

SOUTHERN REGIONAL SCHOOL DISTRICT BIOLOGY/LIFE SCIENCE CURRICULUM

9-12

Aligned to the 2009 New Jersey Core Curriculum Content Standards

EXCELLENCE IN EDUCATION

SOUTHERN REGIONAL SCHOOL DISTRICT BIOLOGY/LIFE SCIENCE CURRICULUM

Content Area: Science

Course Title: BIOLOGY

Grade Level: 10-12

Unit Plan 1

Nature of Life

Unit Plan 2

Ecology

Unit Plan 3

Cellular Processes

Unit Plan 4

Genetics

Unit Plan 5

Evolution

Date Created: January 10, 2011

Board Approved on:

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Biology: Nature of Life Unit

Content Area: Biology

Unit Title: The Nature of Life

Target Course/Grade Level: 9-10

Unit Summary

This unit is designed to give students a clear understanding of how scientific thought is used by focusing on life's building blocks and characteristics. Students will explore the foundations of scientific process and thought, the building blocks of life, and the characteristics of living things.

Primary interdisciplinary connections:

Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st Century Themes:

The unit will integrate the 21st Century Life and Career stand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

Technology connections:

For further clarification refer to NJ Class Standard Introductions at www.njcccs.org.

Learning Targets

Content Standards

This unit will assimilate the four strands of the Science Practices Standard 5.1. These include: understanding scientific explanations, generating scientific evidence through active investigations, reflecting on scientific knowledge and participating productively in science.

CONTENT STANDARDS LINK: www.njcccs.org

CPI #	Cumulative Progress Indicator (CPI)
5.1.12.A.1-3	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
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.2	Demonstrate the properties and functions of enzymes by designing and carrying out an experiment
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.2	Use mathematical formulas to justify the concept of an efficient diet.

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5.2.12.A.1	Use atomic models to predict the behaviors of atoms in interactions
5.2.12.A.5	Describe the process by which solutes dissolve in solvents.
5.2.12.A.6	Relate the pH scale to the concentrations of various acids and bases
<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • What is science? • How do we find explanations for events in the natural world? • How does structure relate to function in living systems from the organismal to cellular level? • What are the building blocks of life? • What are the properties of certain compounds found in living things? • What controls the activities in the cell? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Science is an organized way of gathering and analyzing evidence about the natural world. • Biology is the study of life. • Society can limit the application of scientific ideas, especially if new scientific ideas conflict with prevailing cultural beliefs. • Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function. • Certain compounds/ molecules have unique properties that make them suitable for life. • Chemical reactions drive cell activities.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key terms. • Procedures at the core of scientific methodology • Characteristics of living things. • Central themes of biology • Importance of the universal system of measurement • Laboratory safety procedures • Essential laboratory equipment • The nature of matter and the relationships between subatomic particles, atoms and elements. • Unique properties of water essential to organisms. • All organic compounds contain carbon • Functions of each of the four groups of macromolecules essential for life • Chemical reactions are the result of energy changes • Roles of enzymes in living things 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • State the goals of science. • Use scientific methodology to solve a problem. • Identify the characteristics of living things • Understand how the themes of biology unify all biological studies. • Record and analyze data using a universal system of measurement. • Interpret and construct table and graphs that illustrate scientific findings. • Understand, evaluate, and practice safe procedures for conducting science investigations. • Describe the relationship between atomic structure and the molecular basis of life • Compare ionic and covalent bonds. • Describe how the polarity of water results in its ability to form hydrogen bonds and act as a universal solvent. • Use the pH scale to identify acids and bases and predict the effects of pH levels on biological reactions. • Model and provide functions of the four major organic molecules: lipids, proteins, carbohydrates, and nucleic acids. • Recognize that most chemical transformations are made possible by protein catalyst called enzymes. • Conduct an experiment to demonstrate that the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.

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Formative Assessments

For additional ideas please refer to NJ State DOE classroom application documents:

<http://njcccs.org/CADDownload.aspx>

- Observation
- Homework
- Class participation
- Venn Diagrams/Graphic Organizers
- DO-NOW
- Laboratories/Lab Reports
- Notebook
- Writing Assignments

Summative Assessments

For additional ideas please refer to NJ State DOE Professional Education Port (PEP):

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- Chapter/Unit Test
- Writing Assignments
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- Laboratory Practical
- Unit Projects
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- Biology Competency Test

Modifications (ELLs, Special Education, Gifted and Talented)

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

- *Textbook*
- *Laboratory manuals and equipment*
- *Science Websites*
www.pearsonsuccessnet.com
www.biology.com
www.phschools.com
www.arizona.edu
<http://njcccs.org>

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Biology: Ecology Unit

Content Area: Biology

Unit Title: Ecology

Target Course/Grade Level: 9-10

Unit Summary

Earth is a living planet in which all living things are linked to each other and to land, water, and air. Through these links, energy flows and matter cycles in ways that support life. These patterns are changing due to human activity on both the local and global levels. Our goal is to study the impact of our activity on the biosphere and make changes for a healthier future. The primary purpose of this unit is to develop the understanding that the existence of life on earth depends on interactions between organisms and between organisms and their environment. Various community interactions and dynamics will be explored that shape ecosystems. This unit also is designed to make students aware that the human society is part of the biosphere and is the most powerful force for change.

Primary interdisciplinary connections:

Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st Century Themes:

The unit will integrate the 21st Century Life and Career stand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

Technology connections:

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Learning Targets

Content Standards

This unit will assimilate the four strands of the Science Practices Standard 5.1. These include: understanding scientific explanations, generating scientific evidence through active investigations, reflecting on scientific knowledge and participating productively in science.

CONTENT STANDARDS LINK: www.njcccs.org

CPI #	Cumulative Progress Indicator (CPI)
5.1.12.A.1-3	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service.
5.3.12.B.1	Cite evidence that the transfer and transformation of matter and energy links organisms

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	to one another and to their physical setting.
5.3.12.B.2	Use mathematical formulas to justify the concept of an efficient diet.
5.3.12.B.3	Predict what would happen to an ecosystem if an energy source was removed.
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.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.2	Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How do Earth's living (biotic) and nonliving (abiotic) parts interact and affect the survival of organisms and shape ecosystems? • What factors contribute to changes in populations? • How have human activities shaped local and global ecology? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Measurement and observation tools are used to categorize, represent and interpret the natural world. • Evidence is used for building, refining, and/or critiquing scientific explanations. • All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism. • The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation. • The human society is part of the biosphere and is the most powerful force for change.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key terms. • Trophic levels within an ecosystem • The differences between food chains and food webs. • The biogeochemical cycles • The factors that limit population size. • Biological community interactions and symbiotic relationships • The stages of primary and secondary succession. • The characteristics of Earth's major biomes. • The differences between renewable and non-renewable resources. • Characteristics of sustainable development. • Benefits of biodiversity. • Factors that influence our ecological footprint. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Explain that the process of science attempts to find explanations using evidence for events in the natural world, and to use those explanations to make useful predictions. • Identify the levels of organization that ecologists study and describe the methods used to study ecology. • Trace the flow of energy through living systems and evaluate the efficiency of energy transfer among organisms in an ecosystem. • Explain how biotic and abiotic factors influence an ecosystem and describe how matter cycles among these factors. • Describe how the availability of nutrients affects the productivity of ecosystems. • Identify and describe that interactions that shape communities. • List the characteristics used to describe a population and identify factors that affect population size.

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	<ul style="list-style-type: none">• Describe human activities that affect the biosphere and how ecosystems recover from a disturbance.• Explain how environmental resources are classified and identify the characteristics of sustainable development.• Explore the importance of Estuaries in the aquatic ecosystems of the world and how they affect global concerns.
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Formative Assessments

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- Observation
- Homework
- Class participation
- Venn Diagrams/Graphic Organizers
- DO-NOW
- Laboratories/Lab Reports
- Notebook
- Writing Assignments

Summative Assessments

For additional ideas please refer to NJ State DOE Professional Education Port (PEP):

<http://www.state.nj.us/education/njpep/index.html>

- Chapter/Unit Test
- Writing Assignments
- Presentations
- Laboratory Practical
- Unit Projects focused on local ecological dynamics
- Quarterly Exams
- Biology Competency Test

Modifications (ELLs, Special Education, Gifted and Talented)

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

- Textbook
- Laboratory manuals and equipment
- Science Websites
 - <http://www.sciencenetlinks.com>
 - www.biology.com
 - www.phschools.com

Teacher Notes:

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Biology: Cellular Processes Unit

Content Area: Biology

Unit Title: Cellular Processes

Target Course/Grade Level: 9-10

Unit Summary

Cells, the most basic unit of life, are complex and dynamic. Their structures are specifically adapted to their function, and have an overall goal of maintaining homeostasis. In multicellular organisms, cells become specialized to carry out a particular function. Organisms and the cells within them have to grow and develop, move materials around, build new molecules, reproduce new cells, and respond to environmental changes. In order for an organism to perform these necessary functions they must be able to obtain and utilize energy.

Students will learn the discovery, structure and function of prokaryotic and eukaryotic cells. This will provide the foundation for understanding cellular transport and homeostasis. Students will examine how cells grow and reproduce. Additionally, students will learn how cells convert and store available energy.

Primary interdisciplinary connections:

Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st Century Themes:

The unit will integrate the 21st Century Life and Career stand 9.1 strands A-D. These strands include: Critical thinking and problem solving, creativity and innovation, collaboration, teamwork and leadership, and cross cultural understanding and interpersonal communication.

Technology connections:

For further clarification refer to NJ Class Standard Introductions at www.njcccs.org.

Learning Targets

Content Standards

This unit will assimilate the four strands of the Science Practices Standard 5.1. These include: understanding scientific explanations, generating scientific evidence through active investigations, reflecting on scientific knowledge and participating productively in science.

CONTENT STANDARDS LINK: www.njcccs.org

CPI #	Cumulative Progress Indicator (CPI)
5.1.12.A.1-3	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The Four Science Practice Strands encompass the knowledge and

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	reasoning skills that students must acquire to be proficient in service.
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.3	Predict a cell's response in a given set of environmental conditions.
5.3.12.A.4	Distinguish between the processes of cellular growth (cell division) and development (differentiation).
5.3.12.A.5	Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks (e.g., stem cells, sex determination).
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).
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.
5.3.12.B.6	Explain how the process of cellular respiration is similar to the burning of fossil fuels.
<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How does structure relate to function in living systems from the organismal to the cellular level? • How does a cell maintain homeostasis? • How is energy transferred in living systems? • How do cell structures enable cells to carry out life processes? • How and why do cells divide? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function. • All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key terms. • Cells are made of complex molecules that consist mostly of a few elements. • Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes. • Cellular function is maintained through the regulation of cellular processes in response to internal and external environmental conditions. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Model how processes are regulated both internally and externally by environments in which cells exist • Explain how the fundamental life processes of organisms depend on a variety of chemical reactions that occur in specialized areas of the organism's cells • Model how cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings, including the transport of materials into and out of the cell

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| <ul style="list-style-type: none">• Cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.• There is a relationship between the organization of cells into tissues and the organization of tissues into organs.• Plants have the capability to take energy from light to form sugar molecules containing carbon, hydrogen, and oxygen.• All organisms must break the high-energy chemical bonds in food molecules during cellular respiration to obtain the energy needed for life processes. | <ul style="list-style-type: none">• A cell's DNA replicates during cell division.• Explain how cell size and cell division maintain homeostasis.• Explain how environmental factors (such as temperature, light intensity, and the amount of water available) can affect photosynthesis as an energy storing process.• Recognize, analyze and describe the process of photosynthesis as providing a vital connection between the sun and the energy needs of living systems.• Explain how the breakdown of some food molecules enables the cell to store energy in specific molecules that are used to carry out the many functions of the cell.• Recognize that during cell respiration food molecules are broken down in the presence of oxygen to provide energy.• Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration. |
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Formative Assessments

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*resources will vary for each district

Teacher Notes:

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Biology: Genetics Unit

Content Area: Biology

Unit Title: Genetics

Target Course/Grade Level: 9-10

Unit Summary

The genetics unit is a broad overview of basic concepts emphasizing how biological information is passed from one generation to another.

Primary interdisciplinary connections:

Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st Century Themes:

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Technology connections:

For further clarification refer to NJ Class Standard Introductions at www.njcccs.org.

Learning Targets

Content Standards

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CONTENT STANDARDS LINK: www.njcccs.org

CPI #	Cumulative Progress Indicator (CPI)
5.1.12.A.1-3	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service.
5.3.12.D.1	Explain the value and potential applications of genome projects.
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.D.3	Demonstrate through modeling how the sorting and recombination of genes during

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	sexual reproduction has an effect on variation in offspring (meiosis, fertilization).
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).
<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How is genetic information passed through generations? • Why do reproductive cells have one half of the original cell's genetic information? • How does the method of reproduction affect a species' genetic variability? • What are genes and how are they related to chromosomes? • What is the structure of DNA and how was it discovered? • How does DNA replicate? • How does genetic information encoded in DNA get translated into proteins? • Why do some genetic traits follow Mendelian inheritance patterns while others don't? • How do scientists use genetics to study human inheritance? • How does inserting, deleting, or substituting DNA segments alter the genetic code? • What are genetic disorders? • How do scientists manipulate DNA and how does this affect the quality of human life? • What are some of the ethical, social, legal, and public policy issues associated with genetics and biotechnology? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Patterns of inheritance are predictable, and vary within a species. • Hereditary information is stored in DNA and is organized into genes and chromosomes. • DNA directs the synthesis of proteins. • Heritable traits are the result of genes passed from one generation to the next through reproductive cells.. • Advances in biotechnology have improved our understanding of genetics and improved the quality of human life. • There are a wide array of ethical, legal, sociological, and public policy issues that continue to arise as knowledge of biotechnology and genetics advance.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key terms. • Mendel's research and conclusions about inheritance. • How to use Punnett Squares to predict the outcome of genetic crosses. • The phases and events of meiosis, and how meiosis allows for genetic variability. • How mitosis and meiosis differ. • The structural, functional, and biochemical nature of DNA. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Describe and discuss Mendel's experiments. • Use Punnett squares to predict the outcome of genetic crosses. • Identify and explain how meiosis maintains an organism's chromosome number. Compare and contrast mitosis and meiosis. • Identify and explain the structure of DNA and replication.. • Identify and explain the events of protein synthesis. • Compare and contrast DNA and RNA.

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<ul style="list-style-type: none">• The events and mechanisms of DNA replication.• The major historical events and discoveries that led to our understanding about genetics and DNA.• The similarities and differences between DNA and RNA• The events and sequence of protein synthesis.• The various types of mutations and their effects on protein synthesis.• How genes are regulated• The patterns of non-Mendelian.• The inheritance patterns and characteristics of various genetic disorders.• How selective breeding can and has changed species.• Various methods used in DNA and gene analysis.• The importance of biotechnology.	<ul style="list-style-type: none">• Identify mutations in a DNA sequence and demonstrate the effects of the mutations.• Predict the results from non-Mendelian genetic crosses.• Explain the applications of biotechnology.
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SOUTHERN REGIONAL SCHOOL DISTRICT BIOLOGY/LIFE SCIENCE CURRICULUM

Biology: Evolution Unit

Content Area: Biology

Unit Title: Evolution

Target Course/Grade Level: 9-10

Unit Summary

Evolutionary theory provides the best scientific explanation for the unity and diversity of life. It unites all living things in a single tree of life and reminds us that humans are a part of nature.

Primary interdisciplinary connections:

Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st Century Themes:

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Technology connections:

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5.1.12.A.1-3	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The Four Science Practice Strands encompass the knowledge and reasoning skills that students must acquire to be proficient in service.
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.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).

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5.4.12.B.3	Account for the evolution of a species by citing specific evidence of biological mechanisms.	
<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How does natural selection explain changes in the diversity of species? • What evidence can be used to support the theory of evolution? • Why is biodiversity so important? • How can populations evolve to form new species? • How do biologists organize life’s diversity? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • The diversity of life on Earth is the result of evolution. • Species have evolved from common ancestors. • New species evolve from populations not individuals. • Life on Earth is organized into logical groups based on physical similarities and evolutionary relationships. 	
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key terms. • The principles of evolution provide a scientific explanation for the history of life on Earth. • The historical development of Darwinian evolution. • Darwin’s Theory of Natural Selection. • How the diversity of life is organized. • How populations evolve. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Explain that the diversity of life is the result of evolution. • Explain that species evolved from common ancestors. • Describe Darwin’s Theory of Natural Selection. • Discuss how populations evolve to form new species. • Use the physical similarities and evolutionary relationships to organize groups of related species. 	

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Formative Assessments

For additional ideas please refer to NJ State DOE classroom application documents:

<http://njcccs.org/CADDownload.aspx>

- Observation
- Homework
- Class participation
- Venn Diagrams/Graphic Organizers
- DO-NOW
- Laboratories/Lab Reports
- Notebook
- Writing Assignments

Summative Assessments

For additional ideas please refer to NJ State DOE Professional Education Port (PEP):

<http://www.state.nj.us/education/njpep/index.html>

- Chapter/Unit Test
- Writing Assignments
- Presentations
- Laboratory Practical
- Unit Projects
- Quarterly Exams
- Biology Competency Test

Modifications (ELLs, Special Education, Gifted and Talented)

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Follow all IEP modifications/504 plan

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

- Textbook
- Laboratory manuals and equipment
- Science Websites
 - <http://www.sciencenetlinks.com>
 - www.biology.com
 - www.phschools.com