

Anatomy and Physiology

Science Curriculum Framework

Revised 2005

Course Title: Anatomy and Physiology
Course/Unit Credit: 1
Teacher Licensure: Life Science
Grades: 9-12

Anatomy and Physiology

Anatomy and Physiology should develop an understanding of the organization of the human body through studies of body systems, tissues, and the cell and its chemistry. Students should spend time dissecting and viewing body systems as well as collecting and analyzing data. Instruction and assessment should include both appropriate technology and the safe use of laboratory equipment. Students should be engaged in hands-on laboratory experiences at least 20% of the instructional time.

Strand	Content Standard
	Organization of the Human Body
	1. Students shall explore the organizational structures of the body from the molecular to the organism level.
	Cellular Chemistry
	2. Students shall understand the role of chemistry in body processes.
	Anatomy and Physiology of the Cell
	3. Students shall understand that cells are the basic, structural, and functional units of life.
	Tissues
	4. Students shall understand the <i>histology</i> of the human body.
	Body Systems
	5. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>integumentary system</i> .
	6. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>skeletal system</i> .
	7. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>muscular system</i> .
	8. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>nervous system</i> .
	9. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>endocrine system</i> .
	10. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>cardiovascular system</i> .
	11. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>immune and lymphatic systems</i> .
	12. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>respiratory system</i> .
	13. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>digestive system</i> .
	14. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>urinary system</i> .
	15. Students shall describe the <i>anatomy</i> and <i>physiology</i> of the <i>reproductive system</i> .
	Nature of Science
	16. Students shall demonstrate an understanding that science is a way of knowing.
	17. Students shall design and safely conduct scientific inquiry.
	18. Students shall demonstrate an understanding of current life science theories.
	19. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.
	20. Students shall describe the connections between pure and applied science.
	21. Students shall describe various health science careers and the training required for the selected career.

Strand: Organization of the Human Body

Standard 1: Students shall explore the organizational structures of the body from the molecular to the organism level.

OHB.1.AP.1	Infer the relationship between <i>anatomy</i> and <i>physiology</i>
OHB.1.AP.2	Sequence the levels of organization of the human body
OHB.1.AP.3	Identify the major body systems
OHB.1.AP.4	Describe relative positions, body planes, body regions and body quadrants
OHB.1.AP.5	Identify the major body cavities and the subdivisions of each cavity
OHB.1.AP.6	Investigate <i>homeostatic</i> control mechanisms and their importance to health and diseases
OHB.1.AP.7	Predict the effect of positive and negative feedback mechanisms on <i>homeostasis</i>
OHB.1.AP.8	Identify the major characteristics of life: <ul style="list-style-type: none">• metabolism• responsiveness• movement• growth• reproduction• differentiation

Strand: Cellular Chemistry

Standard 2: Students shall understand the role of chemistry in body processes.

CC.2.AP.1	Distinguish between <i>matter</i> and <i>energy</i>
CC.2.AP.2	Explain the basic assumptions and conclusions of the <i>atomic theory</i>
CC.2.AP.3	Distinguish between <i>compounds</i> and <i>mixtures</i>
CC.2.AP.4	Explain the role of ionic, <i>covalent</i> , and <i>hydrogen bonds</i> in the human body
CC.2.AP.5	Write simple formulas and chemical word equations for the four basic types of reactions: <ul style="list-style-type: none">• <i>synthesis</i>• <i>decomposition</i>• single replacement• double replacement
CC.2.AP.6	Analyze the role of water in the human body
CC.2.AP.7	Explain the relationship among acids, bases, and salts
CC.2.AP.8	Relate the concept of pH to <i>homeostasis</i>
CC.2.AP.9	Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids
CC.2.AP.10	Describe the characteristics and importance of <i>enzymes</i>

Strand: Anatomy and *Physiology* of the Cell

Standard 3: Students shall understand that cells are the basic, structural, and functional units of life.

APC.3.AP.1	Explain the structure and function of the <i>plasma membrane</i>
APC.3.AP.2	Compare and contrast the different ways in which substances cross the <i>plasma membrane</i> : <ul style="list-style-type: none">• <i>diffusion</i> and <i>osmosis</i>• <i>facilitated diffusion</i>• <i>active transport</i>• <i>filtration</i>• <i>endocytosis</i>• <i>exocytosis</i>
APC.3.AP.3	Describe the structure and function of <i>organelles</i> and cell parts
APC.3.AP.4	Identify chemical substances produced by cells
APC.3.AP.5	Differentiate among replication, <i>transcription</i> , and <i>translation</i>
APC.3.AP.6	Differentiate between <i>mitosis</i> and <i>meiosis</i>
APC.3.AP.7	Explain the consequences of abnormal cell division

Strand: Tissues

Standard 4: Students shall understand the *histology* of the human body

T.4.AP.1	Describe the structure, location, and function of each <i>tissue</i> category: <ul style="list-style-type: none">• <i>epithelial</i>• <i>connective</i>• <i>nervous</i>• <i>muscle</i>
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Strand: Body Systems

Standard 5: Students shall describe the *anatomy* and *physiology* of the *integumentary system*.

BS.5.AP.1	Identify the components of the <i>integumentary system</i>
BS.5.AP.2	Discuss the physiological mechanisms of the skin
BS.5.AP.3	Identify the macroscopic and microscopic structure of the <i>integumentary system</i>
BS.5.AP.4	Describe disorders associated with the <i>integumentary system</i>

Strand: Body Systems

Standard 6: Students shall describe the *anatomy* and *physiology* of the *skeletal system*.

BS.6.AP.1	Identify the components the <i>skeletal system</i>
BS.6.AP.2	Discuss the physiological mechanisms of the <i>skeletal system</i>
BS.6.AP.3	Identify the macroscopic and microscopic structure of bone
BS.6.AP.4	Describe disorders associated with the <i>skeletal system</i>

Strand: Body Systems

Standard 7: Students shall describe the *anatomy* and *physiology* of the *muscular system*.

BS.7.AP.1	Identify the components the <i>muscular system</i>
BS.7.AP.2	Discuss the physiological mechanisms of the <i>muscular system</i>
BS.7.AP.3	Identify the macroscopic, microscopic, and molecular structure of muscle
BS.7.AP.4	Describe disorders associated with the <i>muscular system</i>

Strand: Body Systems

Standard 8: Students shall describe the *anatomy* and *physiology* of the *nervous system*.

BS.8.AP.1	Identify the components the <i>nervous system</i>
BS.8.AP.2	Discuss the physiological mechanisms of the <i>nervous system</i>
BS.8.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>nervous system</i>
BS.8.AP.4	Describe disorders associated with the <i>nervous system</i>

Strand: Body Systems

Standard 9: Students shall describe the *anatomy* and *physiology* of the *endocrine system*.

BS.9.AP.1	Identify the components of the <i>endocrine system</i>
BS.9.AP.2	Discuss the physiological mechanisms of the <i>endocrine system</i>
BS.9.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>endocrine system</i>
BS.9.AP.4	Describe disorders associated with the <i>endocrine system</i>

Strand: Body Systems

Standard 10: Students shall describe the *anatomy* and *physiology* of the *cardiovascular system*.

BS.10.AP.1	Identify the components of the <i>cardiovascular system</i>
BS.10.AP.2	Discuss the physiological mechanisms of the <i>cardiovascular system</i>
BS.10.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>cardiovascular system</i>
BS.10.AP.4	Describe disorders associated with the <i>cardiovascular system</i>

Strand: Body Systems

Standard 11: Students shall describe the *anatomy* and *physiology* of the *immune* and *lymphatic* systems.

BS.11.AP.1	Identify the components of the <i>immune</i> and <i>lymphatic</i> systems
BS.11.AP.2	Discuss the physiological mechanisms of the <i>immune</i> and <i>lymphatic</i> systems
BS.11.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>immune</i> and <i>lymphatic</i> systems
BS.11.AP.4	Describe disorders associated with the <i>immune</i> and <i>lymphatic</i> systems

Strand: Body Systems

Standards 12: Students shall describe the *anatomy* and *physiology* of the *respiratory system*.

BS.12.AP.1	Identify the components of the <i>respiratory system</i>
BS.12.AP.2	Discuss the physiological mechanisms of the <i>respiratory system</i>
BS.12.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>respiratory system</i>
BS.12.AP.4	Describe disorders associated with the <i>respiratory system</i>

Strand: Body Systems

Standard 13: Students shall describe the *anatomy* and *physiology* of the *digestive system*.

BS.13.AP.1	Identify the components the <i>digestive system</i>
BS.13.AP.2	Discuss the physiological mechanisms of the <i>digestive system</i>
BS.13.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>digestive system</i>
BS.13.AP.4	Describe disorders associated with the <i>digestive system</i>

Strand: Body Systems

Standard 14: Students shall describe the *anatomy* and *physiology* of the *urinary system*.

BS.14.AP.1	Identify the components the <i>urinary system</i>
BS.14.AP.2	Discuss the physiological mechanisms of the <i>urinary system</i>
BS.14.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>urinary system</i>
BS.14.AP.4	Describe disorders associated with the <i>urinary system</i>

Strand: Body Systems

Standard 15: Students shall describe the *anatomy* and *physiology* of the *reproductive system*

BS.15.AP.1	Describe the components and the organization of the <i>reproductive system</i>
BS.15.AP.2	Discuss the physiological mechanisms of the <i>reproductive system</i>
BS.15.AP.3	Identify the macroscopic, microscopic, and molecular structure of the <i>reproductive system</i>
BS.15.AP.4	Describe disorders associated with the <i>reproductive system</i>

Strand: Nature of Science

Standard 16: Students shall demonstrate an understanding that science is a way of knowing.

NS.16.AP.1	Explain why science is limited to natural explanations of how the world works
NS.16.AP.2	Compare and contrast hypotheses, theories, and laws
NS.16.AP.3	Distinguish between a scientific theory and the term “theory” used in general conversation
NS.16.AP.4	Summarize the guidelines of science: <ul style="list-style-type: none">• explanations are based on observations, evidence, and testing• hypotheses must be testable• understandings and/or conclusions may change with additional empirical data• scientific knowledge must have peer review and verification before acceptance

Strand: Nature of Science

Standard 17: Students shall design and safely conduct scientific inquiry.

NS.17.AP.1	Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation
NS.17.AP.2	Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations
NS.17.AP.3	Identify sources of bias that could affect experimental outcome
NS.17.AP.4	Gather and analyze data using appropriate summary statistics
NS.17.AP.5	Formulate valid conclusions without bias
NS.17.AP.6	Communicate experimental results using appropriate reports, figures, and tables

Strand: Nature of Science

Standard 18: Students shall demonstrate an understanding of current life science theories.

NS.18.AP.1	Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review
NS.18.AP.2	Relate the development of the cell theory to current trends in cellular biology
NS.18.AP.3	Describe the relationship between the germ theory of disease and our current knowledge of immunology and control of infectious diseases
NS.18.AP.4	Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome therapy)
NS.18.AP.5	Research current events and topics in human biology

Strand: Nature of Science

Standard 19: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.

NS.19.AP.1	Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables
NS.19.AP.2	Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)
NS.19.AP.3	Utilize technology to communicate research findings

Strand: Nature of Science

Standard 20: Students shall describe the connections between pure and applied science.

NS.20.AP.1	Compare and contrast human biology concepts in <i>pure science</i> and <i>applied science</i>
NS.20.AP.2	Discuss why scientists should work within ethical parameters
NS.20.AP.3	Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology

Strand: Nature of Science

Standard 21: Students shall describe various health science careers and the training required for the selected career.

NS.21.AP.1	Research and evaluate health science careers using the following criteria: <ul style="list-style-type: none">• educational requirements• salary• availability of jobs• working conditions
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Anatomy and Physiology Glossary

Active transport	The movement of substance across cell membranes against concentration gradient, requiring the expenditure of energy (ATP)
Anatomy	The structure or study of structure of the body and the relation of its parts to each other
Atomic number	Number of protons in an atom
Atomic theory	All matter is made up of atoms
Cardiovascular system	Heart, arteries, veins and capillaries
Compounds	A substance that can be broken down into two or more of the substances by chemical means
Connective tissue	The most abundant of the four basic tissue types in the body, performing the functions of binding and supporting; consists of relatively few cells in a great deal of intercellular substances
Covalent bond	The sharing of electrons between atoms in a way that results in each atom having a filled valence shell
Decomposition	One reactant forming two or more products
Diffusion	A passive process in which there is a net or greater movement of molecules or ions from a region of high concentration to a region of low concentration until equilibrium is reached
Digestive system	Composed of mouth, pharynx esophagus, stomach and small intestines
Endocrine system	Composed of specialized glands that secrete chemicals known as hormones directly into the blood
Endocytosis	The uptake into a cell of large molecules and particles in which a segment of plasma membrane surrounds the substance, encloses it, and bring it in: includes phagocytosis, pinocytosis and receptor-mediated endocytosis
Energy	The capacity to do work
Enzyme	A substance that affects the speed of chemical changes: an organic catalyst, usually a protein
Epithelial tissue	Covers the body and its parts; lines various parts of the body, forms continuous sheets that contain no blood vessels; classified according to shape and arrangement
Exocytosis	A process of discharging cellular products too big to go through the membrane
Facilitated diffusion	Diffusion in which a substance not soluble by itself in lipids in transported across a selectively permeable membrane by combining with a transporter (carrier)
Histology	Microscopic study of the structure of tissues
Homeostasis	The condition in which the body's internal environment remains relatively constant, within physiological limits
Hydrogen bond	A weak attractive force existing between a hydrogen atom and a partial positive charge and an electronegative atom

Immune system	Bodies defense system against disease
Integumentary system	Skin and its related structures
Lymphatic system	Supplements the vertebrates circulatory system -- delivers fluid, solutes from interstitial fluid to blood
Matter	Anything that has mass and takes up space
Meiosis	A type of cell division restricted to sex-cell production involving two successive nuclear divisions that result in daughter cell with the haploid (n) number of chromosomes
Mitosis	The orderly division of a cell that ensures that each daughter nucleus has the same number and kind of chromosomes as the original parent nucleus
Mixture	Two or more elements intermingled in properties that can and usually do vary
Muscular Tissue	A tissue specialized to produce motion in response to muscle action potentials by its qualities of contractility, extensibility, elasticity and excitability
Nervous System	Brain, spinal cord and nerves
Organelle	A permanent structure within a cell with characteristic morphology that is specialized to serve a specific function in cellular activities
Osmosis	The net movement of water molecules through a selective permeable membrane from an area of high water concentration to an area of lower water concentration until an equilibrium is reached
Physiology	Science that deals with the functions of an organism or its parts
Plasma (cell) membrane	Outer, limiting membrane that separates the cells internal parts from extracellular fluid and the external environmental
Reproductive system	Responsible for either the formation of new cells for growth, repair or replacement or the production of a new individual
Respiratory system	Composed of nose, pharynx, larynx, trachea, bronchi and lungs
Skeletal system	Bones, cartilage, and ligaments that provide the body with a rigid framework for support and protection
Synthesis	Two or more reactants form one product
Transcription	The synthesis of RNA using one strand of DNA as the template
Translation	The synthesis of a protein
Urinary system	Responsible for excreting most liquid waste

Appendix

Suggested Anatomy and Physiology Labs

Strand	Suggested Laboratory or Activity
Orientation of the body	anatomical position lab
Cellular Chemistry	pH lab osmosis and diffusion lab atom modeling lab
Body Systems	dissection of a mammal lab respiration lab exercise lab blood typing-simulated blood urinalysis reflex lab enzyme lab (digestion)