Biology Curriculum

Board Approved: 02/19/2026

Course Information

High School
Full Year

Course Description:
Biology is the study of life, encompassing its diversity, structure, function, evolution, and interactions within the environment. Students investigate the fundamental concepts of living organisms: cell structure and function, energy use, growth, reproduction, genetics, inheritance, response to the environment, ecology, and evolution.

Transfer Goals:
- Approach science as a reliable and tentative way of knowing and explaining the natural world.
- Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions.
- Use critical thinking, science, and engineering practices to analyze ideas and phenomena to solve problems.
- Recognize that science is an ongoing human endeavor that helps us understand our universe.

Curriculum Standards: Science Missouri Learning Standards

Curriculum Resource(s): HMH Science Dimensions Biology, 2018

Unit 1:Molecules to Organisms

Timeframe: 12 Weeks

Unit Description: In this unit, students will investigate the structure and function of macromolecules, DNA, proteins, cells, and the process of cell division. Through the use of creating models and using evidence, students will be able to explain how key structures and their functions allow an organism to maintain homeostasis.

Enduring Understandings:

- Genetic information stored in DNA directs the production of proteins, which carry out the structure and function of life.
- Living organisms are made of systems and subsystems that interact to maintain balance, support growth, and carry out life processes.
- Energy and matter flow through organisms via processes like photosynthesis, cellular respiration, and chemical reactions involving macromolecules.
- Cell division and differentiation are essential for growth, repair, and the development of complex organisms.
- All living things are made from a small set of elements that combine into macromolecules with specific roles, supporting life's essential functions.

Essential Questions:

- What are the essential functions of all living things?
- How does DNA control the proteins produced in an organism, and what are the roles of proteins?
- What is the connection between genes and proteins?
- How do cells, tissues, organs, and systems work together to keep an organism alive?
- Why is system organization important for survival in multicellular organisms?
- How do organisms detect and respond to changes in their environment?
- What systems help maintain balance inside the body (homeostasis)?
- How do new cells form and become specialized to perform specific functions?
- Why is cell division important for growth, development, and repair?
- How do plants and animals get and use energy?
- What is the relationship between photosynthesis and cellular respiration in ecosystems?
- How is energy stored, transferred, and used by living organisms?
- What happens to matter and energy during chemical reactions in the body?

Unit 1 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
9-12.LS1.A.1	● I can construct a model of how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.

9-12.LS1.A.2	● **I can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.**
9-12.LS1.A.3	● I can plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
9-12.LS1.B.1	● **I can develop and use models to communicate the role of mitosis, cellular division, and differentiation in producing and maintaining complex organisms.**
9-12.LS1.C.1	● I can use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy.
9-12.LS1.C.2	● I can use a model to describe the relationship between carbon dioxide and water being produced from sugar and oxygen through the process known as cellular respiration. ● I can use a model to show that the chemical reaction of oxygen and food releases energy as the matter is rearranged.
9-12.LS1.C.3	● I can construct an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form large carbon-based molecules. ● I can revise an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form large carbon-based molecules.

Unit 2: Ecology and Cycling of Matter

Timeframe: 5 weeks

Unit Description: In this unit, students will learn how energy and matter flow and cycle throughout an ecosystem through ecological relationships. Changes in ecosystems can impact the stability and ecological relationships within the system. Students will understand how organisms interact with each other and how human activities can impact both organisms and cycles within ecosystems.

Enduring Understandings:

- Ecosystems are shaped by interactions between living and nonliving factors, and population sizes depend on resource availability and environmental conditions.
- Energy flows and matter cycles through ecosystems via processes such as photosynthesis, respiration, and decomposition, forming interconnected food webs.
- The carbon cycle connects Earth's spheres through biological and chemical processes that influence ecosystem balance and climate.
- Ecosystems can maintain stability, but environmental changes—natural or human-caused—can disrupt populations, biodiversity, and ecosystem dynamics.
- Human activities impact biodiversity and ecosystem health, and sustainable solutions are necessary to protect and restore ecological balance.

Essential Questions:

- How do biotic (living) and abiotic (non-living) factors influence the strength and stability of ecosystems?
- What are the key processes that cycle matter and flow energy through ecosystems, and how do environmental conditions impact these processes?
- How does energy move through an ecosystem, and why do producers have access to the most energy compared to consumers?
- How does carbon cycle through ecosystems, and how do photosynthesis, respiration, decomposition, and combustion contribute to this cycle?
- How do ecosystems maintain stable populations, and what happens when changes disrupt those populations?
- How do human activities like overpopulation, habitat destruction, and pollution affect biodiversity and ecosystem health?
- What strategies can be designed to address environmental challenges and protect biodiversity in ecosystems?

Unit 2 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
9-12.LS2.A.1	• **I can use mathematical and/or computational representations to evaluate the significance of a phenomenon related to the number of organisms and populations an ecosystem can support.**
9-12.LS2.B.1	• I can construct or revise an explanation based on evidence that the processes of photosynthesis, chemosynthesis, and aerobic and anaerobic respiration are responsible for the cycling of matter and flow of energy through ecosystems and that environmental conditions restrict which reactions can occur.

priority standards indicated in **bold*

9-21.LS2.B.2	• **I can communicate the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem.**
9-12.LS2.B.3	• I can use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere.
9-12.LS2.C.1	• I can evaluate the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics.
9-12.LS2.C.2	• I can design, evaluate, and refine solutions that positively impact the environment and biodiversity.
9-12.ESS3.D.2	• I can predict how human activity affects the relationships between Earth systems in positive ways. • I can predict how human activity affects the relationships between Earth systems in negative ways.
9-12.ESS3.C.1	• I can create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

Unit 3: Heredity-Inheritance, and Variation of Traits

Timeframe: 7 weeks

Unit Description: In this unit, students explore how traits are inherited and vary in populations by modeling how DNA in chromosomes is passed from parents to offspring through meiosis and fertilization. They compare sexual and asexual reproduction, explain how DNA codes for proteins, and examine how mutations can affect traits. Using tools like Punnett squares and pedigrees, students analyze patterns of inheritance and genetic variation, applying concepts of probability and data to understand how traits are expressed and distributed.

Enduring Understandings:

- Traits are inherited through DNA, which is organized into chromosomes and passed from parents to offspring through sexual or asexual reproduction.
- Genetic variation arises from processes like meiosis, fertilization, and mutation, influencing how traits are expressed and inherited.
- DNA contains instructions for making proteins, which determine an organism's traits and functions.
- Patterns of inheritance and trait variation within populations can be predicted and explained using models, probability, and statistics.

Essential Questions:

- How is genetic information stored, packaged, and passed from parents to offspring?
- What processes are the main sources of genetic variation within populations?
- What is the role of DNA in determining an organism's traits?
- How do sexual and asexual reproduction affect genetic variation?
- How do processes like meiosis and fertilization contribute to the genetic diversity of individuals?
- What happens when changes (mutations) occur in DNA, and how can they affect organisms?
- How can models help us understand and predict patterns of inheritance?
- How can we use data and probability to explain the variation of traits in a population?
- How do environmental conditions impact the distribution of traits in a population in addition to genetics?

Unit 3 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
9-12.LS3.A.1	• **I can develop models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.** • **I can use models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.**

9-12.LS3.B.1	• I can compare asexual and sexual reproduction with regard to genetic information and variation in offspring.
9-12.LS3.B.2	• I can develop a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. • I can use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
9-12.LS3.B.3	• I can make a claim that inheritable genetic variations may result from new genetic combinations through meiosis, mutations occurring during replication, and/or mutations caused by environmental factors. • I can defend a claim that inheritable genetic variations may result from new genetic combinations through meiosis, mutations occurring during replication, and/or mutations caused by environmental factors.
9-12.LS3.B.4	• I can apply concepts of statistics to explain the variation and distribution of expressed traits in a population. • I can apply concepts of probability to explain the variation and distribution of expressed traits in a population.

Unit 4: Biological Evolution - Unity & Diversity

Timeframe: 6 weeks

Unit Description: In this unit, students will investigate how genetic variation, competition, and natural selection drive the process of evolution. Common ancestry and biological evolution are supported by multiple lines of evidence, including DNA and amino acid sequence similarities, and patterns in embryological development across species. Changes in the environment can lead to changes in species, as well as the extinction of others. Students model and revise solutions for the negative impacts of human activities on biodiversity.

Enduring Understandings:

- Multiple lines of scientific evidence, including genetic, anatomical, and developmental data, support the theory of biological evolution and common ancestry.
- Evolution occurs through genetic variation, natural selection, and environmental pressures, leading to adaptations, new species, or extinction.
- The frequency of traits in populations changes over time due to selective advantages, which can be analyzed using statistics and probability.
- Human activities impact biodiversity, and protecting ecosystems requires evaluating and implementing sustainable, evidence-based solutions.

Essential Questions:

- How does scientific evidence from DNA, amino acids, and anatomy support the theory of common ancestry and biological evolution?
- What can embryological and anatomical data reveal about the relationships between species that may not be visible in their adult forms?
- How do genetic variation, competition, and natural selection drive the process of evolution?
- How can we use statistical analysis and probability to understand how advantageous traits become more common in a population over time?
- In what ways does natural selection lead to the adaptation of populations, and how do these adaptations affect survival and reproduction?
- How do environmental changes influence the size, diversity, and survival of species?
- What are the impacts of human activities on biodiversity, and how can we mitigate these impacts to protect ecosystems?
- How can we evaluate and design solutions to protect biodiversity, considering both their potential benefits and negative consequences?

Unit 4 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
9-12.LS4.A.1	• I can communicate scientific information that common ancestry and biological evolution are supported by multiple lines of evidence.

9-12.LS4.A.2	• I can analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
9-12.LS4.B.1	• I can construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
9-12.LS4.B.2	• I can apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
9-12.LS4.C.1	• I can construct an explanation for how natural selection leads to the adaptation of populations. • I can use evidence to explain how natural selection leads to adaptation of populations.
9-12.LS4.C.2	• **I can evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.**
9-12.ESS2.E.1	• I can construct an argument based on evidence that the simultaneous coevolution of Earth's systems and life on Earth.
9-12.LS4.C.3	• I can create and revise a model to test a solution to mitigate the adverse impacts of human activity on biodiversity.