Anatomy Unit 4: Transport, Absorption, and Secretion

Content Area: **Science**
Course(s): **Anatomy and Physiology**
Time Period: **MP4**
Length: **45 days**
Status: **Published**

NJSLS - Science

SCI.HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
SCI.HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
SCI.HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
SCI.HS-LS1-4	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Science and Engineering Practices

Developing and Using Models

Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)

Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4)

Planning and Carrying Out Investigations

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)

Constructing Explanations and Designing Solutions

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)

Scientific Investigations Use a Variety of Methods

Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness,

objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

Disciplinary Core Ideas

LS1.A: Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

LS1.B: Growth and Development of Organisms

In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

Crosscutting Concepts

Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2), (HS-LS1-4)

Structure and Function

Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)

Stability and Change

Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

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Rationale and Transfer Goals

The circulatory system is a network of vessels and organs that maintain homeostasis in the body, transport valuable nutrients to cells throughout the system, and remove the wastes produced by cellular function. The pump utilized by this system is a four chambered involuntary muscle that, through rhythmic contractions, pushes blood throughout the body through a network of vessels which includes veins, venules, capillaries, arterioles, and arteries. The connective tissue found in these vessels is blood and it is composed of red cells, which transports oxygen, white blood cells, which combat intruders, and a liquid matrix, called plasma which contains those extracellular components needed to maintain homeostasis. Transportation of immune components as well as fluid and fat reabsorption is accomplished through the highly complex network of vessels and organs known as the lymphatic system.

The digestive system serves to extract usable molecules from the large macromolecules we consume in order to provide materials for cell and tissue development. It also obtains energy from these molecules that may be used to power the many catabolic processes in the body. It is composed of the alimentary canal which includes the esophagus, stomach, small intestines, large intestines, and the rectum as well as accessory digestive organs such as the salivary glands, pancreas, liver, and gallbladder that produce secretions that are essential in completing the digestion process. The excretory system serves to recognize and absorb those

desirable substances needed by the body prior to their excretion and it can make alterations in the exchange of these materials to compensate for the changing needs. It also removes those substances that are counterproductive or toxic to the normal function of the body.

Exchange of oxygen and carbon dioxide are essential in allowing the efficient creation of energy through aerobic cellular respiration. The lungs and their respective airways not only allow for the transfer of essential gases with the environment but also mediate this exchange within the alveolar region of the pulmonary system. In this system blood, from the circulatory system, interfaces with outside air to obtain oxygen and rid the body of carbon dioxide. This process not only adjusts the levels of these essential gases but also assists in the maintenance of the body's pH via the acid base balance.

Enduring Understandings

Arteries and arterioles carry blood from the heart to the body while veins and venules carry blood back to the heart.

Hydrostatic pressure allows for the exchange of materials from blood to tissue.

The human heart is a four chambered muscle that pumps blood throughout the body by responding to the electrical conduction system.

All organisms transfer matter and convert energy from one form to another with the aid of the digestive system.

Oxygen from the respiratory system is used to release energy from foods that we eat, and is carried to all parts of the body by the circulatory system.

Waste is filtered and eliminated by the digestive and urinary systems.

Together, these systems work in the transport of nutrients and the elimination of waste.

Essential Questions

What are the major functions and structures of the circulatory, respiratory, digestive and urinary systems?

How do the circulatory, respiratory, digestive and urinary systems work together to allow for movement of the human body?

What types of disease and deficiencies affect the circulatory, respiratory, digestive and urinary systems?

What can a person do to prevent diseases and disorders that affect the circulatory, respiratory, digestive and urinary systems?

Content - What will students know?

- The heart, veins, arteries and valves work together to transport materials to parts of the body.
- Blood low in oxygen enters the right side of the heart and is pumped into pulmonary circulation. Oxygenated blood is returned to the left side of the heart and then pumped from the left ventricle to the systemic circuit.
- There is an electrical component of the heart and understanding that this component can be analyzed with an ECG.
- Blood pressure is the force blood exerts against the inner walls of blood vessels. Systolic pressure is when the ventricle contracts and diastolic pressure is when the ventricle relaxes. Blood pressure can change based on blood volume, viscosity, and/or cardiac output.
- Blood pressure can be measured using a cuff and sphygmomanometer.
- Different diseases, diet and age can affect the heart and its vessels.
- The respiratory system includes the nose, pharynx, larynx, trachea, bronchi and lungs.
- Inspiration is the movement of air into the lungs and expiration is the movement of air out of the lungs as a result of changing pressure in the alveoli.
- Total lung capacity can be measured by adding the vital capacity with the residual volume of air that stays in the lungs.
- Breathing is regulated within regions of the brain stem.

- Breathing rates can also be affected by emotional state, exercise, and chemicals (such as from vaping).
- Gas exchange occurs as a result of diffusion in the alveoli membranes.
- The digestive system is composed of the mouth, tongue, teeth, salivary glands, pharynx, esophagus, stomach, pancreas, liver, gallbladder, small and large intestine.
- Saliva contains enzymes that initially start the process of digestion.
- Peristalsis motion from smooth muscle moves that food through the digestive tract.
- Hormones help regulate pancreatic secretion.
- The small intestine absorbs nutrients for the body and wastes are moved into the large colon and then eliminated from the body.
- The kidneys of the urinary system help absorb water.
- Nutrients absorbed during digestion are used by the body for energy, growth, maintenance and repair of tissue.

Skills - What will students be able to do?

- Label the major structures of the circulatory system, including the chambers of the heart, valves and major arteries and veins.
- Trace the flow of blood through the heart and body.
- Explain how blood pressure is produced and controlled.
- Correctly measure the blood pressure of a classmate using a blood pressure cuff.
- ID the parts of a normal ECG pattern and discuss the significance of this pattern.
- Students will diagnose case studies related to the circulatory system.
- Dissect a cow heart to observe key structures.
- Examine slides of veins and arteries under the microscope.
- Observe slides of normal arteries vs. arteries that have plaque build up and their role in clots.
- Draw and label the parts of the feedback loop in maintaining blood pressure.
- Describe and label the major structures (and their functions) of the respiratory system.
- Measure the lung volume and capacity using a respirometer.
- Examine the impact of vaping on lung capacity.

- Determine the flow of oxygen or carbon dioxide across the alveoli based on partial pressure of these gasses across the surface membrane.
- Students will diagnosis case studies related to the respiratory system.
- Describe and label the major structures (and their functions) of the digestive system.
- Explain how the contents of the alimentary canal are mixed and moved.
- Test how enzymes in our saliva begin the digestive practice.
- Describe the feedback loops that regulate digestive secretions.
- Students will diagnose case studies related to the digestive system.

Activities - How will we teach the content and skills?

- CH.13 guided notes Chap13-guided notes-cardiovascular system
- CirculatorySystem-Gizmos-DiMartine
- Ch.15 guided notes Copy of Digestive System Coloring
- Ch.16 guided notes
- Labeling the heart Heartlabellingdiagram-dimartine
- Blood Pressure Lab- lab-Pulse rate and BP.pdf
- Heart Dissection Lab: Copy of Heart Dissection (Virtual)
- Lab: lung capacity Lung Capacity Lab
- Digestion lab Digestive Enzyme Lab-saliva
- Digestion labeling/coloring Digestive System Coloring
- Labeling-the respiratory system respiratory-system-labeling-diagram.pdf
- Literacy- Vaping (respiratory system)
- Vocab key terms for each section Vocab template
- Concept map review concept map review template
- Ck12 review concepts (free online text that all teachers can access and use)
- Edpuzzle videos to reinforce concepts (all teachers have access to LHS)

- Lab stations with microscope slides
- Case study appropriate to the body system being covered (Legionnaires disease/Diverticulitis/ carbon monoxide poisoning

Evidence/Assessments - How will we know what students have learned?

- **Assessments can be reviewed for each course in this folder.**
- Quizzes/test
- Kahoot scores
- Literacy rubrics
- Anatomy Benchmark #4

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Analyzing and explaining how the heart moves blood through the body and the factors controlling this function. • Describing the relationship between cardiovascular aging and lifestyle. • Modeling the blood flow through the heart and body.	• In multicellular organisms, the body is a system of multiple, interacting subsystems. • Organs are groups of tissues that work together to perform a particular body function. • Systems interact with other systems.	• Pre-unit vocabulary • Microscope slides • Lab exercises • Notes and group work • literacy • Labeling and online practice

21st Century Life and Careers

WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.TL.1	Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.
TECH.9.4.2.TL.4	Navigate a virtual space to build context and describe the visual content.
TECH.9.4.2.IML.2	Represent data in a visual format to tell a story about the data (e.g., 2.MD.D.10).
TECH.9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).
TECH.9.4.2.IML.4	Compare and contrast the way information is shared in a variety of contexts (e.g., social, academic, athletic) (e.g., 2.2.2.MSC.5, RL.2.9).

Interdisciplinary Connections/Companion Standards