South Carolina Tutorials are designed specifically for the South Carolina College and Career Readiness Standards and the South Carolina Academic Standards to prepare students for the South Carolina End-of-Course Examination Program (EOCEP), ACT Aspire, and the South Carolina Palmetto Assessment of State Standards (SCPASS).

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.

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

## 1. NATURE OF LIFE

- **FROM ATOMS TO BIOSPHERE**
  - **H.B.3A.3** *Construct scientific arguments to support claims that chemical elements in the sugar molecules produced by photosynthesis may interact with other elements to form amino acids, lipids, nucleic acids or other large organic molecules.*

- **CHARACTERISTICS OF LIFE**
  - **H.B.4B.2** *Obtain, evaluate and communicate information on how biotechnology (including gel electrophoresis, plasmid-based transformation and DNA fingerprinting) may be used in the fields of medicine, agriculture, and forensic science.*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*
  - **H.B.2C.2** *Ask scientific questions to define the problems that organisms face in maintaining homeostasis within different environments (including water of varying solute concentrations).*
  - **H.B.2D.1** *Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.*
  - **H.B.2B.3** *Obtain information to contrast the structure of viruses with that of cells and to explain, in general, why viruses must use living cells to reproduce.*

- **HOMEOSTASIS AND DYNAMIC EQUILIBRIUM**
  - **H.B.2C.2** *Ask scientific questions to define the problems that organisms face in maintaining homeostasis within different environments (including water of varying solute concentrations).*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*

## 2. CHEMISTRY OF LIFE

- **BIOMOLECULES**
  - **H.B.2A.1** *Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.*
  - **H.B.2A.2** *Plan and conduct investigations to determine how various environmental factors (including temperature and pH)*

*affect enzyme activity and the rate of biochemical reactions.*

- **H.B.3A.3** *Construct scientific arguments to support claims that chemical elements in the sugar molecules produced by photosynthesis may interact with other elements to form amino acids, lipids, nucleic acids or other large organic molecules.*

- **ENZYMES**
  - **H.B.2A.2** *Plan and conduct investigations to determine how various environmental factors (including temperature and pH) affect enzyme activity and the rate of biochemical reactions.*

## 3. CELL STRUCTURE AND FUNCTION

- **PROKARYOTIC AND EUKARYOTIC CELLS**
  - **H.B.2B.2** *Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal).*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*
  - **H.B.2C.3** *Analyze and interpret data to explain the movement of molecules (including water) across a membrane.*
  - **H.B.2B.1** *Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.*

- **PLANT AND ANIMAL CELLS**
  - **H.B.2B.1** *Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.*
  - **H.B.2B.2** *Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal).*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*

- **PASSIVE TRANSPORT**
  - **H.B.2B.2** *Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal).*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*
  - **H.B.2C.2** *Ask scientific questions to define the problems that organisms face in maintaining homeostasis within different environments (including water of varying solute concentrations).*
  - **H.B.2C.3** *Analyze and interpret data to explain the movement of molecules (including water) across a membrane.*

- **ACTIVE TRANSPORT**
  - **H.B.2B.2** *Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal).*
  - **H.B.2C.1** *Develop and use models to exemplify how the cell membrane serves to maintain homeostasis of the cell through both active and passive transport processes.*
  - **H.B.2C.2** *Ask scientific questions to define the problems that organisms face in maintaining homeostasis within different environments (including water of varying solute concentrations).*
  - **H.B.2C.3** *Analyze and interpret data to explain the movement of molecules (including water) across a membrane.*

## 4. CELLULAR ENERGETICS

- **PHOTOSYNTHESIS**
  - **H.B.3A.1** *Develop and use models to explain how chemical reactions among ATP, ADP, and inorganic phosphate act to transfer chemical energy within cells.*

- **H.B.3A.2** *Develop and revise models to describe how photosynthesis transforms light energy into stored chemical energy.*
- **H.B.3A.3** *Construct scientific arguments to support claims that chemical elements in the sugar molecules produced by photosynthesis may interact with other elements to form amino acids, lipids, nucleic acids or other large organic molecules.*

### CELLULAR RESPIRATION

- **H.B.3A.1** *Develop and use models to explain how chemical reactions among ATP, ADP, and inorganic phosphate act to transfer chemical energy within cells.*
- **H.B.3A.4** *Develop models of the major inputs and outputs of cellular respiration (aerobic and anaerobic) to exemplify the chemical process in which the bonds of molecules are broken, the bonds of new compounds are formed and a net transfer of energy results.*
- **H.B.3A.5** *Plan and conduct scientific investigations or computer simulations to determine the relationship between variables that affect the processes of fermentation and/or cellular respiration in living organisms and interpret the data in terms of real-world phenomena.*
- **H.B.2B.2** *Collect and interpret descriptive data on cell structure to compare and contrast different types of cells (including prokaryotic versus eukaryotic, and animal versus plant versus fungal).*

## 5. CELL GROWTH AND REPRODUCTION

### THE CELL CYCLE

- **H.B.2D.2** *Develop and use models to exemplify the changes that occur in a cell during the cell cycle (including changes in cell size, chromosomes, cell membrane/cell wall, and the number of cells produced) and predict, based on the models, what might happen to a cell that does not progress through the cycle correctly.*
- **H.B.2D.3** *Construct explanations for how the cell cycle is monitored by check point systems and communicate possible consequences of the continued cycling of abnormal cells.*
- **H.B.4A.2** *Develop and use models to explain how genetic information (DNA) is copied for transmission to subsequent generations of cells (mitosis).*
- **H.B.2D.1** *Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.*

### MITOSIS

- **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
- **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
- **H.B.2D.1** *Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.*
- **H.B.2D.2** *Develop and use models to exemplify the changes that occur in a cell during the cell cycle (including changes in cell size, chromosomes, cell membrane/cell wall, and the number of cells produced) and predict, based on the models, what might happen to a cell that does not progress through the cycle correctly.*
- **H.B.4A.2** *Develop and use models to explain how genetic information (DNA) is copied for transmission to subsequent generations of cells (mitosis).*
- **H.B.2D.3** *Construct explanations for how the cell cycle is monitored by check point systems and communicate possible consequences of the continued cycling of abnormal cells.*

### MEIOSIS

- **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
- **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
- **H.B.4C.1** *Develop and use models of sex cell formation (meiosis) to explain why the DNA of the daughter cells is different from the DNA of the parent cell.*
- **H.B.4C.3** *Construct explanations for how meiosis followed by fertilization ensures genetic variation among offspring within the same family and genetic diversity within populations of sexually reproducing organisms.*

## 6. DNA STRUCTURE AND FUNCTION

### COMPONENTS OF DNA

- **H.B.2A.1** *Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.*

- **H.B.4A.1** *Develop and use models at different scales to explain the relationship between DNA, genes, and chromosomes in coding the instructions for characteristic traits transferred from parent to offspring.*
- **H.B.4B.1** *Develop and use models to describe how the structure of DNA determines the structure of resulting proteins or RNA molecules that carry out the essential functions of life.*

- **THE GENETIC CODE**
  - **H.B.2A.1** *Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.*
  - **H.B.4A.1** *Develop and use models at different scales to explain the relationship between DNA, genes, and chromosomes in coding the instructions for characteristic traits transferred from parent to offspring.*
  - **H.B.4B.1** *Develop and use models to describe how the structure of DNA determines the structure of resulting proteins or RNA molecules that carry out the essential functions of life.*
  - **H.B.4B.2** *Obtain, evaluate and communicate information on how biotechnology (including gel electrophoresis, plasmid-based transformation and DNA fingerprinting) may be used in the fields of medicine, agriculture, and forensic science.*

- **DNA REPLICATION**
  - **H.B.4A.1** *Develop and use models at different scales to explain the relationship between DNA, genes, and chromosomes in coding the instructions for characteristic traits transferred from parent to offspring.*
  - **H.B.4A.2** *Develop and use models to explain how genetic information (DNA) is copied for transmission to subsequent generations of cells (mitosis).*

## 7. GENE EXPRESSION

- **TRANSCRIPTION**
  - **H.B.2A.1** *Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.*
  - **H.B.4B.1** *Develop and use models to describe how the structure of DNA determines the structure of resulting proteins or RNA molecules that carry out the essential functions of life.*
  - **H.B.2B.1** *Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.*

- **TRANSLATION**
  - **H.B.2A.1** *Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.*
  - **H.B.4B.1** *Develop and use models to describe how the structure of DNA determines the structure of resulting proteins or RNA molecules that carry out the essential functions of life.*
  - **H.B.2B.1** *Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.*

## 8. MUTATIONS

- **GENETIC CHANGES IN DNA**
  - **H.B.4D.1.1** *can affect the proteins that are produced or the traits that result and*
  - **H.B.4D.1.2** *may or may not be inherited.*

- **GENETIC CHANGES IN CHROMOSOMES**
  - **H.B.2B.1** *Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. Models should compare and contrast how prokaryotic cells meet the same life needs as eukaryotic cells without similar structures.*

- **H.B.4A.1** *Develop and use models at different scales to explain the relationship between DNA, genes, and chromosomes in coding the instructions for characteristic traits transferred from parent to offspring.*
- **H.B.4B.2** *Obtain, evaluate and communicate information on how biotechnology (including gel electrophoresis, plasmid-based transformation and DNA fingerprinting) may be used in the fields of medicine, agriculture, and forensic science.*
- **H.B.4C.1** *Develop and use models of sex cell formation (meiosis) to explain why the DNA of the daughter cells is different from the DNA of the parent cell.*
- **H.B.4C.3** *Construct explanations for how meiosis followed by fertilization ensures genetic variation among offspring within the same family and genetic diversity within populations of sexually reproducing organisms.*
- **H.B.4D.1.1** *can affect the proteins that are produced or the traits that result and*
- **H.B.4D.1.2** *may or may not be inherited.*

## 9. HEREDITY

- **MENDELIAN LAWS OF HEREDITY**
  - **H.B.4A.1** *Develop and use models at different scales to explain the relationship between DNA, genes, and chromosomes in coding the instructions for characteristic traits transferred from parent to offspring.*
  - **H.B.4C.2** *Analyze data on the variation of traits among individual organisms within a population to explain patterns in the data in the context of transmission of genetic information.*
  - **H.B.4C.3** *Construct explanations for how meiosis followed by fertilization ensures genetic variation among offspring within the same family and genetic diversity within populations of sexually reproducing organisms.*
  - **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
  - **H.B.1A.5.3** *use grade-level appropriate statistics to analyze data.*
  - **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*

- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**
  - **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
  - **H.B.1A.5.3** *use grade-level appropriate statistics to analyze data.*
  - **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
  - **H.B.4C.2** *Analyze data on the variation of traits among individual organisms within a population to explain patterns in the data in the context of transmission of genetic information.*

## 10. CYCLES IN NATURE

- **THE CARBON CYCLE**
  - **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
  - **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
  - **H.B.6B.1** *Develop and use models of the carbon cycle, which include the interactions between photosynthesis, cellular respiration and other processes that release carbon dioxide, to evaluate the effects of increasing atmospheric carbon dioxide on natural and agricultural ecosystems.*
  - **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*
  - **H.B.6B.2** *Analyze and interpret quantitative data to construct an explanation for the effects of greenhouse gases (such as carbon dioxide and methane) on the carbon cycle and global climate.*

- **THE NITROGEN AND PHOSPHORUS CYCLES**
  - **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
  - **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
  - **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*
  - **H.B.6D.1** *Design solutions to reduce the impact of human activity on the biodiversity of an ecosystem.*

## 11. MATTER AND ENERGY

- **FOOD CHAINS AND WEBS**

- **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
- **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
- **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*
- **H.B.6D.1** *Design solutions to reduce the impact of human activity on the biodiversity of an ecosystem.*

- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**
  - **H.B.1A.2.1** *understand or represent phenomena, processes, and relationships,*
  - **H.B.1A.6.4** *data communicated in graphs, tables, or diagrams.*
  - **H.B.6A.2** *Use mathematical and computational thinking to support claims that limiting factors affect the number of individuals that an ecosystem can support.*
  - **H.B.6A.1** *Analyze and interpret data that depict changes in the abiotic and biotic components of an ecosystem over time or space (such as percent change, average change, correlation and proportionality) and propose hypotheses about possible relationships between the changes in the abiotic components and the biotic components of the environment.*
  - **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*
  - **H.B.6D.1** *Design solutions to reduce the impact of human activity on the biodiversity of an ecosystem.*

## 12. ECOLOGY OF SUCCESSION

- **SUCCESSION IN COMMUNITIES**
  - **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*
  - **H.B.6A.1** *Analyze and interpret data that depict changes in the abiotic and biotic components of an ecosystem over time or space (such as percent change, average change, correlation and proportionality) and propose hypotheses about possible relationships between the changes in the abiotic components and the biotic components of the environment.*

- **NATURAL IMPACTS ON ECOSYSTEMS**
  - **H.B.1A.8.2** *explain or describe phenomena,*
  - **H.B.6A.1** *Analyze and interpret data that depict changes in the abiotic and biotic components of an ecosystem over time or space (such as percent change, average change, correlation and proportionality) and propose hypotheses about possible relationships between the changes in the abiotic components and the biotic components of the environment.*
  - **H.B.6C.1** *Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.*