

North Carolina Tutorials are designed specifically for the Common Core State Standards for English language arts, the North Carolina Standard Course of Study for Math, and the North Carolina Essential Standards, to prepare students for the READY End-of-Course Assessments.

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. CHEMISTRY OF LIFE

• CHARACTERISTICS OF LIFE

- **NCES.Bio.1.1.2** Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.
- **NCES.Bio.1.2.1** Explain how homeostasis is maintained in the cell and within an organism in various environments (including temperature and pH).
- **NCES.Bio.4.2.2** Explain ways that organisms use released energy for maintaining homeostasis (active transport).
- **NCES.Bio.1.2.3** Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).
- **NCES.Bio.2.1.2** Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.

• BIOMOLECULES

- **NCES.Bio.3.1.2** Explain how DNA and RNA code for proteins and determine traits.
- **NCES.Bio.4.1.1** Compare the structures and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids) as related to the survival of living organisms.
- **NCES.Bio.4.1.2** Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.

• ENZYMES

- **NCES.Bio.4.1.3** Explain how enzymes act as catalysts for biological reactions.

• HOMEOSTASIS AND DYNAMIC EQUILIBRIUM

- **NCES.Bio.1.2.1** Explain how homeostasis is maintained in the cell and within an organism in various environments (including temperature and pH).
- **NCES.Bio.4.2.2** Explain ways that organisms use released energy for maintaining homeostasis (active transport).

2. CELL STRUCTURE AND FUNCTION

• PROKARYOTIC AND EUKARYOTIC CELLS

- **NCES.Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.
- **NCES.Bio.1.1.2** Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.
- **NCES.Bio.1.1.3** Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.
- **NCES.Bio.1.2.3** Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).

• PLANT AND ANIMAL CELLS

- **NCES.Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.

• PASSIVE TRANSPORT

- **NCES.Bio.1.2.1** Explain how homeostasis is maintained in the cell and within an organism in various environments (including temperature and pH).
- **NCES.Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.
- **NCES.Bio.1.1.2** Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.

• ACTIVE TRANSPORT

- **NCES.Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.
- **NCES.Bio.1.2.1** Explain how homeostasis is maintained in the cell and within an organism in various environments (including temperature and pH).
- **NCES.Bio.4.2.2** Explain ways that organisms use released energy for maintaining homeostasis (active transport).
- **NCES.Bio.1.1.2** Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.

3. CELLULAR ENERGETICS

• PHOTOSYNTHESIS

- **NCES.Bio.4.2.1** Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.

• CELLULAR RESPIRATION

- **NCES.Bio.4.2.1** Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.
- **NCES.Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.

4. CELL GROWTH AND REPRODUCTION

- **THE CELL CYCLE**

- **NCES.Bio.1.2.2** *Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.*

- **MITOSIS**

- **NCES.Bio.1.2.2** *Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.*

5. DNA STRUCTURE AND FUNCTION

- **COMPONENTS OF DNA**

- **NCES.Bio.3.1.1** *Explain the double-stranded, complementary nature of DNA as related to its function in the cell.*
- **NCES.Bio.3.1.2** *Explain how DNA and RNA code for proteins and determine traits.*
- **NCES.Bio.4.1.2** *Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.*

- **THE GENETIC CODE**

- **NCES.Bio.3.1.1** *Explain the double-stranded, complementary nature of DNA as related to its function in the cell.*
- **NCES.Bio.3.1.2** *Explain how DNA and RNA code for proteins and determine traits.*
- **NCES.Bio.4.1.2** *Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.*
- **NCES.Bio.3.3.1** *Interpret how DNA is used for comparison and identification of organisms.*
- **NCES.Bio.3.3.2** *Summarize how transgenic organisms are engineered to benefit society.*
- **NCES.Bio.3.3.3** *Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project).*

- **DNA REPLICATION**

- **NCES.Bio.3.1.1** *Explain the double-stranded, complementary nature of DNA as related to its function in the cell.*

6. GENE EXPRESSION

- **TRANSCRIPTION**

- **NCES.Bio.3.3.1** *Interpret how DNA is used for comparison and identification of organisms.*
- **NCES.Bio.3.1.1** *Explain the double-stranded, complementary nature of DNA as related to its function in the cell.*
- **NCES.Bio.3.1.2** *Explain how DNA and RNA code for proteins and determine traits.*
- **NCES.Bio.4.1.2** *Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.*

- **TRANSLATION**

- **NCES.Bio.3.1.2** *Explain how DNA and RNA code for proteins and determine traits.*
- **NCES.Bio.3.1.1** *Explain the double-stranded, complementary nature of DNA as related to its function in the cell.*
- **NCES.Bio.4.1.2** *Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.*
- **NCES.Bio.4.1.3** *Explain how enzymes act as catalysts for biological reactions.*

7. MUTATIONS

- **GENETIC CHANGES IN DNA**

- **NCES.Bio.3.1.3** *Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.*

- **NCES.Bio.3.2.3** Explain how the environment can influence the expression of genetic traits.

- **GENETIC CHANGES IN CHROMOSOMES**

- **NCES.Bio.3.1.3** Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.
- **NCES.Bio.3.2.1** Explain the role of meiosis in sexual reproduction and genetic variation.
- **NCES.Bio.3.2.3** Explain how the environment can influence the expression of genetic traits.
- **NCES.Bio.3.3.3** Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project).

8. HEREDITY

- **MENDELIAN LAWS OF HEREDITY**

- **NCES.Bio.3.2.1** Explain the role of meiosis in sexual reproduction and genetic variation.
- **NCES.Bio.3.2.2** Predict offspring ratios based on a variety of inheritance patterns (including dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits).

- **MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE**

- **NCES.Bio.3.2.2** Predict offspring ratios based on a variety of inheritance patterns (including dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits).

9. REPRODUCTION

- **SEXUAL AND ASEQUAL REPRODUCTION**

- **NCES.Bio.2.1.2** Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.
- **NCES.Bio.3.2.1** Explain the role of meiosis in sexual reproduction and genetic variation.

- **MEIOSIS**

- **NCES.Bio.3.2.1** Explain the role of meiosis in sexual reproduction and genetic variation.
- **NCES.Bio.3.1.3** Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.

10. EVOLUTION

- **MULTIPLE LINES OF EVIDENCE**

- **NCES.Bio.3.4.1** Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.
- **NCES.Bio.3.5.2** Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).
- **NCES.Bio.3.3.1** Interpret how DNA is used for comparison and identification of organisms.

- **THE FOSSIL RECORD**

- **NCES.Bio.3.4.1** Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.
- **NCES.Bio.3.5.2** Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).

11. MECHANISMS OF EVOLUTION

- **NATURAL SELECTION**

- **NCES.Bio.3.4.2** Explain how natural selection influences the changes in species over time.
- **NCES.Bio.1.2.3** Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).
- **NCES.Bio.2.1.2** Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.

- **EVOLUTION OF SPECIES**

- **NCES.Bio.3.4.1** Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.
- **NCES.Bio.3.4.2** Explain how natural selection influences the changes in species over time.
- **NCES.Bio.2.1.2** Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.

12. CLASSIFICATION

- **TAXONOMY**

- **NCES.Bio.3.3.1** Interpret how DNA is used for comparison and identification of organisms.
- **NCES.Bio.3.5.1** Explain the historical development and changing nature of classification systems.
- **NCES.Bio.3.5.2** Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).
- **NCES.Bio.3.3.2** Summarize how transgenic organisms are engineered to benefit society.
- **NCES.Bio.3.3.3** Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project).

- **THE SIX KINGDOMS**

- **NCES.Bio.3.5.2** Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).
- **NCES.Bio.3.3.1** Interpret how DNA is used for comparison and identification of organisms.
- **NCES.Bio.3.5.1** Explain the historical development and changing nature of classification systems.

13. CYCLES IN NATURE

- **THE CARBON CYCLE**

- **NCES.Bio.2.1.1** Analyze the flow of energy and cycling of matter (water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.
- **NCES.Bio.2.2.1** Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.

- **THE NITROGEN AND PHOSPHORUS CYCLES**

- **NCES.Bio.2.1.1** Analyze the flow of energy and cycling of matter (water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.
- **NCES.Bio.2.2.1** Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.

14. MATTER AND ENERGY

- **FOOD CHAINS AND WEBS**

- **NCES.Bio.2.1.1** Analyze the flow of energy and cycling of matter (water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.
- **NCES.Bio.2.1.4** Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).

- **NCES.Bio.2.2.1** Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.
- **NCES.Bio.2.1.3** Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.

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

- **NCES.Bio.2.1.1** Analyze the flow of energy and cycling of matter (water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.
- **NCES.Bio.2.1.3** Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.
- **NCES.Bio.2.2.1** Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.
- **NCES.Bio.2.1.4** Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).

15. ECOLOGY OF SUCCESSION

- **SUCCESSION IN COMMUNITIES**

- **NCES.Bio.2.1.3** Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.
- **NCES.Bio.2.1.4** Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).

- **NATURAL IMPACTS ON ECOSYSTEMS**

- **NCES.Bio.2.1.3** Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.
- **NCES.Bio.2.1.4** Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).