

New Jersey Tutorials are designed specifically for the New Jersey Core Curriculum Content Standards to prepare students for the PARCC assessments, the New Jersey Biology Competency Test (NJBCT).

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.

## 1. NATURE OF LIFE

### • FROM ATOMS TO BIOSPHERE

- **5.3.12.A.a** Cells are made of complex molecules that consist mostly of a few elements. Each class of molecules has its own building blocks and specific functions.
- **5.3.12.A.f** There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.
- **5.3.12.B.a** As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.
- **5.3.12.C.a** Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms.
- **5.3.12.B.1** Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.

### • CHARACTERISTICS OF LIFE

- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.
- **5.3.12.B.5** Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration.
- **5.3.12.B.f** All organisms must break the high-energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes.
- **5.3.12.A.d** Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.

## 2. THE CHEMISTRY OF LIFE

### • BIOMOLECULES

- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.

- **5.3.12.A.a** Cells are made of complex molecules that consist mostly of a few elements. Each class of molecules has its own building blocks and specific functions.
- **5.3.12.B.a** As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.
- **5.3.12.A.1** Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.
- **5.3.12.A.b** Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes.

- **ENZYMES**

- **5.3.12.A.b** Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes.
- **5.3.12.A.2** Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.

### 3. CELL STRUCTURE AND FUNCTION

- **PROKARYOTIC AND EUKARYOTIC CELLS**

- **5.3.12.A.b** Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes.
- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.

- **PLANT AND ANIMAL CELLS**

- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.
- **5.3.12.A.3** Predict a cell's response in a given set of environmental conditions.
- **5.3.12.B.e** In both plant and animal cells, sugar is a source of energy and can be used to make other carbon-containing (organic) molecules.

### 4. ACTIVE AND PASSIVE TRANSPORT

- **PASSIVE TRANSPORT**

- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.
- **5.3.12.A.3** Predict a cell's response in a given set of environmental conditions.

- **ACTIVE TRANSPORT**

- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.
- **5.3.12.A.3** Predict a cell's response in a given set of environmental conditions.

### 5. CELLULAR ENERGETICS

- **PHOTOSYNTHESIS**

- **5.3.12.B.d** Plants have the capability to take energy from light to form sugar molecules containing carbon, hydrogen, and oxygen.
- **5.3.12.B.4** Explain how environmental factors (such as temperature, light intensity, and the amount of water available) can affect photosynthesis as an energy storing process.
- **5.3.12.B.5** Investigate and describe the complementary relationship (cycling of matter and flow of energy) between

photosynthesis and cellular respiration.

- **CELLULAR RESPIRATION**

- **5.3.12.B.5** Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration.
- **5.3.12.B.f** All organisms must break the high-energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes.
- **5.3.12.B.e** In both plant and animal cells, sugar is a source of energy and can be used to make other carbon-containing (organic) molecules.

## 6. CELL GROWTH AND REPRODUCTION

- **THE CELL CYCLE**

- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.
- **5.3.12.A.d** Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.
- **5.3.12.A.4** Distinguish between the processes of cellular growth (cell division) and development (differentiation).

- **MITOSIS**

- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.
- **5.3.12.A.d** Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.

## 7. DNA STRUCTURE AND FUNCTION

- **COMPONENTS OF DNA**

- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.
- **5.3.12.A.1** Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.
- **5.3.12.D.a** Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.

- **THE GENETIC CODE**

- **5.3.12.D.a** Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.

- **DNA REPLICATION**

## 8. GENE EXPRESSION

- **TRANSCRIPTION**

- **5.3.12.A.1** Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models.
- **5.3.12.D.a** Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.

- **TRANSLATION**

- **5.3.12.D.a** Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.
- **5.3.12.A.b** Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known

as enzymes.

## 9. MUTATIONS

### • GENETIC CHANGES IN DNA

- **5.3.12.D.b** Inserting, deleting, or substituting DNA segments can alter the genetic code. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.
- **5.3.12.D.2** Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations.
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.

### • GENETIC CHANGES IN CHROMOSOMES

- **5.3.12.D.a** Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins.
- **5.3.12.D.c** Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.
- **5.3.12.D.3** Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization).
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.
- **5.3.12.D.b** Inserting, deleting, or substituting DNA segments can alter the genetic code. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.
- **5.3.12.D.2** Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations.

## 10. HEREDITY

### • MENDELIAN LAWS OF HEREDITY

- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.
- **5.3.12.D.c** Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.
- **5.3.12.D.3** Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization).

### • MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE

- **5.3.12.D.c** Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.

## 11. REPRODUCTION

### • MEIOSIS

- **5.3.12.D.c** Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.
- **5.3.12.D.3** Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization).
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells

within a population.

- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.
- **5.3.12.E.d** Evolution occurs as a result of a combination of the following factors: Ability of a species to reproduce; Genetic variability of offspring due to mutation and recombination of genes; Finite supply of the resources required for life; Natural selection, due to environmental pressure, of those organisms better able to survive and leave offspring.

- **SEXUAL AND ASEXUAL REPRODUCTION**

- **5.3.12.D.c** Sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations in the offspring of any two parents.
- **5.3.12.D.3** Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization).
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.
- **5.3.12.A.d** Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.

## 12. EVOLUTION

- **MULTIPLE LINES OF EVIDENCE**

- **5.3.12.E.c** The principles of evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as evidenced in the fossil record and in the similarities that exist within the diversity of existing organisms.
- **5.3.12.E.3** Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.).
- **5.3.12.E.b** Molecular evidence (e.g., DNA, protein structures, etc.) substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.
- **5.3.12.E.2** Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence).
- **5.3.12.E.4** Account for the evolution of a species by citing specific evidence of biological mechanisms.

- **THE FOSSIL RECORD**

- **5.3.12.E.c** The principles of evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as evidenced in the fossil record and in the similarities that exist within the diversity of existing organisms.
- **5.3.12.E.3** Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.).
- **5.3.12.E.4** Account for the evolution of a species by citing specific evidence of biological mechanisms.
- **5.3.12.E.2** Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence).

## 13. MECHANISMS OF EVOLUTION

- **NATURAL SELECTION**

- **5.3.12.E.d** Evolution occurs as a result of a combination of the following factors: Ability of a species to reproduce; Genetic variability of offspring due to mutation and recombination of genes; Finite supply of the resources required for life; Natural selection, due to environmental pressure, of those organisms better able to survive and leave offspring.
- **5.3.12.D.2** Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations.
- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.

- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.
- **5.3.12.E.c** The principles of evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as evidenced in the fossil record and in the similarities that exist within the diversity of existing organisms.
- **5.3.12.E.4** Account for the evolution of a species by citing specific evidence of biological mechanisms.

#### ● **EVOLUTION OF SPECIES**

- **5.3.12.E.a** New traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.
- **5.3.12.E.1** Account for the appearance of a novel trait that arose in a given population.
- **5.3.12.E.2** Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence).
- **5.3.12.E.c** The principles of evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as evidenced in the fossil record and in the similarities that exist within the diversity of existing organisms.
- **5.3.12.E.3** Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.).
- **5.3.12.E.d** Evolution occurs as a result of a combination of the following factors: Ability of a species to reproduce; Genetic variability of offspring due to mutation and recombination of genes; Finite supply of the resources required for life; Natural selection, due to environmental pressure, of those organisms better able to survive and leave offspring.
- **5.3.12.E.4** Account for the evolution of a species by citing specific evidence of biological mechanisms.

## 14. CLASSIFICATION

#### ● **TAXONOMY**

- **5.3.12.E.2** Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence).
- **5.1.12.A.b** Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.

#### ● **THE SIX KINGDOMS**

- **5.3.12.E.2** Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence).
- **5.3.12.E.b** Molecular evidence (e.g., DNA, protein structures, etc.) substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.
- **5.3.12.E.3** Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.).

## 15. HOMEOSTASIS

#### ● **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**

- **5.3.12.A.c** Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions.
- **5.3.12.A.f** There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.
- **5.3.12.A.6** Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g., diabetes, cystic fibrosis, lactose intolerance).

#### ● **FEEDBACK MECHANISMS IN ANIMALS**

- **5.3.12.A.f** There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.

## 16. FUNCTIONS OF ANIMAL SYSTEMS

### • THE NERVOUS SYSTEM

- **5.3.12.A.f** *There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.*

### • THE IMMUNE AND LYMPHATIC SYSTEMS

- **5.3.12.A.f** *There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.*
- **5.3.12.A.6** *Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g., diabetes, cystic fibrosis, lactose intolerance).*

## 17. FUNCTIONS OF PLANT SYSTEMS

### • PLANT TISSUES

- **5.3.12.A.f** *There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.*

### • PLANT RESPONSES

- **5.3.12.A.f** *There is a relationship between the organization of cells into tissues and the organization of tissues into organs. The structures and functions of organs determine their relationships within body systems of an organism.*

## 18. MATTER AND ENERGY

### • FOOD CHAINS AND WEBS

- **5.3.12.B.a** *As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.*
- **5.3.12.B.1** *Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.*
- **5.3.12.C.a** *Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms.*
- **5.3.12.C.1** *Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem.*
- **5.1.12.A.b** *Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.*
- **5.3.12.C.b** *Stability in an ecosystem can be disrupted by natural or human interactions.*
- **5.3.12.C.2** *Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.*

### • PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS

- **5.3.12.B.a** *As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.*
- **5.3.12.B.1** *Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.*
- **5.3.12.B.b** *Each recombination of matter and energy results in storage and dissipation of energy into the environment as heat.*
- **5.3.12.B.c** *Continual input of energy from sunlight keeps matter and energy flowing through ecosystems.*
- **5.3.12.B.3** *Predict what would happen to an ecosystem if an energy source was removed.*
- **5.1.12.A.b** *Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.*
- **5.1.12.A.2** *Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.*



- **5.1.12.A.a** *Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles.*
- **5.1.12.C.a** *Refinement of understandings, explanations, and models occurs as new evidence is incorporated.*
- **5.1.12.C.1** *Reflect on and revise understandings as new evidence emerges.*
- **5.1.12.C.b** *Data and refined models are used to revise predictions and explanations.*
- **5.1.12.C.2** *Use data representations and new models to revise predictions and explanations.*

## 19. CYCLES IN NATURE

### • THE CARBON CYCLE

- **5.1.12.A.b** *Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.*
- **5.3.12.B.a** *As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.*
- **5.3.12.B.1** *Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.*
- **5.3.12.B.5** *Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration.*
- **5.3.12.C.b** *Stability in an ecosystem can be disrupted by natural or human interactions.*
- **5.3.12.C.2** *Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.*

### • THE NITROGEN AND PHOSPHORUS CYCLES

- **5.1.12.A.b** *Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.*
- **5.3.12.B.a** *As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products.*
- **5.3.12.B.1** *Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.*
- **5.3.12.C.b** *Stability in an ecosystem can be disrupted by natural or human interactions.*
- **5.3.12.C.2** *Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.*

## 20. ECOLOGY OF SUCCESSION

### • SUCCESSION IN COMMUNITIES

- **5.3.12.C.b** *Stability in an ecosystem can be disrupted by natural or human interactions.*
- **5.3.12.C.2** *Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.*
- **5.3.12.C.1** *Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem.*

### • NATURAL IMPACTS ON ECOSYSTEMS

- **5.3.12.C.1** *Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem.*
- **5.3.12.C.b** *Stability in an ecosystem can be disrupted by natural or human interactions.*
- **5.3.12.C.2** *Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.*
- **5.2.12.D.e** *Chemical equilibrium is a dynamic process that is significant in many systems, including biological, ecological, environmental, and geological systems. Chemical reactions occur at different rates. Factors such as temperature, mixing, concentration, particle size, and surface area affect the rates of chemical reactions.*



