

Science Tutorials offer targeted instruction, practice, and review designed to help students develop fluency, deepen conceptual understanding, and apply scientific thinking skills. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing their ability to explain and analyze biological scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible through focused content, guided analysis, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

This Tutorial is built to state standards and the Next Generation Science Standards for Biology.

Unit 1: Nature of Life

- **FROM ATOMS TO BIOSPHERE**

- HS-LS1-2: From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

- **CHARACTERISTICS OF LIFE**

Unit 2: The Chemistry of Life

- **BIOMOLECULES**

- HS-LS1-6: From Molecules to Organisms: Structures and Processes Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

- **ENZYMES**

- HS-LS1-1: From Molecules to Organisms: Structures and Processes Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Unit 3: Cell Structure and Function

- **PROKARYOTIC AND EUKARYOTIC CELLS**

- **PLANT AND ANIMAL CELLS**

- **PASSIVE TRANSPORT**

- HS-LS1-3: From Molecules to Organisms: Structures and Processes Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

- **ACTIVE TRANSPORT**

- HS-LS1-3: From Molecules to Organisms: Structures and Processes Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Unit 4: Cellular Energetics

- **PHOTOSYNTHESIS**

- HS-LS1-5: From Molecules to Organisms: Structures and Processes Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

- **CELLULAR RESPIRATION**

- HS-LS1-7: From Molecules to Organisms: Structures and Processes Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
- HS-LS2-3: Ecosystems: Interactions, Energy, and Dynamics Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Unit 5: Cell Growth and Reproduction

- **THE CELL CYCLE**

- HS-LS1-4: From Molecules to Organisms: Structures and Processes Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

- **MITOSIS**

- HS-LS1-4: From Molecules to Organisms: Structures and Processes Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Unit 6: DNA Structure and Function

- **COMPONENTS OF DNA**

- HS-LS1-1: From Molecules to Organisms: Structures and Processes Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

- **THE GENETIC CODE**

- HS-LS1-1: From Molecules to Organisms: Structures and Processes Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

- **DNA REPLICATION**

- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Unit 7: Gene Expression

• TRANSCRIPTION

- HS-LS1-1: From Molecules to Organisms: Structures and Processes Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

• TRANSLATION

- HS-LS1-1: From Molecules to Organisms: Structures and Processes Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Unit 8: Mutations

• GENETIC CHANGES IN DNA

- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- HS-LS3-2: Heredity: Inheritance and Variation of Traits Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
- HS-LS4-2: Biological Evolution: Unity and Diversity 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.

• GENETIC CHANGES IN CHROMOSOMES

- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- HS-LS3-2: Heredity: Inheritance and Variation of Traits Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
- HS-LS4-2: Biological Evolution: Unity and Diversity 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.

Unit 9: Heredity

- **MENDELIAN LAWS OF HEREDITY**

- HS-LS3-3: Heredity: Inheritance and Variation of Traits Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**

- HS-LS3-3: Heredity: Inheritance and Variation of Traits Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Unit 10: Reproduction

- **MEIOSIS**

- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- HS-LS4-4: Biological Evolution: Unity and Diversity Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

- **SEXUAL AND ASEXUAL REPRODUCTION**

- HS-LS3-1: Heredity: Inheritance and Variation of Traits Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Unit 11: Evolution

- **MULTIPLE LINES OF EVIDENCE**

- HS-LS4-1: Biological Evolution: Unity and Diversity Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

- **THE FOSSIL RECORD**

- HS-LS4-1: Biological Evolution: Unity and Diversity Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Unit 12: Mechanisms of Evolution

- **NATURAL SELECTION**

- HS-LS4-4: Biological Evolution: Unity and Diversity Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
- HS-LS2-8: Ecosystems: Interactions, Energy, and Dynamics Evaluate the evidence for the role of group behavior on individual and species chances to survive and reproduce.

- **EVOLUTION OF SPECIES**

- HS-LS4-5: Biological Evolution: Unity and Diversity 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.

Unit 13: Classification

- **TAXONOMY**
- **THE SIX KINGDOMS**

Unit 14: Homeostasis

- **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**
- HS-LS1-3: From Molecules to Organisms: Structures and Processes Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- **FEEDBACK MECHANISMS IN ANIMALS**
- HS-LS1-3: From Molecules to Organisms: Structures and Processes Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Unit 15: Functions of Animal Systems

- **THE IMMUNE AND LYMPHATIC SYSTEMS**
- HS-LS1-2: From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **THE NERVOUS SYSTEM**
- HS-LS1-2: From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Unit 16: Functions of Plant Systems

- **PLANT TISSUES**
- HS-LS1-2: From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **PLANT RESPONSES**
- HS-LS1-2: From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Unit 17: Matter and Energy

- **FOOD CHAINS AND WEBS**
- HS-LS2-4: Ecosystems: Interactions, Energy, and Dynamics Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**

- HS-LS2-4: Ecosystems: Interactions, Energy, and Dynamics Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Unit 18: Cycles in Nature

- **THE CARBON CYCLE**

- HS-LS2-5: Ecosystems: Interactions, Energy, and Dynamics Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- HS-LS2-4: Ecosystems: Interactions, Energy, and Dynamics Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

- **THE NITROGEN AND PHOSPHORUS CYCLES**

Unit 19: Ecology of Succession

- **SUCCESSION IN COMMUNITIES**

- HS-LS2-6: Ecosystems: Interactions, Energy, and Dynamics Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

- **NATURAL IMPACTS ON ECOSYSTEMS**

- HS-LS2-6: Ecosystems: Interactions, Energy, and Dynamics Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS4-5: Biological Evolution: Unity and Diversity 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.