



Grade 12

Anatomy and Physiology

SC641 - 1 credit

**Connecticut Technical High School System
39 Woodland Street
Hartford, Connecticut 06105**

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CTECS - Vision of a Graduate

Connecticut Technical Education and Career System

Vision of a Graduate

A CTECS Graduate is...



The Vision of a Graduate (VoG) at the Connecticut Technical Education and Career System (CTECS) embodies our commitment to preparing students for success in Connecticut's workforce.

Developed in collaboration with students, parents, staff, and employers, the VoG ensures that CTECS students are not only job-ready but also equipped to lead, innovate, and adapt in a dynamic world.

As educators, we are dedicated to developing these qualities by providing a comprehensive education that empowers our students to achieve their fullest potential and make meaningful contributions to society.

A Problem Solver <i>Problem solvers tackle challenges by identifying root causes of issues, brainstorming solutions, implementing effective strategies, and demonstrating adaptability.</i> → Engage students with open-ended, creative thinking tasks that require both conventional and innovative solutions. → Facilitate group discussions and collaborative projects. → Use real-world scenarios and hands-on activities. → Highlight the importance of effort, persistence, and continuous learning. → Provide regular feedback and encourage reflection.	Work Ready <i>To be work-ready includes a combination of technical expertise, soft skills, and personal qualities that ensure a graduate can effectively contribute to the workplace from day one.</i> → Set high standards for punctuality, responsibility, professionalism, and task completion. → Use project-based learning and collaborative assignments. → Emphasize clear written and verbal communication. → Offer practical exercises like mock interviews and resume workshops. → Integrate technology and teach digital literacy.
Respectful <i>Graduates who embody respectfulness emphasize the importance of treating others with dignity, valuing diversity, and fostering an inclusive and positive environment, both personally and professionally.</i> → Demonstrate personal, interpersonal, and professional skills. → Show respect for diversity. → Model respect through active listening and empathy. → Set clear expectations for respectful interactions. → Promote collaboration and group discussions. → Celebrate respectful behavior. → Address disrespect promptly and constructively.	Skilled Socially <i>Graduates who are skilled socially are equipped to navigate social environments, build relationships, and contribute positively to their communities and workplaces.</i> → Show awareness of global responsibility to others and the environment. → Participate in community involvement. → Design cooperative group projects and team activities → Set expectations for respect and give regular feedback. → Facilitate discussions on inclusivity, kindness, and respect. → Model positive interactions and recognize strong social skills.
A Critical Thinker <i>Critical thinkers approach problems systematically by analyzing, evaluating, and synthesizing information to make well-informed decisions and contribute to innovative solutions.</i> → Encourage critical thinking individually and collaboratively. → Design lessons that challenge assumptions and explore diverse viewpoints. → Use open-ended questions, rigorous activities, and cross-curricular projects. → Integrate project-based learning and real-world problem-solving. → Offer reflective opportunities like journaling and discussions. → Cultivate an environment that values curiosity and inquiry.	An Effective Communicator <i>Effective communicators convey ideas, information, and emotions accurately and persuasively, fostering understanding and collaboration.</i> → Communicate effectively using oral, written, visual, artistic, and technical modes. → Include group discussions, presentations, and peer reviews. → Promote active listening and thoughtful responses. → Offer clear guidelines and constructive feedback. → Stress clear, respectful, and purposeful communication.

CTECS Instructional Model

CTECS uses the Marzano Compendium to guide research-based instructional strategies that differentiate learning and promote access, engagement, and success for all students. Teachers apply these strategies to support diverse learners (including multilingual learners, students with disabilities, and students with varied academic or technical backgrounds) through scaffolds, modeling, guided practice, and multiple ways to participate and show understanding. This approach ensures every student can work toward proficiency in the Priority Standards and the competencies outlined in the CTECS Vision of a Graduate.

Curriculum Introduction

This curriculum document outlines the essential learning for this academic program and provides a clear structure for planning, instruction, and assessment. It includes the components required by NEASC Standard 2.2a, along with elements that reflect the unique nature of CTECS academic programs. The curriculum is organized to show what students learn in each course, how learning progresses across grade levels, and how instruction supports both technical skill development and the CTECS Vision of a Graduate.

Teachers should use this document to:

- Understand the overall structure and expectations of the course sequence
- Reference the Course Map to see the scope and sequence of Priority Standards
- Use the Priority Standards and Units of Study to guide daily, weekly, and cycle-based planning
- Integrate Big Ideas, Essential Questions, Skills/Learning Outcomes, vocabulary, and resources during lesson design
- Plan and implement formative assessments to monitor progress and guide instruction
- Prepare students for the District Summative Assessments, ensuring alignment with the Course Map
- Maintain consistency of instruction across campuses while adapting to student needs

Curriculum Components

Course Map

A Course Map serves as the scope and sequence for this course by outlining the progression of instructional units and the standards that guide teaching and assessment. While each campus will have individual student needs, cycle schedules, and industry-based opportunities, all instructors are expected to teach the standards outlined in the Course Map. Using the Course Map below, teachers will intentionally plan learning experiences that prepare students to meet the identified standards within the designated assessment windows.

Priority Standards (Units of Study)

Priority Standards identify the most essential learning in the trade program. They reflect the core technical competencies, safety practices, and industry-aligned skills that require the greatest instructional focus and appear on program assessments. In CTE programs, each Priority Standard also functions as a Unit of Study, because it includes the required components such as big ideas, essential questions, content topics, and skills/learning outcomes aligned to assessments.

Learning Outcomes

Learning outcomes are what students will know (Concepts) and be able to do (Skills). Concepts identify the major content topics within the Priority Standard (Unit of Study). They appear in the left column of the Learning Outcomes table and follow a similar coding structure as the Priority Standard. Skills are learning objectives that describe the measurable actions students must be able to perform to demonstrate proficiency. They appear in the right column of the Learning Outcomes table and show the progression of learning evidence in the Priority Standard.

Resources

Resources include the tools, equipment, texts, materials, and digital tools that support learning within each unit and reflect industry standards.

Assessment Practices

Teachers use ongoing formative assessments—such as questioning, checks for understanding, performance demonstrations, reflections, and teacher observation—to monitor progress, guide instruction, and support all learners in mastering the Priority Standards.

Vocabulary

Essential vocabulary includes the technical and academic terms students must understand and use accurately to engage in scientific learning and demonstrate proficiency on assessments.

Vocabulary is foundational to safety, precision, and communication, and should be a primary initial focus within each unit and taught explicitly through modeling, demonstration, and repeated application.

Human Anatomy and Physiology Philosophy

The Human Anatomy and Physiology course is a comprehensive program designed to help students explore the intricate relationship between the structural organization (anatomy) and biological functions (physiology) of the human body. This academic curriculum ensures students develop an in-depth understanding of scientific content while building essential skills, such as critical thinking, effective communication, and problem-solving that align with the Vision of a Graduate and are central to their future professional lives.

Aligned with the Next Generation Science Standards (NGSS), the program engages students in Scientific Practices and Crosscutting Concepts to investigate how the body's various systems work together to maintain homeostasis. Students gain rigorous academic and practical experience through hands-on laboratory activities, including microscopic tissue analysis, the use of anatomical models, and the active collection and analysis of physiological data.

In accordance with the CTECS instructional model, instruction is driven by observable phenomena and research-based strategies that challenge learners to use scientific knowledge to explain or predict real-world health events. By exploring specialized systems such as the nervous, cardiovascular, and immune systems, students prepare for a successful transition to post-secondary education or professional careers in the healthcare and medical communities.

INSTRUCTIONAL CONSIDERATIONS

Anchoring Phenomena: In accordance with NGSS philosophy, instructors will ***use observable phenomena and student-generated questions to drive instruction***. Natural phenomena are observable events that occur in the universe and that we can use our science knowledge to explain or predict; they are the context for the work of both the scientist and the engineer. The point of using phenomena to drive instruction is to help ALL students engage in practices to develop the knowledge necessary to explain or predict phenomena. Effective instruction, therefore, results in students being able to explain carefully selected and relevant phenomena by developing and applying the Learning Outcomes and crosscutting concepts (CCCs) through the use of the science and engineering practices (SEPs).

Human Anatomy and Physiology - Course Map

Semester 1

Cycles 1-2

- [Unit 1: Foundations of Anatomy & Homeostasis](#)
 - [Priority Standard 1: Characteristics of Living Things](#)
 - [Priority Standard 2: Levels of Organization](#)

Cycles 3-4

- [Unit 2: Support and Movement](#)
 - [Priority Standard 3: Support and Movement](#)
 - [Priority Standard 4: Muscular Support and Movement](#)
 - [Priority Standard 5: Skeletal Support and Movement](#)
 - [Priority Standard 6 : Joint Support and Movement](#)

Cycle 5

- [Unit 3: Regulation and Integration](#)
 - [Priority Standard 7: Nervous System Regulation and Integration](#)

Semester 2

Cycles 6-7

- [Unit 3: Regulation and Integration](#)
 - [Priority Standard 8: Sensory Regulation and Integration](#)
 - [Priority Standard 9: Endocrine Regulation and Integration](#)

Cycles 8-9

- [Unit 4: Transport and Protection](#)
 - [Priority Standard 10: Blood Transport](#)
 - [Priority Standard 11: Cardiovascular System Transport](#)
 - [Priority Standard 12: Lymphatic Protection](#)
 - [Priority Standard 13: Immune Protection](#)

Cycle 10

- [Unit 5: Waste Removal](#)
 - [Priority Standard 14: Urinary Waste Removal](#)

Unit 1: Foundations of Anatomy & Homeostasis

Unit 1 Anchoring Phenomena: Foundations of Anatomy & Homeostasis: The phenomenon of homeostatic balance, specifically how the body maintains a stable internal environment despite external changes.

Priority Standard 1: Characteristics of Living Things	
Big Idea (s) The human body is organized to accomplish life processes, and organs are composed of specific tissues with specific functions.	
Essential Question(s): - How is the human body organized? - How does the body maintain balance of each system?	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by:</i>
1.1 Anatomy and Physiology Definitions 1.2 Structural Organization Levels 1.3 Homeostatic Mechanisms 1.4 Anatomical Terminology 1.5 Organ Systems 1.6 Body Cavities and Organs	- Explain the relationship between anatomy and physiology. - List the organizational levels and a describe the ways in which they are related (Chemical, Cellular, Tissue, Organ, System, Organismal) - Describe and provide specific examples of homeostasis. - Demonstrate different directional terms and the use of terms for body regions, planes, and cavities. - List organs included within each system and identify them on a torso model. - Evaluate a model or diagram to identify body cavities and locate associated organs
Vocabulary: Anatomy, Physiology, Homeostasis, Negative Feedback, Superior/Inferior, Anterior/Posterior, Sagittal, Transverse, Thoracic, Abdominal.	
Resources: Gizmos: Homeostasis, Edpuzzle: Intro to Anatomy, InnerBody (interactive).	
SEP and CCC Connections: - SEP: Constructing Explanations and Designing Solutions (As evidenced by: Constructing explanations of anatomy/physiology relationships and definitions of homeostasis). - CCC: Structure and Function (The relationship between body organization and life processes); Stability and Change (Maintaining balance through homeostatic mechanisms).	

Priority Standard 2: Levels of Organization

Big Idea (s)

- Each type of tissue is composed of similar cells specialized to carry on a particular function.

Essential Question (s):

- How do specific tissues contribute to organ function?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
2.1 Tissue Function and Contribution 2.2 Primary Tissue Families 2.3 Structural and Functional Differences 2.4 Tissue Repair Processes 2.5 Microscopic Tissue Differentiation 2.6 Physical Tissue Locations	• List the four major tissue types found in the human body (epithelial, connective, muscular, nervous) and give examples of the specific tissues found in each category. • Compare and contrast the structure and function of the four major tissue types. • Describe the general characteristics of each kind of tissue. • List the four major types with specific examples in each. • Evaluate the structural and functional differences between the four major tissue types. • Evaluate the steps required to repair an injured tissue and the immune system's involvement (Inflammatory Response). • Label diagrams of tissue cells observed under a microscope (Squamous, Cuboidal, and Columnar, Adipose, and Bone). • List at least two body locations for each tissue type.

Vocabulary: Squamous, Cuboidal, Columnar, Adipose, Cartilage, Neuron, Neuroglia, Histology, Inflammation.

Resources: Gizmos: Cell Types, Edpuzzle: Tissues Part 1 & 2, Virtual Microscope labs.

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Constructing labeled diagrams of tissue cells observed under a microscope).
- CCC: Structure and Function (Specialized cells and tissues carry out particular functions); Systems and System Models (Relationship between tissue types and organ function).

Unit 2: Support and Movement

Unit 2 Anchoring Phenomena: The phenomenon of mechanical protection and motion, focusing on how the integumentary, muscular, and skeletal systems interact to facilitate movement and protect organs.

Priority Standard 3: Support and Movement	
Big Idea (s) The skin and body membranes are essential in maintaining homeostasis.	
Essential Question (s): How does the skin help regulate the body?	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by:</i>
3.1 Environmental Interaction Controls 3.2 Membrane Types and Locations 3.3 Membrane Structural Makeup 3.4 Skin Functions 3.5 Skin Layer Structure 3.6 Skin Pigmentation Factors 3.7 Skin Gland Classifications 3.8 Accessory Organs 3.9 Integumentary Health Disorders 3.10 Microscopic Skin Features	- Describe the functions of the skin. - Demonstrate the location of membranes on a model and describe their functions (Cutaneous, Mucous, Serous, Synovial). - Evaluate the differences in tissues found in each type of membrane. - List the functions of skin and describe how each is accomplished. - Interpret a diagram to distinguish between the epidermis, dermis, and subcutaneous layers. - Interpret the process of how cells produce pigment. - Evaluate the differences in functions and secretions of skin glands (Sebaceous, Sweat (Apocrine and Eccrine)). - Interpret the function of accessory organs on a diagram (Nails and Hair). - Evaluate research regarding the facts, causes, and treatments of skin disorders (Cancer, Burns, Acne). - Demonstrate the identification of skin layers, follicles, and glands in prepared slides.
Vocabulary: Epidermis, Dermis, Melanin, Sebaceous, Keratin, Mucous Membrane, Synovial.	
Resources: Edpuzzle: The Integumentary System, Gizmos: Histology (Skin focus), American Cancer Society (Skin Cancer resources) SEP and CCC Connections: - SEP: Obtaining, Evaluating, and Communicating Information (As evidenced by: Evaluating research regarding facts, causes, and treatments of skin disorders). - CCC: Systems and System Models (Control of interactions between internal and external environments); Structure and Function (Tissue makeup and structure of major membrane types).	

Priority Standard 4: Muscular Support and Movement

Big Idea (s):

- Muscle types are different in structure and function; actions provide motion, propel fluids, generate heartbeats, and distribute heat

Essential Question (s):

- How are muscles responsible for motion?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
4.1 Movement and Posture Roles 4.2 Muscle Tissue Comparisons 4.3 Skeletal Muscle Anatomy 4.4 Contraction Events 4.5 Muscle Response Types 4.6 Superficial Muscle Anatomy 4.7 Muscular System Disorders 4.8 Microscopic Muscle Features 4.9 Origin and Insertion Points 4.10 Muscle Action Categories	● Interpret the physiological function of muscles in movement and posture. ● Evaluate the structure and location of the three types of muscle tissue (Skeletal, Cardiac, and Smooth). ● Label a diagram of skeletal muscle and muscle fiber. ● Interpret the sequence of events in muscle cell contraction starting from the action potential. ● Evaluate the differences between graded response, tetanus, and contraction types (Isotonic vs. Isometric Contractions). ● Demonstrate the identification of muscles on a diagram or model. ● Evaluate research on muscular disorders including causes, effects, and treatments (Cerebral Palsy, Muscular Dystrophy). ● Illustrate and label the three muscle tissue types. ● Label origin and insertion points of a muscle on a diagram. ● Evaluate the actions of prime movers, synergists, and antagonists.

Vocabulary: Sarcomere, Myosin, Actin, Acetylcholine, Tetanus, Isotonic, Isometric, Antagonist.

Resources: Gizmos: Muscle-and-Bone, Edpuzzle: Muscle Contraction, GetBodySmart (Muscular tutorials).

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Constructing labeled diagrams of skeletal muscle and fiber).
- CCC: Cause and Effect (Initiation of action potentials and events of muscle cell contraction); Structure and Function (Differences in structure and function between the three types of muscle tissue).

Priority Standard 5: Skeletal Support and Movement	
Big Idea (s) Bones are alive and multifunctional; the skeleton supports, protects, and is essential for movement	
Essential Question (s): How is the skeleton involved in support and movement of the body?	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by:</i>
5.1 Skeletal Protection and Arrangement 5.2 Skeletal System Functions 5.3 Bone Structure Types 5.4 Microscopic Bone Anatomy 5.5 Bone Development and Repair 5.6 Major Skeletal Divisions 5.7 Skeletal Disorders and Diseases 5.8 Vertebrae Classifications 5.9 Individual Bones and Processes	- Evaluate the skeletal arrangement required for support and protection of vital organs. - List the three functions of the skeletal system. - Evaluate the structural differences between compact and cancellous (spongy) bone. - Label the major parts of bone structures on a diagram (Haversian Systems Osteocytes, etc). - Interpret the processes of bone formation, growth, and repair. - Demonstrate the identification of bones and their classification as appendicular or axial. - Evaluate research regarding skeletal disorders, causes, and treatments (Rickets, Osteoporosis, Fractures, etc). - Interpret vertebrae types through structural observation. - Demonstrate the identification of individual bones and processes from a skeleton.
Vocabulary: Osteocyte, Periosteum, Axial, Appendicular, Ossification, Epiphysis, Diaphysis.	
Resources: Gizmos: Skeletal System, Edpuzzle: Bone Growth, Bone Box (3D Viewer).	
SEP and CCC Connections: - SEP: Constructing Explanations and Designing Solutions (As evidenced by: Interpreting processes of bone formation, growth, and repair). - CCC: Structure and Function (Skeletal arrangement required for support and protection of vital organs).	

Priority Standard 6 : Joint Support and Movement

Big Idea (s):

- Joints enable the body to move.

Essential Question (s):

- What motions are possible at each type of joint?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
6.1 Major Joint Type Characteristics 6.2 Joint Locations and Movement Levels 6.3 Specific Movement Patterns 6.4 Joint Structure and Mobility	• Describe the characteristics of the three major joint types. • Evaluate the amount of movement allowed by each joint type (Synovial, Fibrous, Cartilaginous). • Demonstrate and name the different types of joint movements (Flexion and Rotation, Abduction, and Supination). • Evaluate the structure and mobility of the three categories of joints.

Vocabulary: Synovial, Ligament, Circumduction, Adduction, Rotation, Amphiarthrosis.

Resources: Edpuzzle: Joints, Gizmos: Muscle and Bone (Joint focus), BioDigital Human.

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Demonstrating and naming the different types of joint movements).
- CCC: Structure and Function (Joint structure and mobility across major categories; structure dictates the amount of movement allowed).

Unit 3: Regulation and Integration

Unit 3 Anchoring Phenomena: The phenomenon of biological communication, involving how the body detects environmental stimuli and processes information to trigger responses.

Priority Standard 7: Nervous System Regulation and Integration

Big Idea (s):

- The neuron is the basic cell; the system collects and responds to stimuli to maintain homeostasis.

Essential Question (s):

- How does the body receive information from the environment?
- How is sensory information sent and received within the body?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
7.1 System Coordination for Homeostasis 7.2 Nervous System Divisions 7.3 Neuron Structure and Function 7.4 Nerve Impulse Conduction 7.5 Reflex Arc Elements 7.6 Meningeal Layers 7.7 Brain and Spinal Cord Anatomy 7.8 Cerebrospinal Fluid (CSF) 7.9 Autonomic and Somatic Differences 7.10 Sympathetic and Parasympathetic Divisions 7.11 Nervous System Disorders 7.12 Neuron and Neuroglia Differences 7.13 Reflex Actions	• Interpret the coordination of body systems required to maintain homeostasis. • List the functions for the central and peripheral nervous systems. • Illustrate a neuron with labeled parts and functions. • Interpret the events leading to the generation and conduction of a nerve impulse (Potentials, Synaptic Transmission). • List the elements of a reflex arc. • List the three meningeal layers and their functions. • Demonstrate the identification of major brain and spinal cord parts on a diagram. • Evaluate differences between somatic and autonomic and nervous systems. • Evaluate differences between sympathetic/parasympathetic divisions. • Evaluate research on nervous system disorders including causes and effects. • Demonstrate various reflex actions

Vocabulary: Myelin, Synapse, Neurotransmitter, Cerebrum, Brainstem, Meninges, Dendrite.

Resources: Gizmos: Sensing System, Edpuzzle: Nervous System Parts 1-3, Neuroscience for Kids (UW).

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Constructing an illustration of a neuron with labeled parts and functions).
- CCC: Stability and Change (Coordination and integration of body systems required to maintain homeostasis); Systems and System Models (Major divisions of the nervous system and their functions).

Priority Standard 8: *Sensory Regulation and Integration*

Big Idea (s)

- Sensory receptors detect environmental changes and trigger impulses processed by the Central Nervous System.

Essential Question(s):

- How is sensory information collected and used by the body?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
8.1 Environmental Change Detection 8.2 Somatic and Special Senses 8.3 Receptor Types and Functions 8.4 Smell and Taste Mechanisms 8.5 Ear Structural Components 8.6 Sound Vibration Pathways 8.7 Eye Structural Components 8.8 Light Transmission Pathways	● Interpret the mechanisms used by senses to detect environmental changes. ● Evaluate the differences between somatic and special senses. ● List the five receptor types and their functions. ● Interpret the location, structure, and function of smell and taste receptors. ● Label a diagram of the ear. ● Interpret the pathway of sound from the tympanic membrane to receptors. ● Label a diagram of the eye. ● Interpret the pathway of light through the eye to the retina.

Vocabulary: Photoreceptor, Chemoreceptor, Cochlea, Retina, Olfactory, Gustatory, Tympanic Membrane.

Resources: Gizmos: Sight vs. Sound, Edpuzzle: The Senses, Exploratorium (Sense exhibits).

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Constructing labels for diagrams of the eye and ear).
- CCC: Cause and Effect (Sensory receptors detect environmental changes and trigger impulses processed by the CNS).

Priority Standard 9: Endocrine Regulation and Integration	
Big Idea (s) The endocrine system controls and regulates metabolic processes.	
Essential Question (s): How is the endocrine system used as a communication system?	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by:</i>
9.1 Internal Environment Maintenance 9.2 Major Endocrine Glands 9.3 Hormone Effect Categories 9.4 Hormone Physiological Effects 9.5 Pituitary and Hypothalamic Regulation 9.6 Secretion Level Consequences 9.7 Negative Feedback Control	- Interpret the endocrine control of the internal environment. - Demonstrate the identification of glands and tissues on a model or diagram. - Evaluate the differences in effects between steroid and non-steroid hormones. - List the names and functions of hormones produced by each gland. - Interpret the regulation of the pituitary gland by the hypothalamus. - Evaluate the results of abnormal hormone secretion (Hypersecretion, Hyposecretion). - Interpret the concept of negative feedback using a specific example.
Vocabulary: Hormone, Pituitary, Hypothalamus, Insulin, Glucagon, Adrenaline, Target Cell.	
Resources: Edpuzzle: Endocrine System, Gizmos: Human Endocrine System, Khan Academy (Endocrine).	
SEP and CCC Connections: - SEP: Constructing Explanations and Designing Solutions (As evidenced by: Interpreting the concept of negative feedback using a specific example). - CCC: Stability and Change (Endocrine control of the internal environment and metabolic processes).	

Unit 4: Transport and Protection

Unit 4 Anchoring Phenomena: The phenomenon of internal transport and defense, centered on how blood and lymph move vital nutrients and protect against pathogens.

Priority Standard 10: Blood Transport

Big Idea (s)

- Blood is one of the body's main transport systems.

Essential Question (s):

- What are the different roles of blood in the body?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
10.1 Primary Blood Functions 10.2 Erythrocyte Characteristics 10.3 Leukocyte Roles and Types 10.4 Plasma Components and Functions 10.5 Hemostasis Stages 10.6 Blood Grouping Systems 10.7 Blood Disorders • Anemia • Leukemia • Hemophilia 10.8 Microscopic Cell Identification 10.9 White Blood Cell Diagnostics	• List the functions of blood (Oxygen Transportation, Infection Defense, Coagulation). • Interpret the structure, function, and life cycle of red blood cells. • Illustrate, label, and describe the five types of leukocytes. • List the components of plasma. • Evaluate the importance of the events leading to hemostasis. • Evaluate blood groups to explain the basis for transfusion reactions (ABO, Rh Factor). • Evaluate research regarding blood disorders, causes, and treatments (Anemia, Leukemia, Hemophilia, etc). • Demonstrate the identification of blood cells on a microscope slide. • Interpret a white blood cell differential to deduce a diagnosis.

Vocabulary: Erythrocyte, Leukocyte, Hemoglobin, Plasma, Platelet, Antigen, Antibody.

Resources: Gizmos: Blood Typing, Edpuzzle: Blood, Red Cross (Blood types).

SEP and CCC Connections:

- SEP: Analyzing and Interpreting Data (As evidenced by: Interpreting a white blood cell differential to deduce a diagnosis).
- CCC: Systems and System Models (Blood as one of the body's main transport systems).

Priority Standard 11: *Cardiovascular System Transport*

Big Idea (s)

- The cardiovascular system powers and transports oxygen, nutrients, and wastes

Essential Question (s):

- What is the heart's role in the cardiovascular system?
- What are the functions of arteries, veins, and capillaries?
- How does the cardiovascular system maintain health?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
11.1 Cardiovascular Component Roles 11.2 Heart Structure and Function 11.3 Cardiac Blood Flow Pathway 11.4 Electrical Conduction Systems 11.5 Circulatory Divisions 11.6 Heart Regulation and Cardiac Cycle 11.7 Vessel Structural Differences 11.8 Capillary Material Exchange 11.9 Venous Blood Return Mechanisms 11.10 Blood Pressure Control	● Interpret the roles of cardiovascular components in the body. ● Demonstrate the identification of heart parts and their functions on a diagram. ● Interpret the flow of blood through the heart chambers, valves, and vessels. ● Interpret the electrical conduction system of the heart. ● Interpret the flow of blood through systemic, cardiac, and pulmonary circulations. ● Evaluate the cardiac cycle and its control mechanisms. ● Evaluate the structural and functional differences between arteries, veins, and capillaries. ● Interpret the process of material exchange between blood and body cells. ● Interpret the mechanisms that aid in returning venous blood to the heart. ● Evaluate how blood pressure is produced and controlled.

Vocabulary: Ventricle, Atrium, Aorta, Capillary, Systole, Diastole, Pulse.

Resources: Gizmos: Circulatory System, Edpuzzle: The Heart, American Heart Association.

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Identifying heart parts and their functions on a diagram).
- CCC: Structure and Function (Structural and functional differences between arteries, veins, and capillaries).

Priority Standard 12: Lymphatic Protection

Big Idea (s)

- The lymphatic system maintains fluid balance and plays a major defense role against pathogens.

Essential Question (s):

- How does the lymphatic system protect the body against infection?
- What is the function of the lymph nodes in the body?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
12.1 System Functions 12.2 Lymph Formation and Transport 12.3 Lymphatic Organs 12.4 Major Lymphatic Pathways 12.5 Lymph Node Structure 12.6 Microscopic Lymphatic Features	• Describe the structure and functions of the lymphatic system (Fluid Balance, Immunity, etc). • Interpret the pathway of lymph from formation to transport. • Evaluate three lymphatic organs and their specific functions. • Demonstrate the identification of major lymphatic pathways on a diagram. • Illustrate and label the structure of a lymph node. • Demonstrate the identification of microscopic structures on a diagram.

Vocabulary: Lymph, Node, Spleen, Thymus, Pathogen, Thoracic Duct.

Resources: Edpuzzle: Lymphatic System, Gizmos: Disease Spread, Virtual Anatomy (Lymph).

SEP and CCC Connections:

- SEP: Developing and Using Models (As evidenced by: Constructing a labeled drawing of the structure of a lymph node).
- CCC: Systems and System Models (Pathway of lymph from formation to transport and its role in fluid balance).

Priority Standard 13: Immune Protection

Big Idea (s):

- The immune system has both specific and non-specific lines of defense.

Essential Question (s):

- How does the immune system work with the lymphatic system to protect against infection?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
13.1 Pathogen Defense Mechanisms 13.2 Defense System Categories 13.3 Antibody and Antigen Actions 13.4 B- and T-Cell Functions 13.5 HIV and AIDS Relationship	• Interpret the defense mechanisms used by the immune system against pathogens. • Evaluate the differences between innate (non-specific) and adaptive (specific) defenses. • Evaluate antibody and antigen definition, function, and action. • Evaluate the differences between B- and T-cell functions. • Evaluate the relationship between the HIV virus and AIDS.

Vocabulary: Antigen, Antibody, Phagocyte, B-cell, T-cell, Vaccine, Immunity.

Resources: Gizmos: Immune System, Edpuzzle: Immunity, CDC (Immune response).

SEP and CCC Connections:

- SEP: Engaging in Argument from Evidence (As evidenced by: Evaluating the relationship between the HIV virus and AIDS).
- CCC: Cause and Effect (Defense mechanisms used by the immune system—specific and non-specific—against pathogens).

Unit 5: Waste Removal

Unit 5 Anchoring Phenomena: The phenomenon of selective filtration, focusing on how the body maintains chemical balance by removing waste through the urinary system.

Priority Standard 14: Urinary Waste Removal

Big Idea (s):

The urinary system is a selective filter.

Essential Question (s):

- What is the role of the urinary system in maintaining the body's chemical balance?

Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by:</i>
14.1 Urinary System Organs 14.2 Nephron Structure and Parts 14.3 Renal Blood Flow Pathways 14.4 Glomerular Filtrate Composition 14.5 Filtration Pressure and Rate Factors 14.6 Renal Tubule Filtrate Pathways 14.7 Reabsorption and Secretion Effects 14.8 Concentration Controls 14.9 Micturition Reflex 14.10 Urinary Disorders 14.11 Kidney Physical Locations 14.12 Kidney Gross Anatomy 14.13 Urinalysis Testing Protocols	- Interpret the relationship between urinary system organs and their functions. - Illustrate and label a nephron and the function of its parts. - Interpret the flow of blood through the kidney vessels. - Interpret the production and composition of glomerular filtrate. - Evaluate the factors that influence filtration pressure and rate. - Interpret the movement of filtrate through the renal tubule. - Evaluate how tubular reabsorption and secretion affect urine composition. - Design a table relating concentration and volume with hormonal, neural, and chemical controls. - Evaluate research regarding renal disorders and diseases (Renal Failure, Kidney Stones, etc). - Design a diagram showing the location of the kidneys in the body. - Demonstrate the identification of kidney parts on a model or diagram. - Evaluate urinalysis results to determine substances present.

Vocabulary: Nephron, Glomerulus, Ureter, Bladder, Urethra, Filtration, Dialysis.

Resources: Gizmos: Urinary System, Edpuzzle: The Kidney, Biology Corner (Urinalysis lab).

SEP and CCC Connections:

- SEP: Analyzing and Interpreting Data (As evidenced by: Evaluating urinalysis results to determine substances present in a specimen).
- CCC: Stability and Change (Maintenance of chemical balance through selective filtration); Systems and System Models (Relationship between urinary system organs and their functions).

Appendix A: Vocabulary

- **Abdominal:** Relating to the abdomen, the region of the body between the thorax and the pelvis.
- **Acetylcholine:** A neurotransmitter that triggers muscle contraction at the neuromuscular junction.
- **Actin:** A thin contractile protein filament found in muscle fibers that interacts with myosin.
- **Adduction:** The movement of a limb toward the midline of the body.
- **Adipose:** Connective tissue used for the storage of fat.
- **Adrenaline (Epinephrine):** A hormone secreted by the adrenal glands, especially in conditions of stress, increasing rates of blood circulation and breathing.
- **Amphiarthrosis:** A joint that permits only slight motion, such as the vertebrae.
- **Anatomy:** The study of the structural organization of the human body.
- **Anterior/Posterior:** Terms describing the front (anterior) and back (posterior) of the body.
- **Antagonist:** A muscle that opposes or reverses the action of another muscle.
- **Antibody:** A protein produced by the immune system to identify and neutralize foreign objects like bacteria and viruses.
- **Antigen:** A toxin or other foreign substance which induces an immune response in the body.
- **Aorta:** The main artery of the body, supplying oxygenated blood to the circulatory system.
- **Appendicular:** Relating to the limbs (arms and legs) and the girdles that attach them to the axial skeleton.
- **Atrium:** Each of the two upper cavities of the heart from which blood is passed to the ventricles.
- **Axial:** Relating to the head, neck, and trunk—the central axis of the body.
- **B-cell:** A type of lymphocyte responsible for producing antibodies as part of the adaptive immune system.
- **Bladder:** A muscular sac that stores urine before it is excreted from the body.
- **Brainstem:** The part of the brain that connects to the spinal cord, controlling basic life functions like breathing and heart rate.
- **Capillary:** The smallest of the body's blood vessels, where the exchange of water and chemicals between the blood and the tissues occurs.
- **Cartilage:** A firm, flexible connective tissue found in various forms in the larynx and respiratory tract, and on articulating surfaces of joints.
- **Cerebrum:** The largest part of the brain, responsible for voluntary muscular activity, vision, speech, taste, hearing, thought, and memory.
- **Chemoreceptor:** A sensory organ or cell that responds to chemical stimuli.
- **Circumduction:** A circular movement of a limb or eye.
- **Cochlea:** The spiral cavity of the inner ear containing the organ of Corti, which produces nerve impulses in response to sound vibrations.
- **Columnar:** Epithelial cells that are taller than they are wide.
- **Cuboidal:** Epithelial cells that are cube-shaped, appearing as squares in cross-section.
- **Dendrite:** A short branched extension of a nerve cell, along which impulses received from other cells are transmitted to the cell body.

- **Dermis:** The thick layer of living tissue below the epidermis that contains blood capillaries, nerve endings, and hair follicles.
- **Dialysis:** A process for removing waste and excess water from the blood and is used primarily as an artificial replacement for lost kidney function.
- **Diaphysis:** The shaft or central part of a long bone.
- **Diastole:** The phase of the heartbeat when the heart muscle relaxes and allows the chambers to fill with blood.
- **Epidermis:** The outermost layer of cells in the skin.
- **Epiphysis:** The end part of a long bone, which grows separately from the shaft.
- **Erythrocyte:** A red blood cell that (in humans) is typically a biconcave disc without a nucleus, containing hemoglobin.
- **Filtration:** In the kidney, the process of removing waste and excess substances from the blood to form urine.
- **Glucagon:** A hormone formed in the pancreas that promotes the breakdown of glycogen to glucose in the liver.
- **Glomerulus:** A cluster of capillaries around the end of a kidney tubule, where waste products are filtered from the blood.
- **Gustatory:** Relating to the sense of taste.
- **Hemoglobin:** A red protein responsible for transporting oxygen in the blood of vertebrates.
- **Histology:** The study of the microscopic structure of tissues.
- **Homeostasis:** The tendency of a system to maintain a stable internal environment despite external changes.
- **Hormone:** A regulatory substance produced in an organism and transported in tissue fluids to stimulate specific cells or tissues into action.
- **Hypothalamus:** A region of the brain that coordinates both the autonomic nervous system and the activity of the pituitary gland.
- **Immunity:** The ability of an organism to resist a particular infection or toxin.
- **Inflammation:** A localized physical condition in which part of the body becomes reddened, swollen, hot, and often painful, especially as a reaction to injury or infection.
- **Insulin:** A hormone produced in the pancreas that regulates the amount of glucose in the blood.
- **Isometric:** Relating to muscular action in which tension is developed without contraction (shortening) of the muscle.
- **Isotonic:** Relating to muscular action in which the muscle maintains uniform tension and shortens as it contracts.
- **Keratin:** A fibrous protein forming the main structural constituent of hair and the outer layer of skin.
- **Leukocyte:** A white blood cell that circulates in the blood and body fluids and is involved in counteracting foreign substances and disease.
- **Ligament:** A short band of tough, flexible, fibrous connective tissue that connects two bones or cartilages or holds together a joint.
- **Lymph:** A colorless fluid containing white blood cells, which bathes the tissues and drains through the lymphatic system into the bloodstream.
- **Melanin:** A dark brown to black pigment occurring in the hair, skin, and iris of the eye.

- **Meninges:** The three membranes (the dura mater, arachnoid, and pia mater) that line the skull and vertebral canal and enclose the brain and spinal cord.
- **Mucous Membrane:** An epithelial tissue that secretes mucus and lines many body cavities and tubular organs.
- **Myelin:** A mixture of proteins and phospholipids forming a whitish insulating sheath around many nerve fibers, increasing the speed at which impulses are conducted.
- **Myosin:** A fibrous protein that forms (together with actin) the contractile filaments of muscle cells.
- **Negative Feedback:** A mechanism that consists of a response that is the opposite of the stimulus, used to maintain homeostasis.
- **Nephron:** Each of the functional units in the kidney, consisting of a glomerulus and its associated tubule.
- **Neuroglia:** Non-neuronal cells in the central nervous system and peripheral nervous system that do not produce electrical impulses; they maintain homeostasis and provide support for neurons.
- **Neuron:** A specialized cell transmitting nerve impulses; a nerve cell.
- **Neurotransmitter:** A chemical substance that is released at the end of a nerve fiber by the arrival of a nerve impulse.
- **Node (Lymph Node):** Each of a number of small swellings in the lymphatic system where lymph is filtered and lymphocytes are formed.
- **Olfactory:** Relating to the sense of smell.
- **Ossification:** The process in which bone is formed.
- **Osteocyte:** A bone cell, formed when an osteoblast becomes embedded in the matrix it has secreted.
- **Pathogen:** A bacterium, virus, or other microorganism that can cause disease.
- **Periosteum:** A dense layer of vascular connective tissue enveloping the bones except at the surfaces of the joints.
- **Phagocyte:** A type of cell within the body capable of engulfing and absorbing bacteria and other small cells and particles.
- **Photoreceptor:** A structure, especially a sensory cell or sense organ, that responds to light.
- **Physiology:** The branch of biology that deals with the normal functions of living organisms and their parts.
- **Pituitary:** The major endocrine gland, a pea-sized body attached to the base of the brain, important in controlling growth and development.
- **Plasma:** The colorless fluid part of blood, lymph, or milk, in which corpuscles or fat globules are suspended.
- **Platelet:** A small colorless disk-shaped cell fragment without a nucleus, found in large numbers in blood and involved in clotting.
- **Pulse:** A rhythmical throbbing of the arteries as blood is propelled through them by the heart.
- **Retina:** A layer at the back of the eyeball containing cells that are sensitive to light and that trigger nerve impulses.
- **Rotation:** Movement in which a bone spins on its longitudinal axis.
- **Sagittal:** A vertical plane which passes from front to rear dividing the body into right and left sections.

- Sarcomere: A structural unit of a myofibril in striated muscle, consisting of a dark band and the nearer half of each adjacent pale band.
- Sebaceous: Glands in the skin which secrete a lubricating oily matter (sebum) into the hair follicles.
- Spleen: An abdominal organ involved in the production and removal of blood cells and forming part of the immune system.
- Squamous: Relating to epithelial cells that are thin, flat, and scale-like.
- Superior/Inferior: Anatomical directions meaning "above" (superior) and "below" (inferior).
- Synapse: A junction between two nerve cells, consisting of a minute gap across which impulses pass by diffusion of a neurotransmitter.
- Synovial: Relating to a type of joint which is surrounded by a fluid-filled capsule.
- Systole: The phase of the heartbeat when the heart muscle contracts and pumps blood from the chambers into the arteries.
- T-cell: A lymphocyte of a type produced or processed by the thymus gland and actively participating in the immune response.
- Target Cell: A cell which bears receptors for a hormone, drug, or other signaling molecule.
- Tetanus: A sustained muscular contraction evoked when the motor nerve that innervates a skeletal muscle emits action potentials at a very high rate.
- Thoracic: Relating to the thorax, the area between the neck and the abdomen (the chest).
- Thoracic Duct: The main vessel of the lymphatic system, passing upward in front of the spine and draining into the left subclavian vein.
- Thymus: A lymphoid organ situated in the neck of vertebrates that produces T cells for the immune system.
- Transverse: A horizontal plane dividing the body into upper and lower parts.
- Tympanic Membrane: A membrane forming part of the organ of hearing, which vibrates in response to sound waves; the eardrum.
- Ureter: The duct by which urine passes from the kidney to the bladder.
- Urethra: The duct by which urine is conveyed out of the body from the bladder.
- Vaccine: A substance used to stimulate the production of antibodies and provide immunity against one or several diseases.
- Ventricle: Each of the two main chambers of the heart, left and right.