Biology Curriculum: General

For High School Biology

Textbook: *Biology*, Miller & Levine, 2010

Unit 1: Cellular Structure **Unit 2: Cellular Processes**	**Marking Period 1** **Pacing**: Cellular Structure: 20 days Cellular Processes: 25 days
Unit 3: Ecosystems **Unit 4: Ecological Dynamics**	**Marking Period 2** **Pacing**: Ecosystems: 20 days Ecological Dynamics: 25 days
Unit 5: DNA & Genetics **Unit 6: Genetic Diversity**	**Marking Period 3** **Pacing:** DNA & Genetics: 20 days Genetic Diversity: 25 days
Unit 7: Genetics & Evolution **Unit 8: Natural Selection** **Unit 9: Biodiversity**	**Marking Period 4** **Pacing:** Genetics & Evolution: 10 days Natural Selection: 15 days Biodiversity: 10 days

Unit 1: Cellular Structure Unit 2: Cellular Processes	
Pacing **Unit 1: Cellular Structure: 20 days** **Unit 2: Cellular Processes: 25 days**	
Learning Targets	
Code	**Learning Standards**
HS-LS1-2	- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms
HS-LS1-3	- Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis
HS-LS1-4	- Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS1-6	- Construct and revise an explanation based on evidence for how carbon, hydrogen and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules
Cross Cutting Concepts	
Systems and System Models	- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales
Energy and Matter	- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system - Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems
Structure and Function	- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem
Stability and Change	- Feedback (negative or positive) can stabilize or destabilize a system
Science and Engineering Practices	
Developing and Using Models	- Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
Planning and Carrying Out Investigations	- Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models
Constructing Explanations and Designing Solutions	- Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent studentgenerated sources of evidence consistent with scientific ideas, principles, and theories
Disciplinary Core Ideas	
LS1.A: Structure and Function	- Systems of specialized cells within organisms help them perform the essential functions of life. - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry

	out most of the work of cells. Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. - Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside living systems.
LS1.B: Growth and Development of Organisms	- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism
LS1.C: Organization for Matter and Energy Flow in Organisms	- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. - The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. - As matter and energy flow through different Crosscutting Concepts Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales. - Energy and Matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. - Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. - Structure and Function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. - Stability and Change Feedback (negative or positive) can stabilize or destabilize a system. - Use a Variety of Methods Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. - Organizational levels of living systems, chemical elements are recombined in different ways to form different products. - As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.
Career Readiness Standards	
9.2.12.CAP.3	- Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.5	- Assess and modify a personal plan to support current interests and postsecondary plans.
Interdisciplinary Practices (ELA)	
RST.11-12.1	- Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account

WHST.9-12.2	- Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes
WHST.9-12.5	- Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience
WHST.11-12.8	- Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation
WHST.9-12.9	- Draw evidence from informational texts to support analysis, reflection, and research.
SL.11-12.5	- Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest
Interdisciplinary Practice (Mathematics)	
MP.4	- Model with mathematics
HSF-IF.C.7	- Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases
HSF-BF.A.1	- Write a function that describes a relationship between two quantities.

Unit Essential Questions

- How do the structures of organisms enable life's functions?
- How do organisms detect, process, and use information about the environment?
- How do cells transport materials into, out and throughout the cell?
- How do cells reproduce?
- How does differentiation allow for multicellular organisms?

Unit Engineering Practices

- Developing and Using Models
  - Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
  - Use a model based on evidence to illustrate the relationships between systems or between components of a system.
- Planning and Carrying Out Investigations
  - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data and refine the design accordingly.
- Constructing Explanations and Designing Solutions
  - Construct an explanation based on valid and

Unit Enduring Understandings

Students will understand that

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.
- Multi cellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
- Living systems, from the organism to the cellular level, demonstrate the complementary nature of structure and function.
- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants

reliable evidence obtained from a variety of sources and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. ● The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.
Unit 1 Objectives *Students will be able to…* ● Explain why enzymes are important to living things. ● State the cell theory. ● Distinguish between prokaryotic and eukaryotic cells. ● Describe how the different types of microscopes work. ● Describe the structure and function of the nucleus, mitochondria, and chloroplast.	**Unit 1 Topic List and Textbook Correlation:** ● Macromolecules (2.3;2.4) ● Cell Theory (7.1) ● Endosymbiotic Theory (19.3) ● Cell Types (7.1) ● Cell Anatomy (7.2) ● Cell Hierarchy (7.4) ● Microscopes (7.1)
Unit 2 Objectives *Students will be able to…* ● Describe the structure and function of the cell membrane. ● Describe the hierarchical structural organisms (Cells through Ecosystem). ● Describe how homeostasis is essential for maintaining an organisms' internal environment. ● Discuss how the integrated functioning of all parts of systems is important for successful interpretation of inputs and responses. ● Explain how cancer cells are different from other cells. ● Describe how the cell cycle is regulated. ● Describe how homeostasis is maintained in animals.	**Unit 2 Topic List and Textbook Correlation:** ● Cellular Transport (7.3) ● Cellular Signaling (7.4;10.3; 28.1) ● Mitosis (7.4) ● Homeostasis (7.4; 28.4) ● Differentiation (10.4;13.4)

Assessment Evidence	
Formative Assessment: ● Homework ● Class participation ● Do-Now/Exit Cards ● Laboratory Reports ● Projects ● POGIL activities	**Summative Assessment:** ● Unit Test ● Topic Presentations w/Question & Answer Session ● Laboratory Practical

<table>
<tr><td>Benchmark:
- New Jersey Student Learning Assessment:Science (NJSLA)
- Quaterly Exams
- Unit Test
- Performance Assessment</td><td>Alternative:
- Oral Presentation
- Video Recording
- Virtual Lab</td></tr>
<tr><td colspan="2">Learning Plan</td></tr>
<tr><td>Learning Activities:
● Graphic Organizers
● POGIL activities
● Microscope Labs
● Argument Driven Labs
● Design Challenges
● Writing Assignments
● Analysis of Graphs, Tables & Raw Data</td><td>Modifications (ELLs, Special Education, Gifted and Talented)
ELL:
- Audiobooks, Movies, and other digital media in lieu of print versions
- Native language tests and native language English Dictionary
Special Education:
- Response to Intervention (RTI)
- Follow all IEP modifications
- Oral Instructions
- Record lessons instead of taking notes
- Outline of lessons
- Study guide with answers
- Word Processor to type notes
- Frequent breaks
504:
- Response to Intervention (RTI)
- Follow 504 plan
- Oral Instructions
- Record lessons instead of taking notes
- Outline of lessons
- Study guide with answers
- Word Processor to type notes
- Frequent breaks

Gifted and Talented:
- Peer Tutoring
- Cooperative learning groups
- Differentiated instruction
Students at Risk of School Failure:
● Extended Time
● Flexible Grouping
● Small Group Instruction
● Peer Buddies
● Tiered Activities
● Manipulatives
● Graphic Organizers</td></tr>
<tr><td></td><td></td></tr>
</table>

Unit 3: Ecosystems Unit 4: Ecological Dynamics	
Pacing: **Unit 3: Ecosystems: 20 days** **Unit 4: Ecological Dynamics: 25 days**	
Learning Targets	
Code	**Learning Standards**
HS-LS1-5	- Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy
HS-LS1-7	- Use a model to illustrate the cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy
HS-LS2-1	- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
HS-LS2-2	- Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales
HS-LS2-3	- Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions
HS-LS2-4	- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem
HS-LS2-5	- Develop a model to illustrate the role of photosynthesis & cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere & biosphere
HS-LS2-6	- Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
HS-LS2-7	- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
HS-LS2-8	- Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce
HS-ETS1	- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS3	- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-ETS4	- Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Cross Cutting Concepts	
Cause and Effect	- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects
Scale, Proportion, and Quantity	- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. - Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.
Systems and System Models	- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
Energy and Matter	- Energy cannot be created or destroyed— it only moves between one place and another place, between objects and/or fields, or between systems.

	- Energy drives the cycling of matter within and between systems.
Stability and Change	- Much of science deals with constructing explanations of how things change and how they remain stable.
Science and Engineering Practices	
Developing and Using Models	- Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show how relationships among variables between systems and their components in the natural and designed worlds.
Using Mathematics and Computational Thinking	- Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
Constructing Explanations and Designing Solutions	- Constructing explanations and designing solutions in 9– 12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
Engaging in Argument from Evidence	- Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
Disciplinary Core Ideas	
LS2.A: Interdependent Relationships in Ecosystems	- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems	- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. - Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. - Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.
LS2.C: Ecosystem Dynamics, Functioning, and Resilience	- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability

LS2.D: Social Interactions and Group Behavior	- Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.
LS4.D: Biodiversity and Humans	- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value
PS3.D: Energy in Chemical Processes	- The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.
ETS1.B: Developing Possible Solutions	- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts.
Career Readiness Standards	
9.2.12.CAP.3	- Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.5	- Assess and modify a personal plan to support current interests and postsecondary plans.
Interdisciplinary Practices (ELA)	
RST.9-10.8	- Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
RST.11-12.1	- Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
RST.11-12.7	- Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
RST.11-12.8	- Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
WHST.9-12.2	- Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST.9-12.5	- Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience
WHST.9-12.7	- Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
Interdisciplinary Practice (Mathematics)	
MP.2	- Reason abstractly and quantitatively
MP.4	- Model with mathematics
HSN-Q.A.1	- Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSN-Q.A.2	- Define appropriate quantities for the purpose of descriptive modeling.
HSN-Q.A.3	- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSS-ID.A.1	- Represent data with plots on the real number line.
HSS-IC.A.1	- Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
HSS-IC.B.6	- Evaluate reports based on data

Unit Essential Questions

- How and why do organisms interact with their environment and what are the effects of these interactions?
- How do organisms interact with the living and nonliving environments to obtain matter and energy?
- How do matter and energy move through an ecosystem?
- What happens to ecosystems when the environment changes?
- How do organisms interact in groups so as to benefit individuals?

Unit Engineering Practices

- Developing and Using Models
  - Use a model based on evidence to illustrate the relationships between systems or between components of a system.
  - Develop a model based on evidence to illustrate the relationships between systems or components of a system.
- Using Mathematics and Computational Solutions
  - Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Engaging in Argument from Evidence
  - Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Unit Enduring Understandings

Students will understand that…

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen
- As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.
- Photosynthesis and cellular respiration - including anaerobic processes- provide most of the energy for life processes
- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
- Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and biosphere through chemical, physical, geological and biological processes

Unit 3 Objectives

Students will be able to…

- Describe how matter cycles among the living and nonliving parts of an ecosystem.
- Explain why nutrients are important in living systems.
- Describe how the availability of nutrients affects the productivity of ecosystems.

Unit 3 Topic List & Textbook Correlation:

- Carbon Cycle (3.4)
  - Photosynthesis (8.2)
  - Cell Respiration (9.1)
- Nutrient Cycles (3.4)
- Food Chains (3.2; 3.3)
- Ecosystem Stability & Resilience (5.2)
  - Succession (4.3)

● Describe the relationship amongst organisms in a food chain/web. ● Explain how relative amounts of energy differs at each trophic level. ● Describe how organisms obtain energy and nutrients. ● Compare succession types and discuss effects on ecosystem stability. ● Explain where organisms get the energy they need for life processes. ● Discuss the relationship between photosynthesis and cellular respiration in ecosystem stability.	- Limiting Factors (5.1; 5.2) - Carrying Capacity (5.2)

Unit 4 Objectives *Students will be able to …* ● Describe the role competition and predation plays in shaping communities. ● Identify types of symbiotic relationships in nature. ● Discuss the role keystone and invasive species play in their habitats. ● Identify the significance of behavior on the success of animals. ● Explain how environmental changes affect animal behavior ● Explain how social behaviors increase the evolutionary fitness of a species ● Summarize the ways that animals communicate	**Unit 4 Topic List & Textbook Correlation:** ● Interdependent Relationships (4.2) - Predator /Prey - Symbiosis - Parent/Child - Invasive Species - Keystone Species - Niches ● Social Interactions & Group Behavior (29.1; 29.2)
Assessment Evidence	
Formative Assessment: ● Homework ● Class participation ● Do-Now/Exit Cards ● Laboratory Reports ● Projects ● POGIL activities	**Summative Assessment:** ● Unit Test ● Topic Presentations w/Question & Answer Session ● Laboratory Practical ● Quarterlies
Benchmark: - New Jersey Student Learning Assessment:Science (NJSLA) - Quaterly Exams - Unit Test - Performance Assessment	**Alternative:** - Oral Presentation - Video Recording - Virtual Labs
Lesson Planning	
Learning Activities: ● Graphic Organizers ● POGIL activities ● Microscope Labs ● Argument Driven Labs ● Design Challenges ● Writing Assignments	**Modifications (ELLs, Special Education, Gifted and Talented)** **ELL:** - Audiobooks, Movies, and other digital media in lieu of print versions - Native language tests and native language English Dictionary

● Analysis of Graphs, Tables & Raw Data	**Special Education:** - Response to Intervention (RTI) - Follow all IEP modifications - Oral Instructions - Record lessons instead of taking notes - Outline of lessons - Study guide with answers - Word Processor to type notes - Frequent breaks **504:** - Response to Intervention (RTI) - Follow 504 plan - Oral Instructions - Record lessons instead of taking notes - Outline of lessons - Study guide with answers - Word Processor to type notes - Frequent breaks **Gifted and Talented:** - Peer Tutoring - Cooperative learning groups - Differentiated instruction **Students at Risk of School Failure**: ● Extended Time ● Flexible Grouping ● Small Group Instruction ● Peer Buddies ● Tiered Activities ● Manipulatives ● Graphic Organizers

Unit 5: DNA & Genetics **Unit 6: Genetic Variation**	
Pacing **Unit 5: DNA & Genetics: 20 days** **Unit 6: Genetic Variation: 25 days**	
Learning Targets	
Code	**Learning Standards**
HS-LS1-1	- Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells
HS-LS3-1	- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristics traits passed from parents to offspring.
HS-LS3-2	- Make and defend a claim based on evidence that inheritable genetic variations may result

		from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3	-	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
Career Readiness Standards		
9.2.12.CAP.3	-	Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.5	-	Assess and modify a personal plan to support current interests and postsecondary plans.
Interdisciplinary Practices (ELA)		
RST .11-12.1	-	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
RST .11-12.9	-	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
WHST .9-12.1	-	Write arguments focused on discipline-specific content.
Interdisciplinary Practices (Mathematics)		
MP.2	-	Reason abstractly and quantitatively.
Cross Cutting Concepts		
Cause and Effect	-	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
Scale, Proportion, and Quantity	-	Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth v s. exponential growth).
Science and Engineering Practices		
Asking Questions and Defining Problems	-	Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations
Analyzing and Interpreting Data	-	Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency , and the use of models to generate and analyze data.
Engaging in Argument from Evidence	-	Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
Disciplinary Core Ideas		
LS1.A : Structure and Function	-	A ll cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.
LS3.A : Inheritance of Traits	-	Each chromosome consists of a single v ery long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism hav e the same genetic content, but the genes used (expressed) by the cell may be regulated in different way s. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some hav e no as-y et known function.
LS3.B: Variation of	-	In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic

Traits	variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. - -Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the v ariation and distribution of traits observ ed depends on both genetic and env ironmental factors

Unit Essential Questions

- What are the chemical components of DNA?
- How does information flow from DNA to RNA to direct the synthesis of proteins?
- How do mutations affect genes?
- How can two alleles from different genes be inherited together?
- How does meiosis create genetic diversity?
- Does the environment have a role in how genes determine traits?
- What are some other patterns of inheritance?

Unit Engineering Practices

- Asking Questions and Defining Problems
  - Ask questions that arise from examining models or a theory to clarify relationships.
- Developing and Using Models
  - Use a model based on evidence to illustrate the relationships between systems or between components of a system.
- Analyzing and Interpreting Data
  - Apply concepts of statistics and probability to scientific and engineering questions and problems, using digital tools when feasible.
- Engaging in Argument from Evidence
  - Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.

Unit Enduring Understandings

Students will understand that…

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA containing the instructions that code for the formation of proteins.
- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.
- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited.

Unit 5 Objectives

Students will be able to…

- Identify the chemical components of DNA
- Model the structure and function of a DNA molecule.
- Model the events of DNA replication.
- Identify the function of protein synthesis.

Unit 5 Topic List & Textbook Correlation:

- DNA Structure (12.2)
- DNA Replication (12.3)
- RNA Structure (13.1)
- Protein Synthesis (13.2)

Unit 6 Objectives

Students will be able to…

- Identify mutations in a DNA sequence and demonstrate the effects of the mutations.
- Identify the main sources of genetic variation in a population
- Use human genetics to describe other patterns of inheritance
- Explain how geneticists use the principles of

Unit 6 Topic List & Textbook Correlation:

- Meiosis (11.4)
- Probability (11.2)
- Patterns of Inheritance (11.3)
  - Codominance
  - Incomplete Dominance
  - Multiple Alleles
  - Polygenic Traits
- Genetic Variation

probability to make Punnett Squares	- Mutations (13.3) - Sexual Reproduction - Lateral Gene Transfer (17.1)
Assessment Evidence	
Formative Assessment: ● Homework ● Class participation ● Do-Now/Exit Cards ● Laboratory Reports ● Projects ● POGIL activities	**Summative Assessment:** ● Chapter Test ● Topic Presentations w/Question & Answer Session ● Laboratory Practical
Benchmark: - New Jersey Student Learning Assessment:Science (NJSLA) - Quaterly Exams - Unit Test - Performance Assessment	**Alternative:** - Oral Presentation - Video Recording - Virtual Labs
Learning Plan	
Learning Activities: ● Graphic Organizers ● POGIL activities ● Microscope Labs ● Argument Driven Labs ● Design Challenges ● Writing Assignments ● Analysis of Graphs, Tables & Raw Data	**Modifications (ELLs, Special Education, Gifted and Talented)** **ELL:** - Audiobooks, Movies, and other digital media in lieu of print versions - Native language tests and native language English Dictionary **Special Education:** - Response to Intervention (RTI) - Follow all IEP modifications - Oral Instructions - Record lessons instead of taking notes - Outline of lessons - Study guide with answers - Word Processor to type notes - Frequent breaks **504:** - Response to Intervention (RTI) - Follow 504 plan - Oral Instructions - Record lessons instead of taking notes - Outline of lessons - Study guide with answers - Word Processor to type notes - Frequent breaks **Gifted and Talented:** - Peer Tutoring

	- Cooperative learning groups - Differentiated instruction **Students at Risk of School Failure**: ● Extended Time ● Flexible Grouping ● Small Group Instruction ● Peer Buddies ● Tiered Activities ● Manipulatives ● Graphic Organizers

Unit 7: Genetics & Evolution **Unit 8: Natural Selection** **Unit 9: Biodiversity**	
Pacing: **Unit 7: Genetics & Evolution :10 days** **Unit 8: Natural Selection: 15 days** **Unit 9: Biodiversity: 10 days**	
Learning Targets	
Code	**Learning Standards**
HS-LS4-1	- Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence
HS-LS4-2	- Construct an explanation based on evidence that the processes of evolution primarily results from four factors: (1)the potential for a species to increase number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction,(3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3	- Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4- 4	- Construct an explanation based on evidence for how natural selection leads to adaptations of populations.
HS-LS4-5	- Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1)increases in the number of individuals of some species, (2)the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6	- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity
HS-ET1-3	- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-ET1-4	- Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Career Readiness Standards	
9.2.12.CAP.3	- Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.5	- Assess and modify a personal plan to support current interests and postsecondary plans.
Interdisciplinary Practices (ELA)	

RST .11-12.1	-	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
RST .11-12.8	-	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
WHST .9-12.2	-	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST .9-12.5	-	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or try ing a new approach, focusing on addressing what is most significant for a specific purpose and audience.
WHST .9-12.7	-	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST .9-12.9	-	Draw evidence from informational texts to support analysis, reflection, and research.
SL.11-12.4	-	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate ey e contact, adequate volume, and clear pronunciation.
Interdisciplinary Practices (Mathematics)		
MP.2	-	Reason abstractly and quantitatively.
MP.4	-	Model with mathematics.
Cross Cutting Concepts		
Patterns	-	Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
Cause and Effect	-	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
Science and Engineering Practices		
Analyzing and Interpreting Data	-	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency , and the use of models to generate and analyze data.
Using Mathematics andComputati onal Thinking	-	Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analy ze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions
Constructing Explanations and Designing Solutions	-	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student generated sources of evidence consistent with scientific ideas, principles, and theories.
Engaging in A rgument from Evidence	-	Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science.

Obtaining, Evaluating, and Communicating Information	- Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.
Disciplinary Core Ideas	
LS4.A : Evidence of Common Ancestry and Diversity	- Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
LS4.B: Natural Selection	- Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. - The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
LS4.C: Adaptation	- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an env ironment's limited supply of the resources that individuals need in order to surv iv e and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. - Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically , behaviourally , and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. - Adaptation also means that the distribution of traits in a population can change when conditions change. - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes - Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost
LS4.D: Biodiversity and Humans	- Humans depend on the living world for the resources and other benefits provided by biodiversity . But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasives species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.
ET S1.B: Developing Possible Solutions	- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety , reliability , and aesthetics, and to consider social, cultural, and environmental impacts. Both physical models and computers can be used in various ways to aid in the engineering design process. - Computers are useful for a v variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his

	or her needs.

Unit Essential Questions

- How can populations evolve to form new species?
- How is evolution defined in genetic terms?
- What determines the number of phenotypes for a given trait?
- How does natural selection affect single-gene and polygenic traits?
- What is genetic drift?
- What conditions are required to maintain genetic equilibrium?
- What types of isolation lead to the formation of new species?
- What is natural selection?
- What does Darwin's mechanism for evolution suggest about living and extinct species?
- What processes influence whether species survive or become extinct?

Unit Engineering Practices

- Analyzing and Interpreting Data
  - Apply concepts of statistics and probability (including determining function fits to data, slope, intercept , and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Using Mathematics & Computational Thinking
  - Create or revise a simulation of phenomenon, designed device, process or system.
- Constructing Explanations & Designing Solutions
  - Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Engaging in Argument from Evidence
  - Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.
- Obtaining, Evaluating and Communicating Information
  - Communicate scientific information in multiple formats (including orally, graphically, textually and mathematically.)

Unit Enduring Understandings

Students will understand that…

- Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.
- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.
- Adaptation also means that the distribution of traits in a population can change when conditions change.
- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.
- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, over exploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that

	ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
Unit 7 Objectives *Students will be able to…* ● Define evolution in terms of genetic terms. ● Identify the main sources of genetic variation in a population. ● State what determines the number of phenotypes for a trait. ● Describe genetic drift & its effects on a population. ● Explain how different factors affect genetic equilibrium. ● Identify the types of isolation that can lead to the formation of new species.. ● Explain how new genes evolve. ● Explain how molecular evidence can be used to trace the process of evolution.	**Unit 7 Topic List & Textbook Correlation:** ● Gene Pools (17.1) ● Genetic Drift (17.2) ● Speciation (17.3) ● Molecular Evolution (17.4)
Unit 8 Objectives *Students will be able to…* ● State Darwin's contributions to science. ● Explain how geologic distribution of species relates to their evolutionary history. ● Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. ● Describe what homologous structures and embryology suggest about the process of evolutionary changes.	**Unit 8 Topic List & Textbook Correlation:** ● Evidence of Evolution (16.4) ● Darwin & Natural Selection (16.3) ● Adaptations ● How Natural Selection Works (17.3)
Unit 9 Objectives *Students will be able to…* ● Identify the types of isolation that can lead to the formation of new species. ● Identify the processes that influence survival or extinction of a species. ● Describe how human activities affect the biosphere, including the land, water and air. ● Describe the relationship between resource use and sustainable development. ● Identify the role of ecology in a sustainable future. ● Identify the role of humans on the survival or extinction of species.	**Unit 9 Topic List & Textbook Correlation:** ● Speciation (17.3) ● Extinction (19.2) ● Human Activity (Chapter 6) - Pollution - Climate Change - Population - Habitat Destruction - Biodiversity - Sustainability
Assessment Evidence	

<table>
<tr><td>Formative Assessment:
Homework
Class participation
Do-Now/Exit Cards
Laboratory Reports
Projects
POGIL activities</td><td>Summative Assessment:
Unit Test
Topic Presentations w/Question & Answer Session
Laboratory Practical
Quarterlies</td></tr>
<tr><td>Benchmark:
New Jersey Student Learning Assessment:Science (NJSLA)
Quaterly Exams
Unit Test
Performance Assessment</td><td>Alternative:
Oral Presentation
Video Recording
Virtual Labs</td></tr>
<tr><td colspan="2">Learning Plan</td></tr>
<tr><td>Learning Activities:
Graphic Organizers
POGIL activities
Microscope Labs
Argument Driven Labs
Design Challenges
Writing Assignments
Analysis of Graphs, Tables & Raw Data</td><td>Modifications (ELLs, Special Education, Gifted and Talented)
ELL:
Audi books, Movies, and other digital media in lieu of print versions
Native language tests and native language English Dictionary
Special Education:
Response to Intervention (RTI)
Follow all IEP modifications
Oral Instructions
Record lessons instead of taking notes
Outline of lessons
Study guide with answers
Word Processor to type notes
Frequent breaks
504:
Response to Intervention (RTI)
Follow 504 plan
Oral Instructions
Record lessons instead of taking notes
Outline of lessons
Study guide with answers
Word Processor to type notes
Frequent breaks
Gifted and Talented:
Peer Tutoring
Cooperative learning groups
Differentiated instruction
Students at Risk of School Failure:
● Extended Time
● Flexible Grouping
● Small Group Instruction
● Peer Buddies
● Tiered Activities</td></tr>
</table>

	● Manipulatives ● Graphic Organizers -