Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provides' instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

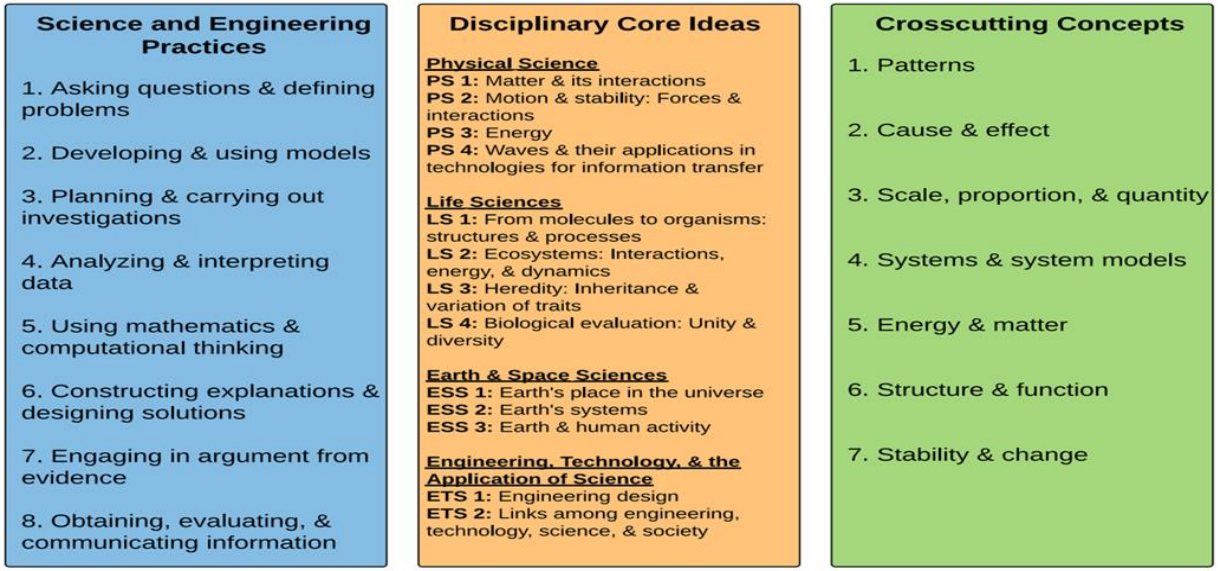
Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, *A Framework for K-12 Science Education* as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The Framework expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The Framework identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the Framework is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the Framework as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band. Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is not meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.



Learning Progression

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.

Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides suggested sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

The map is meant to support effective planning and instruction to rigorous standards. It is not meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other

support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

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Transport of Nutrients and Gases</td><td>2 Weeks</td><td colspan="2">How does blood help maintain homeostasis within the human body?</td><td colspan="3">Centrifuge, hematocrit, packed cell volume, plasma, ABO blood group system, blood type, complete blood count (CBC), erythroblast, erythrocytes, hemoglobin, red blood cells (RBCs), reticulocyte, Rh factor, transfusion, B lymphocyte, basophil, eosinophil, leukocytes, lymphocyte, monocyte, mononuclear white blood cell, neutrophil, T lymphocyte, white blood cell (WBC), platelet, thrombocyte, acute, antibiotic, Kupffer cell, macrophage, mast cell, phagocytosis, clotting factors, thrombin, bilirubin</td></tr>
<tr><th colspan="3">Standards and Related Background Information</th><th colspan="2">Instructional Focus</th><th colspan="3">Instructional Material</th></tr>
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DCI

LS1. From Molecules to Organisms: Structures and Processes

HAP.ETS2: Links Among Engineering, Technology, Science, and Society

Standard(s)

HAP.LS1.17 Examine the structure (molecular and cellular) of blood constituents and describe their function.

HAP.LS1. 22 Analyze ABO and Rh Blood groups as a basis for blood transfusion and infant incompatibility reactions.

Explanation

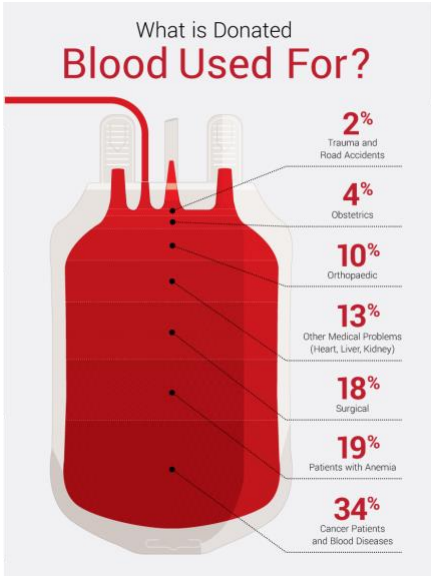
The Cardiovascular System: The heart and circulatory system make up your cardiovascular system. Your heart works as a pump that pushes blood to the organs, tissues, and cells of your body. Blood delivers oxygen and nutrients to every cell and removes the carbon dioxide and waste products made by those cells. Blood is carried from your heart to the rest of your body through a complex network of arteries, arterioles, and capillaries. Blood is returned to your heart through venules and veins. If all the vessels of this network were laid end to end, they would extend for about 60,000 miles (more than 96,500 kilometers), which is far enough to circle the planet Earth more than twice! The one-way system carries blood to all parts of your body. This process of blood flow within your body is called circulation. Arteries

Learning Outcomes

- Describe the composition and volume of whole blood.
- Describe the composition of plasma and discuss its importance in the body.
- Describe the function and physiology of red and white blood cells.
- Explain how blood cells form.
- Understand ABO and Rh blood grouping.

Phenomenon

Blood Donation



Curriculum Resources

Engage

1. A&P Interlude: True Blood
2. Phlebotomy

Videos:

Crash Course-True Blood, Part I

Crash Course-There Will Be Blood, Part 2

Explore

EMC AA&P Workbook &Laboratory Manuel:

Ch. 12 The Lymphatic system and the blood, pgs. 221-225

- Laboratory Activity 1: Pathology of the Blood and Lymphatic System; pgs.235

Explain

- Case Study Investigation #12, pg. 422,452

Elaborate

- A Case Study: Environmental Immunization, pgs. 458-459

Evaluate

- Ch. 12 The Lymphatic system and the blood- Concept Check pgs. 425, 429, 435

Textbook:

Applied Anatomy & Physiology 2nd Ed.: A Case Study Approach; Brian R, Shmaefsky

Ch. 12 The Lymphatic system and the blood; pgs. 422-436

- Tree Man, pg. 427
- Blood Donation Facts, pg. 431
- Science and Social Ethics, pg. 432

carry oxygen-rich blood away from your heart, and veins carry oxygen-poor blood back to your heart. In pulmonary circulation, though, the roles are switched. It is the pulmonary artery that brings oxygen-poor blood into your lungs and the pulmonary vein that brings oxygen-rich blood back to your heart. **<u>Science and Engineering Practice</u>** **Planning and Carrying Out Controlled Investigations** *Students plan and perform investigations to aid in the development of a predictive model for interacting variables, consider the quantity of data with respect to experimental uncertainty, and select methods for collection and analysis of data.* **<u>Cross Cutting Concept</u>** **System and System Models** *Students design or define systems in order to evaluate a specific phenomenon or problem.*	Blood donors' leftover immune cells reveal secrets of antibody affinity. Researchers have gained crucial insights into how natural killer cells circulating in the human body differ from those typically studied in the lab. https://www.sciencedaily.com/releases/2018/03/180309142350.htm	• Polluted Blood, pg. 435 • Related Research-Blood Substitutes, pg. 441 • Autism from Vaccines, pg. 446 • Fear of Blood, pg. 447

Human Anatomy and Physiology **Quarter 3 Curriculum Map** Curriculum Map Feedback Survey							
Quarter 1		Quarter 2		**Quarter 3**		Quarter 4	
Unit 1 Anatomical Orientation	Unit 2 Protection, Support, and Movement	Unit 3 Nervous System	Unit 4 Endocrine System	**Unit 5 Transport of Nutrients and Gases**	Unit 6 Lymphatic System	Unit 7 Absorption and Excretion	Unit 8 Reproduction, Growth, and Development
3 Weeks	6 Weeks	6 Weeks	3 Weeks	**7 Weeks**	2 Weeks	5 Weeks	4 Weeks
Unit 5 Transport of Nutrient and Gases [7 Weeks]							
Overarching Question(s)							

How do the structures of the respiratory system and cardiovascular system work together to maintain homeostasis?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 **Transport of Nutrients and Gases**	2.5 Weeks	How does the circulatory system transport oxygenated and deoxygenated blood throughout the body? **(*Cardiovascular System*)**	blood pressure, blood vessels, circulatory system, heart, pulse, arteries, hydrostatic pressure, lymphatic vessels, veins, constriction, dilation, vasoconstriction, vasodilation, arteriole, cardiac infarction, coronary arteries, coronary veins, endocardium, epicardium, fibrous pericardium, myocardium, pericardium, pulmonary circulation, serous pericardium, systemic circulation, aorta, aortic valve, Atrioventricular (AV) valves, Atrioventricular (AV) nodes, atrium, bicuspid valve, Bundle of His, chambers, chordae tendineae, inferior vena cava, mitral valve, pulmonary artery, pulmonary valve, pulmonary veins, , cardiac cycle, cardiac output, diastole, heart rate, stroke volume, systole
Standards and Related Background Information		**Instructional Focus**	**Instructional Material**
DCI LS1. From Molecules to Organisms: Structures and Processes HAP.ETS2: Links Among Engineering, Technology, Science, and Society **Standard(s)** **HAP.LS1.15** Prepare and/or use a model of a human heart to explain systole and diastole and the heart's internal and external control mechanisms involved in producing the heartbeat. **HAP.LS1.16** Explain blood pressure in terms of systole and diastole. Describe the factors affecting		**Learning Objectives:** • Describe the functions of the cardiovascular system. • Describe the types, structures, and function of the circulatory system vessels. • Describe the flow of blood as it moves through the heart, comparing the pulmonary and systemic circuits. • Describe and identify the four chambers of the heart and the various internal features of each chamber.	**Curricular Resources** **Engage** **Videos:** **Crash Course-The Heart: Under Pressure, Part 1** **Crash Course-The Heart: Heart Throbs, Part 2** **Explore** • Case Study Investigation #11, pg. 380, 391, 399, 402, 404, 413 **EMC AA&P Workbook & Laboratory Manual**: **Ch. 11 The Cardiovascular System, pgs. 194-215** • Laboratory Activity 1: Identifying Heart Sounds, pgs. 215-216

blood pressure and blood pressure's role in homeostasis.
HAP.LS1.14 Describe, in terms of structure and function, the systemic and pulmonary paths of the cardiovascular system.

Explanation
The heart and circulatory system make up your cardiovascular system. Your heart works as a pump that pushes blood to the organs, tissues, and cells of your body. Blood delivers oxygen and nutrients to every cell and removes the carbon dioxide and waste products made by those cells. Blood is carried from your heart to the rest of your body through a complex network of arteries, arterioles, and capillaries. Blood is returned to your heart through venules and veins. If all the vessels of this network were laid end to end, they would extend for about 60,000 miles (more than 96,500 kilometers), which is far enough to circle the planet Earth more than twice! The one-way system carries blood to all parts of your body. This process of blood flow within your body is called circulation. Arteries carry oxygen-rich blood away from your heart, and veins carry oxygen-poor blood back to your heart. In pulmonary circulation, though, the roles are switched. It is the pulmonary artery that brings oxygen-poor blood into your lungs and the pulmonary vein that brings oxygen-rich blood back to your heart.

Misconceptions

- Explain the two main differences between fetal and adult circulation and describe the ways fetal circulation is altered to accommodate these differences?

Phenomenon
Winter and Cardiovascular Diseases
Can shoveling snow put your heart at risk?
According to past estimates, about 100 people — mostly men — die during or just after shoveling snow each year in the US. Many more are admitted to the hospital with chest pain or other heart problems. This latest research further explored the details of this connection. Researchers correlated admissions to the hospital and deaths due to heart attack the day after it snowed in Canada during the years 1981 to 2014. This included more than 128,000 hospital admissions and more than 68,000 deaths due to heart attack.

Cold Weather Has a Chilling Influence on Heart Attack and Stroke
his winter season has produced some of most widespread frigid weather in US history and, per a 2013 article in the North American Journal of Medical Sciences there is a clear seasonal

- Laboratory Activity 2: Identifying Venous Valves, pgs. 216-217

Explain

Elaborate
- A Case Study: Smoking and Heart Disease pg. 419-421

Evaluate
Ch. 11 The Cardiovascular System-Concept Check pgs. 391, 399, 402, 404, 411, 413,
Ch. 11 The Cardiovascular System-Study Guide pgs. 417-418

Textbook:
Applied Anatomy & Physiology 2nd Ed.: A Case Study Approach; Brian R, Shmaefsky
Ch. 11 The Cardiovascular System; pgs. 380-421
- Virtual Physician Passage, pg. 387
- Smoking Your Capillaries, pg. 390
- Robotic Pacemaker, pg. 397
- Cardiovascular Facts, pg. 399
- Related Research-Heart Disease and The "Type D" Personality, pg. 406
- Science and Social Ethics, pg. 410

The most common misconception of the cardiovascular system is involved in blood pathway, blood vessels, and lung function. In blood circulatory systems the movement of blood is carried through the medium of blood vessels which are veins and arteries. Students believe that arteries carry oxygenated blood and veins carry deoxygenated blood. The misconception arrives from the confusion about the function and structure of veins and arteries. The arteries carry oxygenated blood except for the pulmonary artery, which carries deoxygenated blood from the heart to the lungs to undergo gaseous exchange. Veins do carry deoxygenated blood except for the pulmonary vein which carries oxygenated blood from the lungs to the heart. **<u>Science and Engineering Practice</u>** **Developing and Using Models** *Students can create models for the interactions of two separate systems. Students can test the predictive abilities of their models in a real-world setting and make comparisons of two models of the same process or system.* **<u>Cross Cutting Concept</u>** **Structure and Function** *Students apply patterns in structure and function to unfamiliar phenomena. Students infer the function of a component of a system based on its shape and interactions with other components.*	increase of adverse cardiovascular and stroke events during the cold winter season. The epidemiological data cited in the article indicates that low temperatures and barometric pressure changes can induce changes in coagulation factors, hormones, and reduced Vitamin D levels. These in turn can lead to hypertension, angina, acute myocardial infarction, stroke, and other adverse cardiac events. Among the other factors recognized were the seasonal changes in lifestyle factors, including reduced regular physical activity and a less healthy diet, which can impact cholesterol levels.	

Human Anatomy and Physiology
Quarter 3 Curriculum Map
Curriculum Map Feedback Survey

Quarter 1		Quarter 2		**Quarter 3**		Quarter 4	
Unit 1 Anatomical Orientation	Unit 2 Protection, Support, and Movement	Unit 3 Nervous System	Unit 4 Endocrine System	**Unit 5 Transport of Nutrients and Gases**	Unit 6 Lymphatic System	Unit 7 Absorption and Excretion	Unit 8 Reproduction, Growth, and Development
3 Weeks	6 Weeks	6 Weeks	3 Weeks	**7 Weeks**	2 Weeks	5 Weeks	4 Weeks

Unit 5 Transport of Nutrient and Gases [7 Weeks]

Overarching Question(s)

How do the structures of the respiratory system and cardiovascular system work together to maintain homeostasis?

Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 5 Transport of Nutrients and Gases	**2.5 Weeks**	How does the respiratory system function to exchange gases and maintain cellular respiration? **(*Respiratory System*)**	lower respiratory system, upper respiratory system, breathing, lung, ventilation, nose, nostril, paranasal sinuses, adenoids, laryngopharynx, nasopharynx, pharynx, tonsils, epiglottis, glottis, Heimlich maneuver, larynx, vocal cords, primary bronchi, trachea, bronchial tree, bronchoconstriction, bronchiole, bronchodilation, bronchospasm, alveolus (lung), lobe, pleura, serous, surfactant (respiratory), diaphragm, exhalation, expiration, inhalation, inspiration, respiration, millimeters of mercury (mmHg), bronchitis, emphysema, acute respiratory distress syndrome (ARDS), chronic obstructive pulmonary disease (COPD), lung cancer, lung cancer, pneumothorax, sleep apnea, bronchopneumonia, flu, influenza, pneumonia, tuberculosis (TB), total lung capacity
Standards and Related Background Information		**Instructional Focus**	**Instructional Material**

DCI

LS1. From Molecules to Organisms: Structures and Processes

HAP.ETS2: Links Among Engineering, Technology, Science, and Society

Standard

HAP.LS1.18 Explain how the anatomy of the respiratory system functions to provide oxygen and carbon dioxide transport mechanisms between the lungs and the circulatory system, considering capillary structures, red blood cell structures, diffusion, and affinity.

Explanation

The Respiratory System: The respiratory system, which includes air passages, pulmonary vessels, the lungs, and breathing muscles, aids the body in the exchange of gases between the air and blood, and between the blood and the body's billions of cells. Most of the organs of the respiratory system help to distribute air, but only the tiny, grape-like alveoli and the alveolar ducts are responsible for actual gas exchange. In addition to air distribution and gas exchange, the respiratory system filters, warms, and humidifies the air you breathe. Organs in the respiratory system also play a role in speech and the sense of smell. The respiratory system also helps the body maintain homeostasis, or balance among

Learning Outcomes

- Describe the structure, function and location of the respiratory system components.
- What are the mechanics of breathing and pulmonary ventilation?
- How is gas exchanged between the lungs, bronchial tree, alveoli and blood?
- What are the mechanisms of pulmonary ventilation and air volumes?

Phenomenon

The Respiratory System: Explain how the density of air decreases with increasing altitude, so that a given volume of air contains fewer oxygen molecules at high altitude than the same volume of air at sea level. Ask students to hypothesize how this might affect breathing at high altitude. Encourage them to speculate about adaptations that might evolve in human populations that live at high altitudes for many generations. Direct

Curricular Resources

Engage

Videos:

Crash Course-Respiratory System, Part 1

Crash Course-Respiratory System, Part 2

Explore

- Case Study Investigation #10, pg. 346, 359, 363, 369, 371

EMC AA&P Workbook & Laboratory Manual

Ch. 10 The Respiratory System, pgs. 173-187

- Laboratory Activity 1: Histology of Lung Pathology, pg. 188
- Laboratory Activity 2: Lung Function Models (Part 1): Lung Capacity Model, pgs. 188-189
- Laboratory Activity 3: Lung Function Models (Part 2(: Inspiration and Expiration Model, pgs. 189-190

Elaborate

- A Case Study: The White Lung Controversy, pg. 377-379
- Safe Smoke? Passage pg. 361
- Airline Hypoxia Passage pg. 363
- Asthma from Ozone Passage pg. 366

Evaluate:

- The Respiratory System Review
- Ch. 10 The Respiratory System-Concept Check pgs.

Textbook Resources:

Applied Anatomy & Physiology 2nd Ed.: A Case Study Approach; Brian R, Shmaefsky

Ch. 10 The Respiratory System; pgs. 346-379

the many elements of the body's internal environment. **Misconceptions** Misconceptions about the lungs and the mechanics of breathing are common. For example, students commonly think the lungs are muscles that actively suck air into the body during inhalations and expel all the air during exhalations. To overcome these and similar misconceptions, use a simple model to demonstrate how the lungs really work (http://www.sciencenetlinks.com/lessons.php?DocID=245). **Science and Engineering Practice** **Obtaining, Evaluating, and Communicating Information** *(Obtain/Evaluate) Students critically read scientific literature, integrating, extracting, and accurately simplifying main ideas from multiple sources while maintaining accuracy and validating data when possible.* *(Communicate) Students provide written or oral explanations for phenomena and multipart systems using models, graphs, data tables, and diagrams.* **Cross Cutting Concept** **Structure and Function** *Students apply patterns in structure and function to unfamiliar phenomena. Students infer the function of a component of a system*	students to the URLs below to see if their ideas are correct. • http://www.altitude.org/why_less_oxygen.php • http://news.nationalgeographic.com/news/2004/02/0224_040225_evolution.html	

based on its shape and interactions with other components.		

Human Anatomy and Physiology Quarter 3 Curriculum Map Curriculum Map Feedback Survey							
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3 Weeks	6 Weeks	6 Weeks	3 Weeks	7 Weeks	**2 Weeks**	5 Weeks	4 Weeks

Unit 6 Lymphatic System [2 Weeks]			
Overarching Question(s)			
How does the body protect itself from environmental factors?			
Unit, Lesson	**Lesson Length**	**Essential Question**	**Vocabulary**
Unit 6 Lymphatic System	**2 Weeks**	• What characteristics are common to invertebrate and vertebrate immunity? • How do the different components of specific immunity (T cells, B cells, antibodies, etc.) assist in humoral and cellular immunity? How do these relate to vaccines?	lymph, lymphatic system, lymphocyte, Lymph, active immunity, antibody, B cell, cell-mediated immune response, humoral immune response, immune response, immunity, immunization, memory cell, passive immunity, T cell, Innate, B-Cells, Helper T-Cells, Macrophages, Cytokines, Antibodies, Memory Cells, Plasma Cells, Immunogen, Passive immunity, Active immunity, Humoral immunity, Specific immunity, Non-specific immunity, Immunological memory/secondary response, Cytokines, Autocrine or paracrine

		• How does molecular variation contribute to immune system defense against innumerable pathogens?	
Standards and Related Background Information		**Instructional Focus**	**Instructional Material**
DCI LS1. From Molecules to Organisms: Structures and Processes HAP.ETS2: Links Among Engineering, Technology, Science, and Society **Standard** **HAP.LS1.20** Describe the relationship between the structure and function of the lymphatic system. **HAP.LS1.21** Differentiate between innate and adaptive immunity, identifying immune cells that play a role in each. **Explanation** Lymphatic system, a subsystem of the circulatory system in the vertebrate body that consists of a complex network of vessels, tissues, and organs. The lymphatic system helps maintain fluid balance in the body by collecting excess fluid and particulate matter from tissues and depositing them in the bloodstream. It also helps defend the body against infection by supplying disease-fighting cells called lymphocytes. The lymphatic system can be thought of as a drainage system needed because, as blood circulates through		• Describe the anatomy and physiology of the lymph system • Compare and contrast specific (innate) and nonspecific (acquired) defense mechanisms. • Describe the inflammatory response. • Explain antigen recognition by lymphocytes. • Use the terminology associated with the blood and lymphatic system • Learn about the following: blood components, lymphatic system components, immune system function, and mechanisms of immunization and vaccination	**Curricular Resources** **Engage** **Videos:** 1. Lymphatic System: Crash Course A&P #44 - YouTube 2. Introduction to the Lymphatic System - YouTube 3. Why we need a lymphatic system (video) | Khan Academy 4. The lymphatic system's role in immunity (video) | Khan Academy 5. What is actually in lymph (video) | Khan Academy 6. Human Physiology - Lymphatic System: How it Works - YouTube 7. The Lymphatic System explained in 5 minutes - Lymph Vessels ... 8. Introduction to the Lymphatic System - Animated Tutorial 9. How lymphatic vessels move fluid (video) | Khan Academy **Explore** • Case Study Investigation #12, pg. 422,452 • Related Research-Blood substitute, pg. 441 **EMC AA&P Workbook & Laboratory Manual**: **Ch. 12 The Lymphatic system and the blood, pgs. 221-240**

the body, blood plasma leaks into tissues through the thin walls of the capillaries. The portion of blood plasma that escapes is called interstitial or extracellular fluid, and it contains oxygen, glucose, amino acids, and other nutrients needed by tissue cells. Although most of this fluid seeps immediately back into the bloodstream, a percentage of it, along with the particulate matter, is left behind. The lymphatic system removes this fluid and these materials from tissues, returning them via the lymphatic vessels to the bloodstream, and thus prevents a fluid imbalance that would result in the organism's death. The organs and tissues of the lymphatic system are the major sites of production, differentiation, and proliferation of two types of lymphocytes—the T lymphocytes and B lymphocytes, also called T cells and B cells. Although lymphocytes are distributed throughout the body, it is within the lymphatic system that they are most likely to encounter foreign microorganisms. Reference: https://www.britannica.com/science/lymphatic-system **Misconceptions** Lymphatic system and immune system are not the same systems. Lymphatic system and immune system are two systems of the body with different functions. The main difference between lymphatic and immune system is that lymphatic system is a part of the	• Understand the aging and pathology of the lymphatic system • explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines and antibiotics • describe how environment and personal health are related to the immune system **Phenomenon** The lymphatic system has three main functions: It maintains the balance of fluid between the blood and tissues, known as fluid homeostasis. It forms part of the body's immune system and helps defend against bacteria and other intruders. It facilitates absorption of fats and fat-soluble nutrients in the digestive system. The system has special small vessels called lacteals. These enable it to absorb fats and fat-soluble nutrients from the gut. There are about 600 lymph nodes in	• Laboratory Activity 2: Assessing Potential Allergens; pgs. -236 • Immune Defense & Infectious Disease Lab • The Role of the Lymphatic System • Let's Get Defensive **Explain** **Elaborate** **Evaluate** **Textbook:** *Applied Anatomy & Physiology 2nd Ed.: A Case Study Approach; Brian R, Shmaefsky* Ch. 12 The Lymphatic system and the blood; pgs. 422-459

immune system whereas immune system defends the body from foreign materials. The immune system is complex and difficult for students to understand. Take particular care in clarifying the many terms that students encounter in this chapter. Make sure students understand the distinction between the following pairs of terms: a) *leukocyte* and *lymphocyte* b) *antigen* and *antibody* c) *B lymphocyte* and *T lymphocyte* d) *cytotoxic T cell* and *helper T cell*	the body. These nodes swell in response to infection, due to a build-up of lymph fluid, bacteria, or other organisms and immune system cells. A person with a throat infection, for example, may feel that their "glands" are swollen. Swollen glands can be felt especially under the jaw, in the armpits, or in the groin area. These are, in fact, not glands but lymph nodes. Lymph nodes are not the only lymphatic tissues in the body. The tonsils, spleen, and thymus gland are also lymphatic tissues.	

Curriculum and Instruction- Science			
RESOURCE TOOLKIT			
Human Anatomy and Physiology Quarter 3			
Textbook Resources *Applied Anatomy & Physiology 2nd Ed.: A Case Study Approach; Brian R, Shmaefsky* Ch. 12 The Lymphatic system and the blood; pgs. 422-436 Ch. 11 The Cardiovascular System; pgs. 380-421 Ch. 10 The Respiratory System; pgs. 346-379	**DCIs and Standards** **DCI** LS1. From Molecules to Organisms: Structures and Processes HAP.ETS2: Links Among Engineering, Technology, Science, and Society **Standard(s)** HAP.LS1.17 HAP.LS1.22 HAP.LS1.15 HAP.LS1.16 HAP.LS1.14 HAP.LS1.18 HAP.LS1.20 HAP.LS1.21	**Websites/Videos** EMC Bookshelf Glossary CSI Worksheets Crossword Puzzles Human Anatomy Online Biology Corner Explore Health Careers Visible Body	**Additional Resources** **ACT & SAT** TN ACT Information & Resources SAT Connections SAT Practice from Khan Academy Khan Academy Illuminations (NCTM) Discovery Education The Futures Channel The Teaching Channel Teachertube.com