

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.

1. NATURE OF LIFE

- **FROM ATOMS TO BIOSPHERE**

- **HS-LS1-2** *Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.*

- **CHARACTERISTICS OF LIFE**

2. THE CHEMISTRY OF LIFE

- **BIOMOLECULES**

- **HS-LS1-6** *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** *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.*

3. CELL STRUCTURE AND FUNCTION

- **PROKARYOTIC AND EUKARYOTIC CELLS**

- **PLANT AND ANIMAL CELLS**

- **PASSIVE TRANSPORT**

- **HS-LS1-3** *Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.*

- **ACTIVE TRANSPORT**

- **HS-LS1-3** *Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.*

4. CELLULAR ENERGETICS

- **PHOTOSYNTHESIS**

- **HS-LS1-5** Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

- **CELLULAR RESPIRATION**

- **HS-LS1-7** 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** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

5. CELL GROWTH AND REPRODUCTION

- **THE CELL CYCLE**

- **HS-LS1-4** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

- **MITOSIS**

- **HS-LS1-4** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

6. DNA STRUCTURE AND FUNCTION

- **COMPONENTS OF DNA**

- **HS-LS1-1** 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** 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** 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** Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

7. GENE EXPRESSION

- **TRANSCRIPTION**

- **HS-LS1-1** 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** 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** 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.

8. MUTATIONS

- **GENETIC CHANGES IN DNA**

- **HS-LS3-1** 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** 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** 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** 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** 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** 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. HEREDITY

- **MENDELIAN LAWS OF HEREDITY**

- **HS-LS3-3** 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** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

10. REPRODUCTION

- **MEIOSIS**

- **HS-LS3-1** 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** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

- **SEXUAL AND ASEQUAL REPRODUCTION**

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

11. EVOLUTION

- **MULTIPLE LINES OF EVIDENCE**

- **HS-LS4-1** Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

- **THE FOSSIL RECORD**

- **HS-LS4-1** Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

12. MECHANISMS OF EVOLUTION

- **NATURAL SELECTION**

- **HS-LS4-4** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

- **HS-LS2-8** Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

- **EVOLUTION OF SPECIES**

- **HS-LS4-5** 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.

13. CLASSIFICATION

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

14. HOMEOSTASIS

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

15. FUNCTIONS OF ANIMAL SYSTEMS

- **THE IMMUNE AND LYMPHATIC SYSTEMS**
 - **HS-LS1-2** 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** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

16. FUNCTIONS OF PLANT SYSTEMS

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

17. MATTER AND ENERGY

- **FOOD CHAINS AND WEBS**
 - **HS-LS2-4** 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** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

18. CYCLES IN NATURE

- **THE CARBON CYCLE**

- **HS-LS2-5** *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** *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**

19. ECOLOGY OF SUCCESSION

- **SUCCESSION IN COMMUNITIES**

- **HS-LS2-6** *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** *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** *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.*