



**VALWOOD**

*GO BEYOND*

**Honors Anatomy and Physiology Curriculum**



# Honors Anatomy and Physiology (12<sup>th</sup> Grade) Overview

Course Description	Topics at a Glance
<p>Honors Anatomy and Physiology will serve as a college-level introduction to the human body and the biological mechanisms required to support human life and development. Through intensive study, students will learn how to scientifically discuss the positions, postures, and components of various anatomical systems and will comparatively evaluate their evolutionary distinctions from other organisms. Additionally, students will be expected to independently perform labs and participate in dissections designed to reinforce a visual understanding of human construction and physiological interactions.</p>	<ul style="list-style-type: none"> <li>• Introduction to Anatomy and Physiology</li> <li>• Anatomical Organization</li> <li>• Integumentary System</li> <li>• Musculoskeletal System</li> <li>• Cardiovascular System</li> <li>• Immunity</li> <li>• Respiratory System</li> <li>• Digestion and Metabolism</li> <li>• Renal System</li> <li>• Nervous System</li> </ul>

## Assessments

- Instructor-created unit assessments, including quizzes and tests
- Instructor-created semester assessments
- Lab reports, practicals, and independent demonstrations
- Group and/or individual research presentations

## Big Ideas in HONORS ANATOMY AND PHYSIOLOGY (Grade Level Expectations)

Standards	12 <sup>th</sup> Grade	
1. Organization of Living Systems	1.	The functionality of living systems, including cells, tissues, and organs derives from the composition and properties of their building blocks
	2.	Anatomical systems are distinguished by their role, composition, and location
	3.	Changes in lower levels of structure result in often debilitating consequences on the organismal level
	4.	The human body is comprised of several interacting organ systems that allow for homeostasis, reproduction, and metabolism
2. Support and Movement	1.	The integumentary, skeletal, and musculoskeletal systems interact to confer protection, movement, support, and growth upon humans
	2.	The location and points of articulation between joints, tendons, bones, and muscles suggest their unique functions and specific types of body movements
	3.	The presence of calcium in the sarcoplasmic reticulum both supports ossification and bone repair while serving as a functional second messenger in muscle tissues
3. Fluids and Transport	1.	Hematopoiesis provides the circulating components of the blood, lymphatic, and immune systems
	2.	Cardiovascular transport is regulated by electrical activity from the nervous system and blood pressure
	3.	The immune system is a highly complex combination of both innate and adaptive cellular and molecular responses
	4.	Circulation can be manipulated and redirected during fetal development, birth, and surgery
4. Energy, Maintenance, and Environmental Exchange	1.	Gas and nutrient exchange is essential to meet the metabolic demands of a human and is strongly impacted by the structure and location of tissues
	2.	The respiratory system is comprised of several intersecting organs on the path from the nose/mouth to the trachea, lungs, and diaphragm
	3.	The digestive system is comprised of several intersecting organs on the path from the mouth to the esophagus, stomach, and intestinal tract
	4.	Nutrient exchange is influenced by surface area-to-volume ratios
5. Regulation and Control	1.	The nervous system controls all voluntary and involuntary actions, behaviors, and responses through electrical stimulation and neurotransmitter secretion
	2.	The nervous system is responsible for bodily regulation but is itself regulated through innate negative feedback mechanisms
	3.	The hypothalamic-pituitary axis is largely responsible for management of the endocrine system
	4.	The endocrine system directly articulates with the nervous system to control hormone production in response to internal and external stimuli

## LIFE SCIENCE

**Description of Standard:** Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.

### **Valwood Graduate Competencies**

The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

#### **Valwood Graduate Competencies in the LIFE SCIENCE STANDARD:**

- ◆ Analyze the relationship between structure and function across all major levels of organization in living systems
- ◆ Evaluate and express the role of natural selection and/or the environment in the development and interdependence of molecules, cells, and all living systems
- ◆ Analyze the impact of environmental pressures on the evolution and functionality of living systems
- ◆ Explain how organisms fulfill all requirements of a living system, maintain homeostasis, and respond to external stimuli

**Content Area: HONORS ANATOMY AND PHYSIOLOGY****Standard: LIFE SCIENCE 1 – Organization of Life****Valwood Graduates:**

Analyze the relationship between structure and function across all major levels of organization in living systems

**GRADE LEVEL EXPECTATION****Concepts and skills students master:**

- The functionality of living systems, including cells, tissues, and organs derives from the composition and properties of their building blocks
- The human body is comprised of several interacting organ systems that allow for homeostasis, reproduction, and metabolism

**Evidence Outcomes****21<sup>st</sup> Century Skills and Readiness Competencies****Students can:**

- Correctly identify the biological hierarchy of organization from molecular structures to the organismal level
- Describe structures, regions, and systems using appropriate anatomical terminology
- Identify and explain the functions of various tissue types and make a justifiable claim about how their form enables their unique function
- Distinguish the morphological and physiological characteristics of some representative cell types in the human body
- Discuss the biological hallmarks of aging in human tissues
- Engage in thoughtful discourse regarding reductionism versus holism in biological discovery
- Create models of basic homeostatic mechanisms on the cellular level

**Inquiry Questions:**

- How do changes to cells or tissues impact the functionality of an organ system?
- What are the terms used to locate and identify body regions, tissue types, processes, and motion?
- What are the merits of reductionism/holism in science?
- What are general ways in which the body achieves homeostasis?
- How does aging influence the functionality of body systems and why are animals generally more susceptible to the effects than other eukaryotes?

**Relevance and Application:**

- Students will gain the ability to both discuss and interpret anatomical diagrams, diagnostics, diseases, and structures
- The Greek and Latin terminology used in anatomy are universal and breakdown language barriers across the discipline

**Nature of Discipline:**

- To establish effective written and verbal communication
- To conduct appropriate observations and analysis of biological structures
- To form an interdisciplinary network of knowledge, including history, etymology, linguistics, chemistry, and biology

**Content Area: HONORS ANATOMY AND PHYSIOLOGY****Standard: LIFE SCIENCE 2 – Support and Movement****Valwood Graduates:**

- Analyze the relationship between structure and function across all major levels of organization in living systems
- Evaluate and express the role of natural selection and/or the environment in the development and interdependence of molecules, cells, and all living systems

**GRADE LEVEL EXPECTATION****Concepts and skills students master:**

The integumentary, skeletal, and musculoskeletal systems interact to confer protection, movement, support, and growth upon humans

**Evidence Outcomes****Students can:**

- Describe the integumentary system, its components and accessory structures, and the role it plays in homeostasis
- List and describe the classes, processes, and functions of all bones in the axial and appendicular skeleton
- Identify and define the different body movements facilitated by joints, tendons, and muscles
- Explain the formation of all major components of the musculoskeletal system
- Discuss the effect of exercise, nutrition, and hormones on bone and muscle tissue
- Identify problems associated with structural systems, offer a diagnosis, and provide reasonable treatments for common diseases

**21<sup>st</sup> Century Skills and Readiness Competencies****Inquiry Questions:**

- How does the integumentary system offer protection to internal structures while still being susceptible to disease?
- What are joints and how do they direct the movement of limbs and appendages?
- How does smooth muscle tissue interact with the skeletal system to provide structure and movement?
- How does exercise alter and/or improve the structure of the musculoskeletal system?

**Relevance and Application:**

- Students can identify problems or malfunctions in the musculoskeletal system and offer an accurate diagnosis and approach to treatment
- The human skeleton is one of the most iconic and identifiable components of human body composition and serves as the foundation for the remaining organ systems

**Nature of Discipline:**

- Connect visual observation with hands-on practice to synthesize all components of anatomical knowledge
- Learn to describe, organize, and identify large volumes of information in a streamlined way

**Content Area: HONORS ANATOMY AND PHYSIOLOGY****Standard: LIFE SCIENCE 3 – Fluids and Transport****Valwood Graduates:**

- Analyze the relationship between structure and function across all major levels of organization in living systems
- Explain how organisms fulfill all requirements of a living system, maintain homeostasis, and respond to external stimuli

**GRADE LEVEL EXPECTATION****Concepts and skills students master:**

Hematopoiesis provides the circulating components of the blood, lymphatic, and immune systems

<b>Evidence Outcomes</b>	<b>21<sup>st</sup> Century Skills and Readiness Competencies</b>
<p><b>Students can:</b></p> <ol style="list-style-type: none"><li>Identify the primary functions of blood, its fluid and cellular components, and its physical characteristics</li><li>Discuss the structure, function, and formation of blood components</li><li>Explain the significance of AB and Rh blood groups in blood transfusions and discuss a variety of blood disorders</li><li>Identify and describe the anatomy of the human heart, compare smooth muscle and cardiac muscle tissue, and model the path of blood through the cardiac circuits</li><li>Describe the effect of exercise on cardiac output and heart rate</li><li>Name the centers of the brain that control heart rate and describe their function</li><li>Discuss the role of leukocytes, lymphocytes, and the innate versus adaptive immune response in preventing and/or curing pathogen-mediated disease</li><li>Discuss the role of the immune response in autoimmunity, transplantation, and cancer</li></ol>	<p><b>Inquiry Questions:</b></p> <ol style="list-style-type: none"><li>How does the blood achieve nutrient transfer and pathological defense as it travels along the same circuit?</li><li>What is the role of proteins in facilitating information and/or nutrient exchange in bodily fluids?</li><li>How does aerobic exercise directly impact cardiac structure and function?</li><li>What are the major components of the innate and adaptive immune response and how do they coordinate a mounted attack against specific pathogens?</li></ol> <p><b>Relevance and Application:</b></p> <ol style="list-style-type: none"><li>The incidence of emerging infectious diseases is on the rise, evidenced by the COVID-19 pandemic, and requires a more robust understanding of the mechanisms of action that both support human immunity while facilitating the continued evolution of disease-causing agents.</li></ol> <p><b>Nature of Discipline:</b></p> <ol style="list-style-type: none"><li>To derive informed diagnostic conclusions from symptoms of both proper and improper immune system functioning</li><li>To reinforce the advantages of holism when evaluating broad functionality across multiple organ systems</li><li>To explain the significance of conserved structures across many genera and biological families</li></ol>

<b>Content Area: HONORS ANATOMY AND PHYSIOLOGY</b>		
<b>Standard: LIFE SCIENCE 4 – Energy, Maintenance, and Environmental Exchange</b>		
<b>Valwood Graduates:</b> - Analyze the relationship between structure and function across all major levels of organization in living systems - Evaluate and express the role of natural selection and/or the environment in the development and interdependence of molecules, cells, and all living systems		
<b>GRADE LEVEL EXPECTATION</b> <b>Concepts and skills students master:</b> Gas and nutrient exchange is essential to meet the metabolic demands of a human and is strongly impacted by the structure and location of tissues		
<b>Evidence Outcomes</b>	<b>21<sup>st</sup> Century Skills and Readiness Competencies</b>	
<p><b>Students can:</b></p> <ol style="list-style-type: none"> <li>a. List the structures of the respiratory, describe their major functions, and outline the forces necessary to allow for air movement into and out of the lungs</li> <li>b. Summarize the process of oxygen and carbon dioxide transport within the respiratory system and discuss how the respiratory system responds to exercise</li> <li>c. List and describe the functional anatomy of the organs and accessory organs of the digestive system</li> <li>d. Discuss the digestion of the three major macronutrients and summarize the processes that regulate ingestion, propulsion, mechanical digestion, chemical digestion, absorption, and defecation</li> <li>e. Explain the role of metabolism in thermoregulation</li> <li>f. Describe the importance of vitamins and minerals as adjuvants in the diet</li> <li>g. Describe the composition of urine as a product of the urinary system and characterize the roles of each component of the urinary system</li> <li>h. Understand and discuss the implications of kidney failure</li> </ol>	<p><b>Inquiry Questions:</b></p> <ol style="list-style-type: none"> <li>1. How do our dietary choices impact our overall health and the functionality of our digestive system?</li> <li>2. What structural differences exist in the macronutrients that require different metabolic approaches?</li> <li>3. How does metabolism, digestion, and thermoregulation impact homeostasis?</li> <li>4. How does urinary analysis offer insight into digestive and metabolic health?</li> </ol>	
		<p><b>Relevance and Application:</b></p> <ol style="list-style-type: none"> <li>1. Students can make more informed choices regarding consumption of nutrients</li> <li>2. Students become more familiar with signs of metabolic or renal distress and are more likely to take appropriate action</li> </ol>
		<p><b>Nature of Discipline:</b></p> <ol style="list-style-type: none"> <li>1. To examine the delicate balance of gastrointestinal health and its far-reaching effects on other major body system</li> <li>2. To evaluate the energetic demands of various tissues and cells relative to the energetic output of macronutrients</li> </ol>

**Content Area: HONORS ANATOMY AND PHYSIOLOGY****Standard: LIFE SCIENCE 5 – Regulation and Control****Valwood Graduates:**

- Analyze the relationship between structure and function across all major levels of organization in living systems
- Explain how organisms fulfill all requirements of a living system, maintain homeostasis, and respond to external stimuli

**GRADE LEVEL EXPECTATION****Concepts and skills students master:**

- The nervous system controls all voluntary and involuntary actions, behaviors, and responses through electrical stimulation and neurotransmitter secretion
- The endocrine system directly articulates with the nervous system to control hormone production in response to internal and external stimuli

**Evidence Outcomes****Students can:**

- Describe the major divisions of the nervous system, both anatomical and functional, including a distinction between gray and white matter structures
- Distinguish major functions of the nervous system, including sensation, integration, and response
- Categorize major neurotransmitters by chemical type and effect
- Locate regions of the cerebral cortex on the basis of anatomical landmarks common to all human brains and distinguish between the adult and infant human brain
- Discuss the chemical composition of hormones and the mechanisms of hormone action
- Summarize the site of production, regulation, and effects of the hormones of the pituitary, thyroid, parathyroid, adrenal, and pineal glands
- Discuss several diseases associated with endocrine system dysfunction

**21<sup>st</sup> Century Skills and Readiness Competencies****Inquiry Questions:**

- How does the brain coordinate control over all bodily processes?
- How are electrical impulses formed, propagated, and received?
- What is the role of the nervous system in regulating gene expression in response to environmental triggers?
- What are the major components of the endocrine system and how does it interact with neurotransmitters?

**Relevance and Application:**

- Reinforces the necessity of earlier topics in CP/Pre-AP/AP Biology regarding active transport and the maintenance of membrane potential
- Mental disorders, including depression, anxiety, and other neuroendocrine disorders, are on the rise in modern society
- Drugs alter the ability of the nervous system to interact with and regulate other body components

**Nature of Discipline:**

- To critically evaluate the importance, necessity, and potential disadvantages of modern medicine in human health
- To address the interconnectedness of molecules and systems in the human body



<b>Content Area: HONORS ANATOMY AND PHYSIOLOGY</b>	
<b>Standard: LIFE SCIENCE 1</b> – Organization of Life <b>LIFE SCIENCE 2</b> – Support and Movement	
<b>Valwood Graduates:</b> - Analyze the relationship between structure and function across all major levels of organization in living systems - Analyze the impact of environmental pressures on the evolution and functionality of living systems	
<b>GRADE LEVEL EXPECTATION</b> <b>Concepts and skills students master:</b> Anatomical systems are distinguished by their role, composition, and location	
<b>Evidence Outcomes</b>	<b>21<sup>st</sup> Century Skills and Readiness Competencies</b>
<b>Students can:</b> a. Summarize differences between human adult and infant development and compare the embryological development of humans to other organisms b. Demonstrate and explain the occurrence of homologous and analogous structures in relation to environmental pressures and genetic regulation c. Explain how the construction of the human body suggests shared ancestry with other vertebrate organisms d. Provide an accurate description of basic reproductive biology, discuss the role of meiosis in genetic diversity, and justify the advantage of genetic diversity in the continuity of life e. Discuss the effect of human practices and modern medicine on agriculture, biological resistance, and fitness of other organisms f. Facilitate discourse on the continuing evolution of humans and other organisms	<b>Inquiry Questions:</b> 1. What traits unite and distinguish humans from other animals? 2. What does the reoccurrence of anatomical structures in different species suggest about the evolution and use of the structure? 3. Under what circumstances would anatomical structures retain the same materials and be rearranged to accommodate different functions?
	<b>Relevance and Application:</b> 1. Although humans share a great deal in common with other humans, they also demonstrate some notable differences while sharing common traits with more distantly related animals 2. The understanding of human anatomy allows inferences on the anatomy and design of other organisms, supporting careers in veterinary medicine and animal sciences
	<b>Nature of Discipline:</b> 1. To evaluate the origins of human and animal life on Earth 2. To establish the existence and role of a common ancestor 3. To use physical evidence to determine evolutionary likeness and relatedness 4. To use physical evidence to identify conserved features and justify their baseline utility in living systems



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