood type and determine potential donors for a transfusion.
The student will produce and analyze a family pedigree for blood type.
The student will graph antibody data collected after an infection and relate this data to the response of body cells.
The student will use information presented in a computer animation to create a flow chart of immune response to a common cold.

**Unit: Homeostasis**
**Duration:** 2 Week(s)

**Unit Overview**
The maintenance of homeostasis is essential to the health and wellness of the human body.

**Enduring Understandings**
Human body systems work together to defend against disease and injury and to maintain health and wellness.

**Essential Questions**
How do human body systems work together to defend against disease and injury to help maintain health and wellness?

**Example Assessment Items**
Design an innovative medical intervention to protect the human body in extreme external environments.
Trace a disease in human systems by generating a fictional case study and compiling a patient case file.

**Topic: Health and Wellness**
**Duration:** 14 Day(s)

**Description**
1. Factors in the external environment affect the body’s internal environment and overall ability to maintain homeostasis.
2. Human body systems work together to defend against disease and injury and to maintain health and wellness.
3. Medical interventions, measures that improve health or alter the course of a disease, include preventative measures, diagnostic tests, treatments, and rehabilitation.

**Learning Targets**
The student will design and innovative medical intervention on invention to protect the human body in extreme external environments.
The student will organize information about body function in detailed graphic organizers.
The student will create and present computer presentations to defend the design of a medical intervention.
The student will use appropriate internet research techniques to study the etiology, diagnosis and treatment of a disease or disorder.
The student will trace disease in human systems by generating a fictional case study and compiling a patient case file.
The student will model a disease and a medical intervention on a skeletal model.
The student will write a reflection on personal identity and on career aspirations.

**Unit: English Language Arts within Science and Technology Content**
**Duration:** Ongoing
Grade(s) 10th - 12th, 1 Credit
Elective Course

HS Human Body Systems
Science

Unit Overview
The following unit is aligned with Common Core and focused on the importance of reading and writing in the content areas. This unit is specifically focused on science and technology.

Enduring Understandings
Reading scientific pieces include various elements that are different than in other contents.
Writing scientific pieces has various elements that are different than in other contents.

Essential Questions
How do reading scientific texts vary from other content areas?
How to you express your idea and knowledge differently in scientific writings?

Learning Targets
The student will cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from or supports the argument presented.

Learning Targets (continued)
The student will write arguments focused on discipline-specific content.
- Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
- Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

The student will write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
- Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

The student will write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

The student will produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

The student will develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

The student will use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.

The student will conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

The student will gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.