SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

BIOLOGY

New Jersey
Student Learning Standards
SCIENCE

All standards are NJSLS-S

SUBJECT: BIOLOGY **GRADE: 9-12**

Cliffside Park Public Schools

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Unit 1: ORIGIN OF LIFE AND BIOLOGICAL MOLECULES

Unit 1: How do the structures of organisms enable life's functions?

Grade: 9-12

Content Area: Life Science

Pacing: 25 Instructional Days

Essential Question

How do the structures of organisms enable life's functions?

Student Learning Objectives (Performance Expectations NJSLS-S)

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-LS1-2.Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3.3.Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Unit Summary

This unit will allow students to explore, research and construct an explanation based on how the structure of DNA determines the structure of proteins. Proteins then carry out essential functions of life through systems of specialized cells. Students will develop and use models to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms, as well as, investigate in order to provide evidence that feedback mechanisms maintain homeostasis.

Technical Terms

DNA, ORGANISM, HOMEOSTASIS

Formative Assessment Measures

Part A: How does the structure of DNA determine the structure of proteins, and what is the function of proteins?

Students who understand the concepts are able to:

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.
- Construct an explanation, based on 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, for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.
- Conduct a detailed examination of the structure and function of DNA.

Part B: What do you mean they say that people are made of a system of systems?

Students who understand the concepts are able to:

Develop and use a model based on evidence to illustrate hierarchical organization of interacting systems that provide specific functions within multicellular organism.

• Develop and use a model based on evidence to illustrate the interaction of functions at the organism system level. • Develop and use a model based on

SUBJECT: BIOLOGY **GRADE: 9-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2018

evidence to illustrate the flow of matter and energy within and between systems of an organism at different scales.

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
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. (HS-LS1-1) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1-1) 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. (HS-LS1-3) 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. (HS-LS1-3) WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1) 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. (HS-LS1-2)	NA

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications			
English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	communication	Higher level questioning
Annotation guides	Extended time	Modified assignments	Critical/Analytical thinking tasks

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Think-pair- share Visual aides Modeling Cognates	Answer masking Answer eliminator Highlighter Color contrast	Counseling	Self-directed activities

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 2: Matter and Energy

Unit 2: How do matter and energy cycle through ecosystems?

Grade: 9-12

Content Area: Life Science

Pacing: 25 Instructional Days

Essential Question

How do organisms obtain and use energy they need to live and grow?
How do matter and energy move through ecosystems?
How do organisms interact with the living and nonliving environment to obtain matter and energy?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

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.

HS-LS1-7: Use a model to illustrate that 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-LS2-3: 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 and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Unit Summary

Energy obtained via photosynthesis provides majority of the energy for life and the life processes. Energy is transferred from producer to consumer by releasing the energy stored in chemical bonds - mostly in the bonds of glucose - through the process of cellular respiration. These carbon based molecules are then broken down, converted, and reassembled as other macromolecules by other life processes. These energies must be converted as energy cannot be created nor destroyed. This is a fundamental concept across all sciences.

Technical Terms

DNA, ORGANISM, HOMEOSTASIS

Disciplinary Core Ideas:	**Crosscutting Concepts:**	**Science and Engineering Practices:**
The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (NJSLS-S-HS-LS1-5) 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. (NJSLS-S-HS-LS1-6)	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. (NJSLS-S-HS-LS1-5), (NJSLS-S-HS-LS1-6) Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.	Use a model based on evidence to illustrate the relationships between systems or between components of a system. (NJSLS-S-HS-LS1-5), (NJSLS-S-HS-LS1-7) Develop a model based on evidence to illustrate the relationships between systems or components of a system. (NJSLS-S-HS-LS2-5) Use mathematical representations of phenomena or design solutions to support claims. (NJSLS-S-HS-LS2-4) 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

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (NJSLS-S-HS-LS1-6),(NJSLS-S-HS-LS1-7) 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. (NJSLS-S-HS-LS1-7) Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (NJSLS-S-HS-LS2-3) 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. (NJSLS-S-HS-LS2-4) 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. (NJSLS-S-HS-LS2-5) The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to NJSLS-S-HS-LS2-5)	(NJSLS-S-HS-LS1-7),(NJSLS-S-HS-LS2-4) Energy drives the cycling of matter within and between systems. (NJSLS-S-HS-LS2-3)	the natural world operate today as they did in the past and will continue to do so in the future. (NJSLS-S-HS-LS1-6),(NJSLS-S-HS-LS2-3)
Formative Assessment Measures		
Part A: Why do astrobiologists look for water on planets and not oxygen when they search for life on other planets?		
Students who understand the concepts are able to:		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

- Construct and revise an explanation for the cycling of matter and flow of energy in aerobic and anaerobic conditions, 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.
- Construct and revise an explanation for the cycling of matter and flow of energy in aerobic and anaerobic conditions, considering that most scientific knowledge is quite durable but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.

Part B: Why is there no such thing as a food chain?

Students who understand the concepts are able to:

- Support claims for the cycling of matter and flow of energy among organisms in an ecosystem using conceptual thinking and mathematical representations of phenomena.
- Use a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and to show how matter and energy are conserved as matter cycles and energy flows through ecosystems. • Use a mathematical model to describe the conservation of atoms and molecules as they move through an ecosystem.
- Use proportional reasoning to describe the cycling of matter and flow of energy through an ecosystem.

Part C: How can the process of photosynthesis and respiration in a cell impact ALL of Earth's systems?

- Develop a model, based on evidence, to illustrate the roles of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere, showing the relationships among variables in systems and their components in the natural and designed world.
- Develop a model, based on evidence, to illustrate the roles of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere at different scales.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• 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.11-12.1 (HS-LS2-3) • 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. SL.11-12.5 (HS-LS1-5)	• Reason abstractly and quantitatively. MP.2 (HS-LS2-4) • Model with mathematics. MP.4 (HS-LS2-4) • 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.1 (HS-LS2-4) • Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.2 (HS-LS2-4) • HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.B.1,

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Modeling Cognates	Highlighter Color contrast		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 3: Interdependent Relationships in Ecosystems
Unit 3:How do organisms interact with the living and nonliving environments to obtain matter and energy?
Grade: 9-12
Content Area: Life Science
Pacing: 25 Instructional Days
Essential Question
How do organisms interact with the living and nonliving environments to obtain matter and energy?
Student Learning Objectives (Performance Expectations NJSLS-S)
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-LS2-6. 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-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity
Unit Summary
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. Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. 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. 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. 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. Emphasis will be placed designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Student learning will focus emphasis on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.

Technical Terms

Formative Assessment Measures

Part A:When they relocate bears, wolves, or other predators, how do they know that they will survive?

Students who understand the concepts are able to:

- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- Use quantitative analysis to compare relationships among interdependent factors and represent their effects on the carrying capacity of ecosystems at different scales.

Part B: What limits the number and types of different organisms that live in one place?

Students who understand the concepts are able to:

- Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- Use the concept of orders of magnitude to represent how factors affecting biodiversity and populations in ecosystems at one scale relate to those factors at another scale.

Part C: How can a one or two inch rise in sea level devastate an ecosystem?

Students who understand the concepts are able to:

- Evaluate the claims, evidence, and reasoning that support the contention that complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- Construct explanations of how modest biological or physical changes versus extreme changes affect stability and change in ecosystems.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes	• Reason abstractly and quantitatively. MP.2 (HS-LS2-1),(HS-LS2-2),(HS-LS2-6) Model with mathematics. MP.4 (HS-LS2-1),(HS-LS2-2)

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

and to any gaps or inconsistencies in the account. RST.11-12.1 (HS-LS2-1),(HS-LS2-2),(HS-LS2- 6) ● 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.11-12.7 (HS-LS2-6) ● 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. RST.11-12.8 (HS-LS2-6) ● Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9- 12.2 (HS-LS2-1),(HS-LS2-2)	● 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.1 (HS-LS2-1),(HS-LS2-2) ● Define appropriate quantities for the purpose of descriptive modeling. HSN.Q.A.2 (HS-LS2-1),(HS-LS2-2) ● Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. HSN.Q.A.3 (HS-LS2-1),(HS-LS2-2) ● Represent data with plots on the real number line. HSS-ID.A.1 (HS-LS2-6) ● Understand statistics as a process for making inferences about population parameters based on a random sample from that population. HSS-IC.A.1 (HS-LS2-6)

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12
Technology Standards	8.1.12.A.5, 8.1.12.C.1, 8.1.12.E.1, 8.2.12.C.6, 8.2.12.C.7, 8.2.12.D.1

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual	Multimedia	Graphic organizers	Tiered activities
dictionaries/translation	Leveled readers	Extended time	Independent research/inquiry
Think alouds	Assistive technology	Parent communication	Collaborative teamwork
Read alouds	Notes/summaries	Modified assignments	Higher level questioning
Highlight key vocabulary	Extended time	Counseling	Critical/Analytical thinking tasks
Annotation guides	Answer masking		Self-directed activities
Think-pair- share	Answer eliminator		
Visual aides	Highlighter		
Modeling	Color contrast		
Cognates			

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 4: Inheritance and Variation of Traits

Unit 4: How are characteristics from one generation related to the previous generation?

Grade: 9-12

Content Area: Life Science

Pacing: 25 Instructional Days

Essential Question

How are characteristics from one generation related to the previous generation?

Student Learning Objectives (Performance Expectations NJSLS-S)

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic 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.

Unit Summary

DNA carries the codes for all living organisms. Genes replicate and are passed on from mother to daughter cells. The process of mitosis divides replicated genes when somatic cells reproduce. During the formation of gametes, meiosis divides the total number of genes to 50% of the normal diploid complement. Mutations occur in genes and may cause alterations in various ways. Modern techniques provided scientists greater ability to manipulate DNA than they have ever before possessed; leading both to great areas of innovation and areas open to ethical questioning.

Technical Terms

Mitosis, S Phase,Gap 1,Gap 2,Karyokinesis,Cytokinesis, Stem cell, Differentiation,Differential gene expression,Centromere

Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
DNA is the material responsible for the passing on of traits from one to another generation. DNA is replicated in an orderly fashion. Genes may mutate naturally on their own, and genes can be manipulated by geneticists	Gene therapies present new forms of treating old illnesses, while genetic practices open new debates regarding bioethics.	Older forms of manipulating genes were limited to breeding practices common to farmers; however,modern science allows scientists to splice genes using restriction enzymes, marker genes and plasmids in newer technologies.

Formative Assessment Measures

Part A: What can't two roses ever be identical?

Students who understand the concepts are able to:

- Ask questions that arise from examining models or a theory to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parent to offspring.

- Use empirical evidence to differentiate between cause and correlation and make claims about the role of DNA and chromosomes in coding the instructions for characteristics passed from parents to offspring.

Part B: How does inheritable genetic variation occur?

Students who understand the concepts are able to:

- Make and defend a claim based on evidence that inheritable genetic variations may result from new genetic combinations through meiosis, viable errors occurring during replication, and/or mutations caused by environmental factors.
- Use data to support arguments for the ways inheritable genetic variation occurs. • Use empirical evidence to differentiate between cause and correlation and

Part C: Can a zoologist predict the distribution of expressed traits in a population?

Students who understand the concepts are able to:

- Apply concepts of statistics and probability (including determining function fits to data, slope, intercepts, and correlation coefficient for linear fits) to explain the variation and distribution of expressed traits in a population.
- Use mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.
- Use algebraic thinking to examine scientific data on the variation and distribution of traits in a population and predict the effect of a change in probability of traits as it relates to genetic and environmental factors.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• 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.9-12.7 (HS-LS1-3) • 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.11-12.8 (HS-LS1-3) • 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. SL.11-12.5 (HS-LS1-2)	NA

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

21st Century Life and Careers	CRP2, CRP4, CRP5, CRP6, CRP7, CRP8, CRP11,CRP12
Technology Standards	8.1.12.A.5, 8.1.12.C.1, 8.1.12.E.1, 8.2.12.C.6, 8.2.12.C.7, 8.2.12.D.1

Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 5: Natural Selection and Evolution
Unit 5: How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? What evidence shows that different species are related?
Grade: 9-12
Content Area: Life Science
Pacing: 25 Instructional Days
Essential Questions
How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? What evidence shows that different species are related?
Student Learning Objectives (Performance Expectations NJSLS-S)
HS-LS-4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence
HS-LS-4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in 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-LS-4-3: 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-LS-4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS-4-5: 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.
Unit Summary
All organisms must adapt to various changes and challenges present in their environment. In this unit, students will be studying and attempting to explain how changes to these environmental factors can force change in the characteristics and adaptations in the organisms themselves. Students will cover the base ideas from the work of Charles Darwin to evaluate evidence to support or disprove these claims. In addition, graphical analysis of population trends and abundance of mutations and genes in the current population allows the students to physically represent the data and use that analysis to prove and disprove ideas and arguments. This unit overlaps and coincides with some of the standards and ideas presented in the Ecological Relationships unit due to the connection between an organism's survival in the environment, from organism competition to environmental factors that can change as ecosystems change over time.
Technical Terms
Formative Assessment Measures
Part A: How does natural selection lead to adaptations of populations?
Students who understand the concepts are able to:

SUBJECT: BIOLOGY **Cliffside Park Public Schools** **GRADE: 9-12**

BOE APPROVAL: August 2018

Part B: Why is it so important to take all of the antibiotics in a prescription if I feel better?
Students who understand the concepts are able to:
• 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 on 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, for how natural selection leads to adaptation of populations. • Use data to differentiate between cause and correlation and to make claims about how specific biotic and abiotic differences in ecosystems contribute to change in gene frequency over time, leading to adaptation of populations.
Part C: How are species affected by changing environmental conditions?
Students who understand the concepts are able to:
• Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. • Analyze shifts in numerical distribution of traits and, using these shifts as evidence, support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. • Observe patterns at each of the scales at which a system is studied to provide evidence for causality in explanations that organisms with an advantageous heritable trait tend to increase in proportion to organism slacking this trait.
Part D: Why do some species live in groups and others are solitary?
Students who understand the concepts are able to:
• Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. • Distinguish between group and individual behavior. • Identify evidence supporting the outcome of group behavior. • Develop logical and reasonable arguments based on evidence to evaluate the role of group behavior on individual and species' chances to survive and reproduce. • Use empirical evidence to differentiate between cause and correlation and to make claims about the role of group behavior on individual and species' chances to survive and reproduce.
Part A2: How can someone prove that birds and dinosaurs are related?
Students who understand the concepts are able to:
• Communicate scientific information in multiple forms that common ancestry and biological evolution are supported by multiple lines of empirical Evidence. • Understand the role each line of evidence has relating to common ancestry and biological evolution.

- Observe patterns in multiple lines of empirical evidence at different scales and provide evidence for causality in explanations of common ancestry and biological evolution.

Part B2: What is the relationship between natural selection and evolution?

Students who understand the concepts are able to:

- 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, that the process of evolution primarily results from four factors: (1) the potential for a species to increase in 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.
- Use empirical evidence to explain the influences of: (1) the potential for a species to increase in 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, on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• 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. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4) • 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. (HS-LS4-5) • WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4) • 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. (HS-LS4-6)	• MP.2 Reason abstractly and quantitatively. (HS-LS4-1), (HS-LS4-2), (HS-LS4-3), (HS-LS4-4),(HS-LS4-5) • MP.4 Model with mathematics. (HS-LS4-2)

SUBJECT: BIOLOGY **GRADE: 9-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2018

• 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. (HS-LS4-6) • WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5) • 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 eye contact, adequate volume, and clear pronunciation. (HS-LS4-1),(HS-LS4-2)	
Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12
Technology Standards	8.1.12.A.5, 8.1.12.C.1, 8.1.12.E.1, 8.2.12.C.6, 8.2.12.C.7, 8.2.12.D.1

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 6: Human Activity and Climate
Unit 6: How do humans depend on Earth's resources? **How and why do humans interact with their environment and what are the effects of these interactions?**
Grade: 9-12
Content Area: Earth and Space Science
Pacing: 20 Instructional Days
Essential Questions
How do humans depend on Earth's resources? How and why do humans interact with their environment and what are the effects of these interactions?
Student Learning Objectives (Performance Expectations NJSLS-S)
HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-6: Use a computational representation to illustrate the relationship among Earth systems and how those relationships are being modified due to human activity.
HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.
HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on a natural systems.
HS-ETS1-3:Evaluate a solution to a complex real world problem based on prioritized criteria and tradeoffs that account for a range constraints including cost, safety,reliability and aesthetics
Unit Summary
In this unit of study, students examine factors that have influenced the distribution and development of human society; these factors include climate, natural resource availability, and natural disasters. Students use computational representations to analyze how earth systems and their relationships are being modified by human activity. Students also develop an understanding of how human activities affect natural resources and of the interdependence between humans and Earth's systems, which affect the availability of natural resources. Students will apply their engineering capabilities to reduce human impacts on earth systems and improve social and environmental cost–benefit ratios. The crosscutting concepts of cause and effect, systems and systems models, stability and change, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for the disciplinary core ideas. Students will analyze and interpret data, use mathematical and computational thinking, and construct explanations as they demonstrate understanding of the disciplinary core ideas.
Technical Terms
Computational representation, interdependence, cost-benefit ratios
Formative Assessment Measures
Part A: How are human activities influence the global ecosystem?
Students who understand the concepts are able to:

- Construct an explanation based on valid and reliable evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- Use empirical evidence to differentiate between how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity

Part B: What are the relationships among earth's systems and how are those relationships being modified due to human activity?

Students who understand the concepts are able to:

- Use a computational representation to illustrate the relationships among Earth systems and how these relationships are being modified due to human activity.
- Describe the boundaries of Earth systems.
- Analyze and describe the inputs and outputs of Earth systems.

Part C: What is the current rate of global or regional climate change and what are the associated future impacts to Earth's systems?

Students who understand the concepts are able to:

- Analyze geosciences data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- Quantify and model change and rates of change in geosciences data and rates of global or regional climate change and associated impacts to Earth systems.

Part D: How can the impacts of human activities on natural systems be reduced?

Students who understand the concepts are able to:

- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems based on scientific knowledge and student generated sources of evidence; prioritize criteria and tradeoff considerations.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
• 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.11-12.1 (HS-ETS1-3) • Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia)	• Reason abstractly and quantitatively. MP.2 (HS-LS2-1), (HS-LS2-2), (HS-LS2-6), (HS-LS2-7) • Model with mathematics. MP.4 (HS-ETS1-3) 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

SUBJECT: BIOLOGY **GRADE: 9-12**

Cliffside Park Public Schools

BOE APPROVAL: August 2018

in order to address a question or solve a problem. RST.11-12.7 (HS-ETS1-3) • 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. RST.11-12.8 (HSETS1-3) • 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. RST.11-12.9 (HSETS1-3).	interpret the scale and the origin in graphs and data displays. HSN.Q.A.1 (HS-ETS1-3). • Define appropriate quantities for the purpose of descriptive modeling. HSN.Q.A.2 (HS-ETS1-3). • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. HSN.Q.A.3 (HS-ETS1-3).

Core Instructional Materials	Can include: Online resources, Textbooks Series, Lab Materials, etc.
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12
Technology Standards	8.1.12.A.5, 8.1.12.C.1, 8.1.12.E.1, 8.2.12.C.6, 8.2.12.C.7, 8.2.12.D.1

Modifications

English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Unit 7: Human Activity and Biodiversity
Unit 7: Would we treat our resources and life support system if we were on a rocket headed for Mars as we do in our community right now?
Grade: 9-12
Content Area: Earth and Space Science
Pacing: 20 Instructional Days
Essential Question
Would we treat our resources and life support system if we were on a rocket headed for Mars as we do in our community right now?
Student Learning Objectives (Performance Expectations NJSLS-S)
HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*
HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3. 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-ETS1-4. 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.
Unit Summary
In this unit of study, mathematical models provide support for students' conceptual understanding of systems and students' ability to design, evaluate, and refine solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Students create or revise a simulation to test solutions for mitigating adverse impacts of human activity on biodiversity. Crosscutting concepts of systems and system models play a central role in students' understanding of science and engineering practices and core ideas of ecosystems. Mathematical models also provide support for students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Human civilization has had a serious negative impact on biodiversity, particularly since the advent of our industrial revolution. The continued loss of habitats due to farming and city /town growth (living space for an increasing human population) has devastated the world's flora and fauna populations. This is exacerbated by big commercial fishing and rampant pollution of our aquatic biomes. the use of harmful chemicals such as pesticides and herbicides, and the release of other toxic compounds into the environment have all lead to a new age of mass extinction. These actions have been very harmful to all life, particularly on vertebrates. Currently the topic of foreign DNA introduction into the wild has further added stress to an already taxed environment (GMOs). These actions have lead to a decrease in overall plant and animal diversity. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary)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 aid humanity by preserving landscapes of recreational or inspirational value. (secondary) (Note: This Disciplinary Core Idea is also addressed by NJSLS-S-HS-LS4-6.)

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

Technical Terms

Formative Assessment Measures
Part A: How might we change habits if we replaced the word "environment" with the word "life support system"?
Students who understand the concepts are able to: ● Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● Quantify and model change and rates of change in the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
Part B: Does reducing human impacts on our global life support system require social engineering or mechanical engineering?
Students who understand the concepts are able to: ● Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. ● Construct explanations for how the environment and biodiversity change and stay the same when affected by human activity. ● Evaluate a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. ● Analyze costs and benefits of a solution for reducing the impacts of human activities on the environment and biodiversity based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
Part C: Is the damage done to the global life support system permanent?
Students who understand the concepts are able to: ● Create or revise a simulation based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations to test a solution to mitigate adverse impacts of human activity on biodiversity. ● Use empirical evidence to make claims about the impacts of human activity on biodiversity. ● Break down the criteria for the design of a simulation to test a solution for mitigating adverse impacts of human activity on biodiversity into simpler ones that can be approached systematically based on consideration of tradeoffs. ● Design a solution for a proposed problem related to threatened or endangered species or to genetic variation of organisms for multiple species. ● Analyze costs and benefits of a solution to mitigate adverse impacts of human activity on biodiversity.

Interdisciplinary Connections	
NJSLS- ELA	**NJSLS- Mathematics**
● 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.11-12.7 (HS-LS2-7)	● Reason abstractly and quantitatively. MP.2 (HS-LS2-7), (HS-ETS1-3) Model with mathematics. MP.4 (HS-ETS1-3) ● Use units as a way to understand problems and to guide the solution of multi-step

SUBJECT: BIOLOGY

Cliffside Park Public Schools

GRADE: 9-12

BOE APPROVAL: August 2018

• 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. RST.11-12.8 (HS-ETS1-3) • 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. RST.11-12.9 (HS-ETS1-3). • 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.9-12.5 (HS-LS4-6).	problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN.Q.A.1 (HS-LS2-7) • Define appropriate quantities for the purpose of descriptive modeling. HSN.Q.A.2 (HS-ETS1-3) • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. HSN.Q.A.3 (HS-ETS1-3)

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