Indiana 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: 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. Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.
- **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. Clarification Statement: Emphasis is on how the structure of regions of DNA, called genes, determine the structure of proteins. Proteins are made and carry out the essential functions of life within different cellular organelles. Examples of essential proteins can include enzymes, membrane channels, immune proteins.
- **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. Clarification Statement: Emphasis is on how the structure of regions of DNA, called genes, determine the structure of proteins. Proteins are made and carry out the essential functions of life within different cellular organelles. Examples of essential proteins can include enzymes, membrane channels, immune proteins.

Copyright© Edmentum Inc. All Rights Reserved.

Unit 2: From DNA to Proteins

- **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. Clarification Statement: Emphasis is on how the structure of regions of DNA, called genes, determine the structure of proteins. Proteins are made and carry out the essential functions of life within different cellular organelles. Examples of essential proteins can include enzymes, membrane channels, immune proteins.
  - 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.
- **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. Clarification Statement: Emphasis is on how the structure of regions of DNA, called genes, determine the structure of proteins. Proteins are made and carry out the essential functions of life within different cellular organelles. Examples of essential proteins can include enzymes, membrane channels, immune proteins.
- **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. Clarification Statement: Emphasis is on how the structure of regions of DNA, called genes, determine the structure of proteins. Proteins are made and carry out the essential functions of life within different cellular organelles. Examples of essential proteins can include enzymes, membrane channels, immune proteins.

Unit 3: Interacting Systems

- **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. Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
- **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. Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.

Copyright© Edmentum Inc. All Rights Reserved.

- **PLANT SYSTEMS**
  - HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.

Unit 4: Homeostasis

- **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**
  - HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
- **HOMEOSTASIS IN ANIMALS**
  - HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
- **HOMEOSTASIS IN PLANTS**
  - HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.

Unit 5: Cellular Processes

- **MITOSIS**
  - HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
- **PHOTOSYNTHESIS**
  - HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.
  - 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. Clarification Statement: Examples of models could include simulations and mathematical models.
- **CELLULAR RESPIRATION**

Copyright© Edmentum Inc. All Rights Reserved.

- 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. Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.
- 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. Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.

Unit 6: Ecosystem Dynamics

- **NATURAL IMPACT OF ECOSYSTEMS**
  - HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.
  - 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. Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.
  - 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. Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.
- **SUCCESSION IN THE COMMUNITIES**
  - HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.

Unit 7: Energy and Matter

- **FOOD CHAINS AND WEBS**
  - 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. Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.
- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**
  - 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. Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.

Copyright© Edmentum Inc. All Rights Reserved.

- HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen, and nitrogen being conserved as they move through an ecosystem.

Unit 8: Cycles in Nature

- **NITROGEN AND PHOSPHORUS CYCLE**
  - 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. Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.
  - HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen, and nitrogen being conserved as they move through an ecosystem.
- **CARBON?CYCLE**
  - 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. Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.
  - HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen, and nitrogen being conserved as they move through an ecosystem.
  - 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. Clarification Statement: Examples of models could include simulations and mathematical models.
  - HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Unit 9: Human Impacts on Ecosystems

- **NATURAL RESOURCES**
  - HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.

Copyright© Edmentum Inc. All Rights Reserved.

- **IMPACTS OF HUMANS**
  - HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.
- **CLIMATE**
  - HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Unit 10: Heredity

- **MENDELIAN LAWS OF HEREDITY**
  - 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-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.
- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**
  - 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-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.

Unit 11: Meiosis and Genetic Variation

- **MEIOSIS**
  - 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. Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.
- **GENETIC CHANGES IN DNA**
  - 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. Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.

Unit 12: Evolution

- **NATURAL SELECTION**

Copyright© Edmentum Inc. All Rights Reserved.

- HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.
- HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.
- 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. Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on the number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.
- HS-LS4-3: 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. Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.
- HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.

- **MULTIPLE LINES OF EVIDENCE**
  - HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.

Copyright© Edmentum Inc. All Rights Reserved.