

Georgia Tutorials are designed specifically for the Georgia Standards of Excellence and the Georgia Performance Standards to prepare students for the Georgia Milestones.

Biology 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.

Unit 1: The Nature of Life

• FROM ATOMS TO BIOSPHERE

- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

• CHARACTERISTICS OF LIFE

- SB1.b: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.
- SB2.c: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture.
- SB5.e: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct explanations that predict an organisms ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).

- SB6.d: Obtain, evaluate, and communicate information to assess the theory of evolution. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms.
- SB1.d: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.
- **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**
 - SB5.e: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct explanations that predict an organisms ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).
 - SB1.d: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.

Unit 2: The Chemistry of Life

- **BIOMOLECULES**
 - SB1.c: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes.
 - SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- **ENZYMES**
 - SB1.c: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes.

Unit 3: Cell Structure

- **PROKARYOTIC AND EUKARYOTIC CELLS**
 - SB1.a: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Construct an explanation of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall,

chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis.

- **PLANT AND ANIMAL CELLS**

- SB1.a: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Construct an explanation of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis.

Unit 4: Active and Passive Transport

- **PASSIVE TRANSPORT**

- SB1.d: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.

- **ACTIVE TRANSPORT**

- SB1.d: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.

Unit 5: Cellular Energetics

- **PHOTOSYNTHESIS**

- SB1.e: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga).
- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

- **CELLULAR RESPIRATION**

- SB1.e: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga).
- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the

cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

Unit 6: Cell Growth and Reproduction

• THE CELL CYCLE

- SB1.b: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.

• MITOSIS

- SB1.b: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.

Unit 7: DNA Structure and Function

• COMPONENTS OF DNA

- SB2.a: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.

• THE GENETIC CODE

- SB2.a: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.
- SB2.c: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture.

• DNA REPLICATION

- SB2.a: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.

Unit 8: Gene Expression

• TRANSCRIPTION

- SB2.a: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an explanation of how the structures of DNA and RNA lead to the

expression of information within the cell via the processes of replication, transcription, and translation.

- **TRANSLATION**

- SB2.a: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.

Unit 9: Mutations

- **GENETIC CHANGES IN DNA**

- SB2.b: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).
- SB2.c: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture.

- **GENETIC CHANGES IN CHROMOSOMES**

- SB2.b: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).
- SB2.c: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture.

Unit 10: Heredity

- **MENDELIAN LAWS OF HEREDITY**

- SB3.a: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.
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- SB3.b: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Use mathematical models to predict and explain patterns of inheritance.

- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**

- SB3.a: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.
- SB3.b: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Use mathematical models to predict and explain patterns of inheritance.

Unit 11: Reproduction

- **MEIOSIS**

- SB1.b: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.
- SB3.a: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.
- SB2.b: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).

- **SEXUAL AND ASEQUAL REPRODUCTION**

- SB1.b: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.
- SB3.c: Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. Construct an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction.

Unit 12: Evolution

- **MULTIPLE LINES OF EVIDENCE**

- SB6.c: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent.
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
- SB6.b: Obtain, evaluate, and communicate information to assess the theory of evolution. Analyze and interpret data to explain patterns in biodiversity that result from speciation.

- **THE FOSSIL RECORD**

- SB6.c: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent.
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
- SB6.b: Obtain, evaluate, and communicate information to assess the theory of evolution. Analyze and interpret data to explain patterns in biodiversity that result from speciation.

Unit 13: Mechanisms of Evolution

- **NATURAL SELECTION**

- SB2.b: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
- SB6.b: Obtain, evaluate, and communicate information to assess the theory of evolution. Analyze and interpret data to explain patterns in biodiversity that result from speciation.
- SB6.d: Obtain, evaluate, and communicate information to assess the theory of evolution. Develop and use mathematical models to support explanations of how undirected genetic

changes in natural selection and genetic drift have led to changes in populations of organisms.

- **EVOLUTION OF SPECIES**

- SB6.c: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent.
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
- SB6.b: Obtain, evaluate, and communicate information to assess the theory of evolution. Analyze and interpret data to explain patterns in biodiversity that result from speciation.
- SB6.d: Obtain, evaluate, and communicate information to assess the theory of evolution. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms.

Unit 14: Classification

- **TAXONOMY**

- SB2.c: Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture.
- SB4.a: Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. Construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes - fungi, plants, animals.
- SB4.b: Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. Analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.

- **THE SIX KINGDOMS**

- SB4.a: Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. Construct an argument

supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes - fungi, plants, animals.

- SB4.b: Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. Analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.
- SB6.a: Obtain, evaluate, and communicate information to assess the theory of evolution. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
- SB6.b: Obtain, evaluate, and communicate information to assess the theory of evolution. Analyze and interpret data to explain patterns in biodiversity that result from speciation.

Unit 15: Functions of Animal Systems

- **THE IMMUNE AND LYMPHATIC SYSTEMS**
- **THE NERVOUS SYSTEM**

Unit 16: Functions of Plant Systems

- **PLANT TISSUES**
- **PLANT RESPONSES**

Unit 17: Matter and Energy

- **FOOD CHAINS AND WEBS**
- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- SB5.a: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.
- SB5.d: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Design a solution to reduce the impact of a human activity on the environment.
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**

- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- SB5.a: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.
- SB5.d: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Design a solution to reduce the impact of a human activity on the environment.
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

Unit 18: Cycles in Nature

- **THE CARBON CYCLE**

- SB1.e: Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga).
- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- SB5.d: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Design a solution to reduce the impact of a human activity on the environment.
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

- **THE NITROGEN AND PHOSPHORUS CYCLES**

- SB5.d: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Design a solution to reduce the impact of a human activity on the environment.

- SB5.b: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

Unit 19: Ecology of Succession

• SUCCESSION IN COMMUNITIES

- SB5.a: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

• NATURAL IMPACTS ON ECOSYSTEMS

- SB5.a: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.
- SB5.c: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.
- SB5.e: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. Construct explanations that predict an organisms ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).