Honors Biology Curriculum
2023-2024

Approved by the Academy for Urban Leadership Board of Trustees

April 2023

Founded in 2010 in Perth Amboy, New Jersey, the Academy for Urban Leadership Charter School is one of Middlesex County's comprehensive Public Charter Schools that serves students in seventh through twelfth grades. The school operates under the terms of a charter granted by the New Jersey Department of Education. AUL offers an advanced academic track and AP courses.

AUL has designed its curriculum to focus on Four Academies which include Applied Science, Law/Public & Safety, Business & Technology and Human Development. Students are given an opportunity to explore interests and take courses related to their chosen field, proving students with an opportunity to utilize knowledge in their everyday life.

MISSION STATEMENT OF ACADEMY FOR URBAN LEADERSHIP CHARTER SCHOOL:

To employ an educational design and experience that merges the highest standards of academic excellence while fostering convictions and commitment to social and economic justice.

Goals:

- Provide each student the resources necessary to excel to his/her maximum ability
- Prepare students for success in post-secondary education
- Prepare students with the skills for the workforce
- Prepare students to be leaders in this community
- Prepare students for their civic responsibilities and instill values of good citizenship
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UNIT OVERVIEW	
CONTENT AREA: **Honors Biology**	**UNIT 0: Science as a Process**
TARGET COURSE/GRADE LEVEL: **Biology 9-12**	**SUGGESTION TIMEFRAME: 2 weeks**
TOPIC: Science as a Process	**CHAPTERS COVERED: Ongoing throughout each unit**

UNIT SUMMARY/ UNIT RATIONALE:

The goals of this Unit is to provide students with learning opportunities that are designed to build scientific literacy, critical thinking, problem solving and analytical skills through the process of inquiry. The learning experiences will engage students in the fundamental questions about the world around them and how scientists investigate and find answers to those questions. Students will have the opportunity to carry out scientific investigations and engineering design projects related to the disciplinary core ideas in life sciences. Students formulate an answer to the question: "How is Science actually conducted?" Students are able to use and understand the process of science as a tool to plan and conduct investigations, analyze data, and communicate. Students will explore climate change data, use a variety of available lab equipment in order to generate their own data, and demonstrate their understanding through critical reading and models.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

ELA:

- 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)
- 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)
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a selfgenerated 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-ESS2-5).

- 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. (HS-LS2-6), (HS-LS2-8)
- 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-LS2-l), (HS-LS2-2), (HS-LS2- 3), (HS-LS2-6), (HS-LS2-8)
- 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. (HS-LS2-6), (HS-LS2-8)

Math:

- MP.2 Reason abstractly and quantitatively. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-6)
- MP.4 Model with mathematics. (HS-LS2-1), (HS-LS2-2), (HS-LS2- 4)
- HSN-Q.A. l 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. (HSLS2-1), (HS-LS2-2), (HS-LS2-4)
- HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4)
- HSS-IC.A. l Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)
- HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-5)

Technology:

8.1.12.A.2 Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

ESSENTIAL QUESTIONS:

- How is life defined?
- What makes something alive?
- How is life organized?
- How do scientists gather and analyze data to investigate specific phenomena?
- How do the structures of organisms enable life's functions?
- What systems and processes keep organisms alive? What happens when those systems break down?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
[Clarification Statement: Examples of investigations could include heart rate response to exercise,stomata response to moisture and temperature,

and root development in response to water levels.] [*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*]

HS - ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraintsfor solutions that account for societal needs and wants.

HS - ETS1-2: Design a solution to a complex real-world problem, based on scientific knowledge, student- generated sources of evidence, prioritized criteria, and trade off considerations. By breaking it down into smaller, more manageable problems that can be solved through engineering.

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions

Content: What information do students need to know?

- Develop and carry out scientific investigations.
- Obtain, evaluate and communicate information to develop technological literacy and an understanding of the role of information technologies in modern scientific endeavors.
- Develop and use models to explain complex processes and relationships between and within organisms.
- Analyze and interpret data and communicate information using a variety of modalities.
- Use mathematics and computational thinking to support scientific conclusions.
- Engage in argument from evidence to explain natural phenomena.
- Investigations of what makes something living or nonliving;
- Systems of specialized cells within organisms help perform essential functions of life;
- Plan and carry out controlled investigations using the scientific process, collect

Process: What will students be able to do with the information?

- Design and carry out a controlled experiment to understand the process of science.
- Use laboratory equipment to obtain qualitative and quantitative data.
- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and

and analyze data, both qualitative and quantitative. • Research online and find credible resources to defend a claim.	computational thinking • Constructing explanations (for science) and designing solutions(for engineering) • Engaging in argument from evidence • Obtaining, evaluating, and communicating information. • Research online and find credible resources to defend a claim. • Present information to a group of individuals while supporting a claim with evidence.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking task Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

- question
- demonstrate
- describe
- explain
- predict

- infer
- conclude
- evidence
- graphical analysis
- statistical analysis
- cause and effect
- structure
- function
- proportion
- evaluate
- identify
- construct
- example
- apply
- data
- support
- investigate
- pattern
- model

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Sample Performance Tasks:

Disruption of Homeostasis- Students will research and conduct experiments to study the effect of changes in the environment or cell structures on the response of an organism. Examples may include heart rate response to exercise, stomate response to moisture and temperature, root development in response to water levels, or research metabolic disorders.

Students will conduct an independent research project that shows the correlation of the loss of homeostasis controls that lead to a systemic disease (breakdown of homeostatic control) of their choice.

Use evidence collected to make an argument "Slime Molds - Are they alive?"
Inquiry activity: Students develop an argument from Is It Alive Inquiry Activity yeast or seeds are alive. Students will practice checklist for characteristics that make something designing controlled investigations as well as alive. Use checklist to evaluate several samples, collecting and analyzing data in order to construct explanations.

Summative Assessments:
Do-Nows

Exit Tickets
Question and answer/reflections
Group/individual discussion
End of chapter Quiz
End of Unit Test
One Project or Lab related to the Unit
Benchmark Exam

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston
Deepl.com (English to Spanish)
Resources on Edulastic
Teacher created hands on activities.
Student resources on Google classroom.
Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook
Smart Board
Online access to internet websites andreadings required.

UNIT OVERVIEW	
CONTENT AREA: **Honors Biology**	**UNIT 1: Chemistry of Life**
TARGET COURSE/GRADE LEVEL: **Grade 9-12**	**SUGGESTION TIMEFRAME: 4 weeks**
TOPIC: Chemistry of Life	**CHAPTERS COVERED: Chapter 1, 2 and 3**

UNIT SUMMARY/ UNIT RATIONALE:

This unit sets the foundation for students to understand the chemical basis of life, which is needed for mastery of future areas of focus and provides students with a survey of the elements necessary for carbon-based systems to function. Students learn that water and the properties of water play a vital role in the survival of individuals and biological systems. They also learn that living systems exist in a highly complex organization that requires input of energy and the exchange of macromolecules. This unit also addresses in detail how and in what conformations molecules called monomers bond together to form polymers. The structure of monomers and polymers determines their function. In the units that follow, students will need to understand and explain the interaction and bonding of atoms to form molecules

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Math:

- Use a mathematical model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms. Identify important quantities in the role of cellular division and differentiation in producing and maintaining complex organisms and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.
- Graph functions expressed symbolically showing the role of cellular division and differentiation in producingand maintaining complex organisms and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
- Write a function that describes a relationship between the role of cellular division and differentiation and the production and maintenance of complex organisms.

Social Studies:

Standard 6.1 U.S. History: America in the World. All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities. Standard 6.2 Standard 6.2 World History: Global Studies: All students will acquire the knowledge and skills to think analytically and systematically about how

past interactions of people, cultures, and the environment affect issues across timeand cultures. Such knowledge and skills enable students to make informed decisions as socially and ethically responsible world citizens in the 21st century.

ESSENTIAL QUESTIONS:

What are organic compounds and how do they help things live?
Why is water so important to life?
How is carbon uniquely suited to form biological macromolecules?
What are the functional groups associated with carbon that give organic compounds their unique properties?
How are macromolecules formed from monomers?
How do living things regulate chemical reactions? What are some factors that affect the function of enzymes?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outer most electron states of atoms, trends in the periodic table, and knowledge of the patternsof chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]

HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems thatprovide specific functions within multicellular organisms.
[Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen and oxygenfrom sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.[Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*]

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions

Content: What information do students need to know?

Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and placesthose with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

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 ofnumerous 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.

Process: What will students be able to do with the information?

- Describe the structure and properties of atoms and molecules.
- Investigate the properties of water and its essential role in living systems.
- Investigate the importance of pH in biological systems.
- Describe the patterns of bonding between atoms and molecules.
- Explain the properties of carbon and its role in biological systems.
- Engage in argument from evidence to explain the origins of life from inorganic compounds.

Systems and Models

- The hierarchical organization of interacting systems provide specific functions within organisms.
- Structure and function: an atom's a molecule or a cell's configuration determines its chemical and physical properties and hence its function.

Patterns

The building blocks of life form more complex structures in recognizable patterns.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking task Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

- atom
- monomer
- polymer
- macromolecule
- carbohydrate
- monosaccharide
- disaccharide
- polysaccharide
- starch

- glycogen
- cellulose
- lipid
- hydrophobic
- fat
- unsaturated fat
- saturated fat
- phospholipid
- steroid
- anabolic steroid
- nucleic acid
- nucleotide
- Ribonucleic Acid (RNA)
- Deoxyribonucleic Acid (DNA)
- protein
- amino acid
- peptide bond
- polypeptide
- molecule
- organic molecule
- electron
- proton
- neutron
- covalent bonds
- hydrogen bonds
- double bond
- organic compound
- hydrophilic
- hydrophobic
- chemical reaction
- reactant
- product
- activation energy
- active site
- catalyst

- enzyme
- substrate
- induced fit
- competitive inhibitor
- noncompetitive inhibitor
- adhesion
- cohesion
- pH
- electronegativity
- nonpolar
- polar covalent bond
- hydrogen bond
- surface tension
- heat
- solute
- solvent
- hypertonic
- hypotonic
- isotonic

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Summative Assessment:

Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
Properties of water activity/lab
Macromolecule activity/lab
Enzyme Lab
End of chapter Quiz
End of Unit Test
One Project related to the Unit
Benchmark Exam

Sample Performance Tasks:

Obtain, evaluate, and communicate information about the cause and effect relationship between diet and nutrition as they relate to the hierarchical structural organization and function of the digestive system. (**HS-LS1-3, HS-LS1-6)**

Plan and carry out an investigation to identify the properties of the four major organic compounds: proteins (with emphasis on enzymes), lipids, carbohydrates and nucleic acids. **(HS-LS1-6)**

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston

Deepl.com (English to Spanish)

Resources on Edulastic

Teacher created hands on activities.

Student resources on Google classroom.

Teacher created hands on activities.

Student resources on Google classroom.

Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook

Smart Board

Online access to internet websites and readings required.

UNIT OVERVIEW	
CONTENT AREA: **Honors Biology**	**UNIT 2 : Cells and Origin of Life**
TARGET COURSE/GRADE LEVEL: **Grade 9-12**	**SUGGESTION TIMEFRAME: 4 weeks**
TOPIC: Cells and Origin of Life	**CHAPTERS COVERED: Chapter 4 and 5**

UNIT SUMMARY/ UNIT RATIONALE:

The cell is the basic unit of life. Cells contribute to the organization of life and provide the environment in which organelles function. Organelles in turn provide compartmentalization and organize cellular products for dispersal and waste for disposal. Cells have membranes that allow them to establish and maintain an internal environment. These membranes also control the exchange of material with the cell's external environment—an important, foundational concept. The maintenance of the internal and external conditions of a cell is called homeostasis. Student understanding of these concepts will be necessary in later units when the focus of instruction shifts to cellular products and by-products and when students learn why cellular exchange of energy and materials matters.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

ELA:

RST.9-10.1 Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending toprecise details for explanations or descriptions.

WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence. A. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. B. Develop claim(s) and counterclaims using sound reasoning, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form and in a manner that anticipates the audience's knowledge level and concerns. C. Use transitions (e.g. words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and betweenclaim(s) and counterclaims. D. Establish and maintain a style and tone appropriate to the audience and purpose (e.g. formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing. E.Provide a concluding. (HS-LS1-1).

WHST.9-10.7 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)

MATH:

MP.2	Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)
MP.4	Model with mathematics. *(HS-LS1-4)*
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.*(HS-LS1-4)*

ESSENTIAL QUESTIONS:

What are the characteristics shared by all living things?
How are cells organized to perform the work that they do?
How do cells differentiate into different types?
How do different types of cells work together to maintain homeostasis in a multicellular organism?
How do cells produce/obtain energy to sustain life?
What experiments have led to our modern understanding of cells?
What is the difference between prokaryotic and eukaryotic cells?
How does the structure of the plasma membrane allow it to function as a regulatory and/or a protective barrier for the cells?
What mechanisms transport materials across the plasma membrane?
What is the role of ATP in cellular activities?

LEARNING TARGETS

NEW JERSEY STUDENT 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 specializedcells. [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]

HS-LS1-4: Use a model to illustrate the role of cellular division [mitosis] and differentiation in producingand maintaining complex organisms. [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]

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 for form amino acids and/or other largecarbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models

and simulations to support explanations.] [*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
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9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions

Content: What information do students need to know?

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 ofnumerous 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.

Growth and Development of Organisms

Process: What will students be able to do with the information?

- Explain how organic compounds formed on earth and eventually congregated to form the primitive cell
- Describe the structure and function of prokaryotic cells and their importance in the ecosystem.
- Explain how bacteria and viruses cause diseases and how they can be prevented.
- Describe the structure and function of viruses and their importance in life
- Describe the structure and function of specialized structures within cells.

• 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.	• Compare and contrast the structure and functions of different types of cells. • Use a compound microscope to observe the similarities and differences between the different kinds of cells. • Calculate Surface area to Volume ratio for sample 3-D objects to explain the significance as it relates to cell function. Prepare and selectively stain cells on a slide. • Describe the structure of the cell membrane and the mechanisms whereby substances enter and leave cells.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking tasks Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

- asexual reproduction
- cell
- Cell Theory
- cell (plasma) membrane

- cell wall
- cytoskeleton
- cytoplasm
- chloroplast
- endoplasmic reticulum
- eukaryote
- Golgi apparatus
- homeostasis
- lysosomes
- mitochondrion
- nucleus
- nucleolus
- nuclear envelope
- organelle
- organism
- organ system
- plastid
- prokaryote
- population
- ribosome
- sexual reproduction
- tissue
- unicellular/multicellular
- vacuole
- active transport
- carrier (transport) protein
- concentration gradient
- concentration
- diffusion
- endocytosis
- exocytosis
- facilitated diffusion
- impermeable
- lipid bi-layer
- passive transport

- phagocytosis
- pinocytosis
- pumps (ion or molecular)
- osmosis
- selective permeability
- endomembrane system
- hypotonic
- hypertonic
- isotonic
- osmotic pressure
- carrier protein
- homeostasis
- osmotic regulation
- glycoprotein
- fluid mosaic model

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Summative Assessment:

Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
Characteristics of Life Project
Cell Theory Timeline
Cell Organelle Case Study/Organelle Project
Stem Cell Discussion
Cell Lab
Cell Membrane Activities
Osmosis/Cell Transport Problems
Passive Transport Lab
End of chapter Quiz
End of Unit Test
One Project related to the Unit
Benchmark Exam

Sample Performance Tasks:

- Obtain, evaluate, and communicate information about the cause and effect relationship between diet and nutrition as they relate to the hierarchical structural organization and function of the digestive system. (**HS-LS1-3, HS-LS1-6)**
- Develop and use a model of the cell membrane to explain how its structure relates to its function in determining mechanisms of cell transport allowing the cell to remain alive as external conditions change.(**HS-LS1-2, HS-LS1-3)**
- Plan and conduct an investigation of the mechanism and control of the cell cycle in order to explain how itrelates to stability and change of a complex organism. (**HS-LS1-4)**
- Construct an explanation based on evidence on how the structure and function of a protein is dependenton the genetic information in the DNA sequence. **(HS-LS1-1)**

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston

Deepl.com (English to Spanish)

Resources on Edulastic

Teacher created hands on activities.

Student resources on Google classroom.

Teacher created hands on activities.

Student resources on Google classroom.

Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook

Smart Board

Online access to internet websites andreadings required.

UNIT OVERVIEW	
CONTENT AREA: Honors Biology	**Unit 3: Matter and Energy in Organisms and Ecosystems**
TARGET COURSE/GRADE LEVEL: **Biology 9-12**	**SUGGESTION TIMEFRAME: 4-5 Weeks**
TOPIC: Matter and Energy	**CHAPTERS COVERED: Chapter 6, 7, 18 and 21**

UNIT SUMMARY/ UNIT RATIONALE:

In Unit 3, students build on knowledge gained in Unit 2 about the structure and function of cells, focusing on cellular energetics. Living systems are complex in their organization and require constant energy input. This unit will provide students with the knowledge necessary to master the concepts of energy capture and use. Students work through enzyme structure and function, learning the ways in which the environment plays a role in how enzymes perform their function(s). Students gain a deeper understanding of the processes of photosynthesis and cellular respiration, knowledge they will use in Unit 6 while studying how cells use energy to fuel life processes.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Math

• HSN-Q.A. l 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. (HSLS2-l), (HS-LS2-2), (HS-LS2-4)

• HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-l), (HS-LS2-2), (HS-LS2-4) • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

ELA

• 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-LSl-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. (HS-LSl-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. (HS-LS 1- 7)
• 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-LS2-3)
• 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. (HS-LS2-3)

Computer Science and Design Thinking

• 8.2.12.ETW.3 Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution**.**

ESSENTIAL QUESTIONS:

- How do living and nonliving parts of the Earth interact and affect the survival of organisms?
- How do photosynthetic organisms capture energy from the sun?
- How do organisms obtain, store and use the energy they need to survive?
- What is the difference in the ways matter and energy move through an ecosystem?
- How have increased greenhouse gas emissions affected our climate?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing

organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

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. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions oridentification of macromolecules.]

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. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process ofcellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]

HS-LS2-3: Construct and revise an explanation based on evidence for the cycling of matter and flowof energy in aerobic and anaerobic conditions. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]

HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow ofenergy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning todescribe the cycling of matter and flow of energy.]

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. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to themacroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment

Boundary: Assessment does not include complex chemical reactions.]

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issuesuch as climate change
9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effectsand determine why some solutions (e.g., political. economic, cultural) may work better than others

Content: What information do students need to know?

<u>Organization for Matter and Energy Flow in Organisms</u>

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxideplus 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 organizational levels of living systems,

Process: What will students be able to do with the information?

Ecology (Food Webs/Food Chains, Energy Pyramids and Matter Cycles)

- Explain how biotic and abiotic factors influence an ecosystem.
- Model the methods used to study ecology.
- Describe how consumers obtain energy and nutrients.

chemical elements arerecombined 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 transferto the surrounding environment.

<u>Cycles of Matter and Energy Transfer in Ecosystems</u>

- 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 organismsat 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.

<u>Energy in Chemical Processes</u>

- The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.

- Trace the flow of energy through living systems.
- Calculate the transfer of energy between trophic levels in an ecosystem.
- Describe how climate change affects population changes and extinctions.
- Evaluate the interdependence of food webs. Describe how changes to one population can affect otherspecies in the food web.
- Predict the impact of a decline in a keystone species.
- Identify the three types of ecological pyramids.
- Describe how matter cycles among living and nonliving parts of an ecosystem.
- Describe how water cycles through the biosphere.
- Differentiate between the way matter and energy move through an ecosystem.

Photosynthesis

- Describe the role of ATP in cellular activity.
- Explain where plants get the energy they need to produce food.
- State the overall equation for photosynthesis.
- Describe what happens during the light-dependent and light-independent reactions of photosynthesis.
- Relate the structure of the chloroplast to its roles in photosynthesis.
- Identify factors that affect the rate at which photosynthesis occurs.
- Explain how climate change affects water availability.
- Evaluate changing levels of carbon

	dioxide in the atmosphere. ● Describe the inputs and outputs of carbon in the carbon cycle. **Cellular Respiration** ● Define cellular respiration. ● Relate the structure of the mitochondrion to its roles in cell respiration. ● Diagram the interdependent cyclical relationship between photosynthesis and cell respiration. ● Model the general steps of cellular respiration. ● Identify how much ATP cellular respiration generates. ● Explain how organisms get energy in the absence of oxygen. ● Describe the inputs and outputs of carbon in the carbon cycle.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking tasks Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

Photosynthesis
Chemosynthesis
Cellular respiration
Aerobic
Anaerobic
Anabolic
Catabolic
Reactant
Product
ATP
Hydrolysis
Fermentation
Light-dependent reaction
Light-independent reaction
Exothermic reaction
Endothermic reaction
Carbon cycle
Glucose
Kinetic energy
Potential energy
Chemical equation

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Sample Performance Tasks:

Photosynthesis:

Virtual Photosynthesis Lab : http://www.reading.ac.uk/virtualexperiments/ves/preloader- photosynthesis-full.html
Students measure the rate of photosynthesis happening in elodea in thisinteractive lab that allows students to manipulate variables and measure/collect/analyze data.

HHMI Photosynthesis Animation and Student Worksheets

Photosynthesis Case Study: "Sweet Beats: Making Sugars Out of Thin Air"

Photosynthesis Case Study" "Killing Chloroplasts"

Cellular Respiration:

Cellular Respiration Lab

Case Study: "Mystery of the Seven Deaths" http://sciencecases.lib.buffalo.edu/cs/files/cellular_respiration.pdf

In this interrupted case study, students learn about the function of cellular respiration and the electron transport chain and what happens when that function is impaired. The case is loosely based on the real-life 1982 ChicagoTylenol murders where seven people died when Tylenol capsules were laced with cyanide. Students play the role of medical examiner as they analyze the autopsy results to determine the cause of the mysterious deaths of these seven victims.

Students will develop a model to show the relationships among nitrogen and the ecosystem including parts that are not observable but predict observable phenomena. They will then construct an explanation of the effects of the environmental and human factors on this cycle.

Summative Assessment:

Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
End of chapter Quiz

End of Unit Test

One Project related to the Unit

Benchmark Exam

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston

Deepl.com (English to Spanish)

Resources on Edulastic

Teacher created hands on activities.

Student resources on Google classroom.

Teacher created hands on activities.

Student resources on Google classroom.

Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook

Smart Board

Online access to internet websites andreadings required.

UNIT OVERVIEW	
CONTENT AREA: Honors Biology	**UNIT 4: Interdependent Relationships in Ecosystems**
TARGET COURSE/GRADE LEVEL: **Grade 9-12**	**SUGGESTION TIMEFRAME: 4 weeks**
TOPIC: Interdependent Relationships in Ecosystems	**CHAPTERS COVERED: Chapter 19,20,21 and 22**

UNIT SUMMARY/ UNIT RATIONALE:

This is a unit in which students will be introduced to the interaction and interdependence between organisms and the environment. In exploring ecosystems they will learn about Earth's basic biomes, the abiotic and biotic factors that make up different ecosystems, and how these factors interact with living organisms in the classroom. This unit will introduce biodiversity and population dynamics within ecosystems and how they are important in structuring an ecosystem through food webs and trophic interactions. Students will investigate the biodiversity of invertebrates and microorganisms from a nearby offshore ocean ecosystem. Finally, students will build ecosystems in jars that they must balance to keep alive. Students are able to investigate explanations for the structure and function of inorganic organic compounds, the hierarchical systems of organisms. Students demonstrate their understanding through critical reading, using models, and conducting investigations.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

ELA:

RL.9-10.1 Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain. (HS-LS1-6),(HS-LS2-3)

W.9-10.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. A. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. C. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. D. Use precise language and domain-specific vocabulary to manage the complexity of the topic. E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g. formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are

	writing. F. Provide a concluding paragraph or section that supports the argument presented (e.g., articulating implications or the significance of the topic). (HS-LS1-6),(HS-LS2- 3)
W.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach, or consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 9–10). (HS- LS1-6),(HS-LS2-3)
W.9-10.9	Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research. A. Apply grades 9–10 Reading standards to literature (e.g., "Analyze how an author draws on and transforms source material in a specific work [e.g., how Shakespeare treats a theme or topic from mythology or the Bible or how a later author draws on a play by Shakespeare]"). B. Apply grades 9–10 Reading standards to nonfiction informational (e.g., "Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning").(HS-LS1-5),(HS-LS1-7)

MATH:

MP.2	Reason abstractly and quantitatively. (HS-LS2-4)
MP.4	Model with mathematics. (HS-LS2-4)
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. (HS-LS2-4)
HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-4)
HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HSLS2-4)

Standard 6.1U.S. History :

America in the World. All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions thatreflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

Standard 6.2 World History:

Global Studies: All students will acquire the knowledge and skills to think analytically and systematically about how past interactions of people, cultures, and the environment affect issues across time and cultures. Such knowledge and skills enable students to make informed decisions as socially and ethically responsible world citizens in the 21st century.

ESSENTIAL QUESTIONS:

Why is it important to preserve all components of an ecosystem?

How do matter and energy link organisms to each other and their environments? Why is sunlight essential to life on Earth?

How can change in one part of an ecosystem affect change in other parts of the ecosystem?

How do humans have an impact on the diversity and stability of ecosystems?

How is carrying capacity modified by a change in limiting factors?
How do the cycles of matter effect environmental conditions?

EARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
[Clarification Statement: 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.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]

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.
[Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.][*Assessment Boundary: Assessment is limited to provided data.*]

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.
[Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change). [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
[Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes

to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issuesuch as climate change
9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effectsand determine why some solutions (e.g., political. economic, cultural) may work better than others.

Content: What information do students need to know?

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 andresources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

Process: What will students be able to do with the information?

- Differentiate between an organism's niche and habitat.
- Explain the different types of intraspecific and interspecific relationships among organisms within anecosystem.
- Demonstrate the flow of energy through an ecosystem.

Ecosystem Dynamics, Functioning, and Resilience

- 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 physicaldisturbance 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.
- 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.

Social Interactions and Group Behavior

- Group behavior has evolved because membership can increase the chances of survival for individualsand their genetic relatives.

Adaptation

- 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.

Biodiversity and Humans

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss ofspecies (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 essentialto supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

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

- Explain how the cycles of matter effect environmental conditions.
- Differentiate among the effects of density-dependent and density-independent limiting factors on a population.
- Interpret and predict population growth curves of carrying capacity and exponential growth.
- Given characteristics of an interspecific relationship, determine the type of symbiosis and competition.
- Predict consequences of removing a species from a food web.
- Explain the cyclic nature of matter versus linear flow of energy through an ecosystem.
- Create a flow chart to explain how a new community grow after an abrupt change through ecological succession.
- Graph different growth curves for populations.
- Analyze organism characteristics to understand how they interact with an ecosystem.
- Evaluate a natural disaster to determine the upcoming steps in ecological succession

engineering design process. Computers are useful for a 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.	

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activitie Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking tasks Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

Biotic factor and Abiotic factor
Habitat and Niche
Level of organization in ecology
Food chain and Food web
Generalist and specialist
Keystone species
Invasive species
Umbrella species

Indicator species
Trophic level
Energy, number and biomass pyramid
Biological Magnification
Producer
Consumer (primary, secondary, tertiary)
Autotroph, heterotroph
Carnivore, herbivore, detritivore, decomposer
Primary and secondary succession
Pioneer species
Climax community
Carbon cycle, water cycle, nitrogen cycle
Symbiosis (parasitism, mutualism, commensalism)
Population dynamics (Size, density, dispersion)
Limiting factors (density dependent and density independent)
Population growth curves and carrying capacity
Global warming and greenhouse effect
pH and acid rain
Habitat fragmentation
Renewable and nonrenewable resources

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Sample Performance Tasks:

Surviving Winter in the Dust Bowl (Food Chains and Trophic Levels): This is one of 30 lessons from the NSTA Press Book Scientific Argumentation in Biology. The lesson engages students in an argumentation cycle based on an engaging scenario in which their group is a farm family trying to survive a dust bowl winter with limited food and water resources. The family has abull, a cow, and limited amounts of water and wheat. Students are presented with four options that include various combinations of eating orkeeping the animals alive and eating the wheat. Within this scenario, the lesson provides data on nutritional requirements of cows and humans, along with nutritional contents of wheat, milk, and beef. Students then use this data to construct an argument for the best strategy to allow their family to survive. As they construct this argument, students build and apply knowledge of food chains, trophic levels, interdependence among organisms, and energy transfers within ecosystems. This lesson is intendedfor middle or high school students. Teachers are encouraged to refer to the preface, introduction, student assessment samples, and appendix provided in the full book for important background on the practice of argumentation and resources for classroom implementation.

The Bean Game: Exploring Human Interactions with Natural Resources: This activity explores the various influences of human consumption of natural resources over time. (use this asa primer for making a computational model).

National Climate Assessment: Students explore the simulations found at this website in order to create a computational simulation to illustrate the relationships among management ofnatural resources, the sustainability of human populations, and biodiversity.

Read and react- pick one invasive species to research andpresent findings to class
http://www.washingtonpost.com/news/energy- environment/wp/2015/02/23/like-most-invasive-species- pythons-are-in-the-u-s-to-stay/

Rainforest carbon cycling and biodiversity: Students apply this model to simulate how atmospheric CO2 concentrationsinfluence global climate.

Reefs at Risk: and NOAA Coral Reefs at Risk: Students access andexplore a series of interactive maps displaying coral reef data from around the globe and develop hypotheses related to the impacts of climate change (i.e. increased levels of carbon dioxide in our atmosphere) on coral reef health.

Building Biodiversity and the PREDICTS project and GLOBIO project: Students explore this website to develop an understanding of how computational models of the impacts onbiodiversity are created. Next, they explore Conservation Mapsfor a global perspective of land use and conservation efforts

Summative Assessment:
Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
End of chapter Quiz
End of Unit Test
One Project or Lab related to the Unit
Benchmark Exam

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston
Deepl.com (English to Spanish)
Resources on Edulastic
Teacher created hands on activities.
Student resources on Google classroom.
Teacher created hands on activities.
Student resources on Google classroom.
Biology lab manual

TECHNOLOGY RESOURCES:
Individual student Chromebook
Smart Board
Online access to internet websites and readings required.

UNIT OVERVIEW	
CONTENT AREA: Honors Biology	**UNIT 5: Inheritance and Variation of Traits**
TARGET COURSE/GRADE LEVEL: Biology 9-12	**SUGGESTION TIMEFRAME: 10 to 15 Weeks**
TOPIC: : Inheritance and Variation of Traits	**CHAPTERS COVERED: Chapter 8,9,10,11,12 and 13**

UNIT SUMMARY/ UNIT RATIONALE:

Students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of cellular division, which passes traits from one generation to the next. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop conceptual models of the role of DNA in the unity of life on Earth and use statistical models to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of structure and function, patterns, and cause and effect are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

ELA:

RST.9-10.1.	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. (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.9-10.2.	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. A. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. C. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to manage the complexity of the topic

	and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g. formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing. F. Provide a concluding paragraph or section that supports the argument presented. HS-LS4-1),(HS-LS4- 2),(HS-LS4-3),(HS-LS4-4)
WHST .9-10.9	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 information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. (HS-LS4-1),(HS-LS4-2)

MATH:

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)

ESSENTIAL QUESTIONS:

- How are the characteristics from one generation related to the previous generation?
- How are the characteristics of life passed down from one generation to the next?
- How can scientists predict and/or observe patterns in heredity?
- How does the information in DNA end up giving us our traits?
- What did Mendel discover about the passing on of traits?
- How are the different forms of a gene distributed to offspring?
- How are Punnett Squares used to predict the outcome of a cross?
- How do we predict the outcome of traits inherited by co-dominance, incomplete dominance, multiple alleles, and polygenic traits? How is gender determined? How are the traits that are linked to our gender inherited?
- How does the environment play a role in how genes determine traits?
- How can a pedigree be used to predict traits?
- How has genetic engineering impacted the fields of medicine, forensics, and agriculture?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding theinstructions for characteristic traits passed from parents to offspring.

[*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]

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.
[Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressedtraits in a population.
[Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*]

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.Cl.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately

Content: What information do students need to know?

Structure and Function

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA thatcontain the instructions that code for the formation of proteins.

Inheritance of Traits

- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is aparticular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments

Process: What will students be able to do with the information?

<u>Meiosis</u>

- Model the process of meiosis, by which cells halve their genetic material in order to maintain chromosomenumbers in sexual reproduction.
- Contrast meiosis and mitosis.
- Contrast the number of chromosomes in body cells and in gametes.
- Explain how variation is introduced in

of DNA are involved in regulatory or structural functions, and some have no as-yet known function. **Variation of Traits** 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 mutation, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, andviable mutations are inherited. • Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both geneticand environmental factors. **Natural Hazards** ● Natural hazards and other geologic events have shaped the course of human history; [they] havesignificantly altered the sizes of human populations and have driven human migrations. **Human Impacts on Earth Systems** ● The sustainability of human societies and the biodiversity that supports them requires responsiblemanagement of natural resources.	meiosis through the process of crossing over and independentassortment of chromosomes. ● Demonstrate how chromosomal abnormalities result from nondisjunction and rearrangement of chromosomes during meiosis. <u>Genetics</u> ● Describe Mendel's studies and conclusions about inheritance. ● Illustrate patterns of inheritance using Punnett Squares. ● Differentiate between Mendelian and Non-Mendelian patterns of inheritance. ● Explain the relationship between genes and the environment. <u>Mutations</u> ● Define mutations and describe the different types of mutations. ● Describe the effects mutations can have on genes. ● Predict the pattern of inheritance of human genetic disorders. ● Explain the importance of maintaining genetic diversity for the health of a population. ● Describe how changes to the climate/environment can be a threat to genetic diversity. ● Evaluate the potential of genetic technologies (such as genetically modified organisms) to combat the effects of climate change.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking tasks Self-directed activities Independent research/inquiry

INSTRUCTION

CONTENT VOCABULARY:

- genotype
- phenotype
- inheritance
- dominant inheritance
- recessive inheritance
- homozygous
- heterozygous
- hybrid
- gene
- allele
- independent assortment
- segregation
- Punnett square
- purebred
- genetics

- trait
- self-fertilization
- cross-fertilization
- true-breeding
- P generation
- F1 generation
- F2 generation
- Monohybrid
- Dominant allele
- Recessive allele
- Test cross
- Rule of multiplication
- Rule of addition
- Chi square
- Degrees of freedom
- co dominance
- incomplete dominance
- complete dominance
- polygenic
- multiple alleles
- sex-linked
- probability
- ABO Blood group
- genetic engineering
- hybridization
- inbreeding
- polyploidy
- gel electrophoresis
- Polymerase Chain Reaction (PCR)
- DNA profiling
- plasmid
- gene therapy
- genetically modified food
- selective breeding
- gene splicing

- genetic marker
- forensics
- transgenic
- biotechnology
- recombinant organism
- human genome project
- cloning
- genetically modified organism (GMO)

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Sample Performance Tasks:

- Use interactive DNA timeline to read history of DNA structure
  http://www.dnai.org/timeline/

- Investigate probabilities using Monty's probability game http://www.theproblemsite.com/games/monty_hall_game.asp#gameTop

- Bacterial ID lab http://media.hhmi.org/biointeractive/vlabs/bacterial_id/index.html

- Interactive Gel electrophoresis and PCR

- Bacterial ID lab http://media.hhmi.org/biointeractive/vlabs/bacterial_id/index.html

- Research GM food pros and cons and write at least 3 of each

  http://www.csa.com/discoveryguides/gmfood/overview.php
  http://www.discovery.com/tv-shows/curiosity/topics/10-genetically- modified-food-products.htm
  http://www.who.int/topics/food_genetically_modified/en/

Summative Assessment:

Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
End of chapter Quiz

End of Unit Test

One Project related to the Unit

Benchmark 3 Exam

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Text Book: Modern Biology by Holt, Rinehart & Winston

Deepl.com (English to Spanish)

Resources on Edulastic

Teacher created hands on activities.

Student resources on Google classroom.

Teacher created hands on activities.

Student resources on Google classroom.

Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook

Smart Board

Online access to internet websites and readings required.

UNIT OVERVIEW	
CONTENT AREA: **Honors Biology**	**UNIT 6: Natural Selection and Evolution**
TARGET COURSE/GRADE LEVEL: **Biology 9-12**	**SUGGESTION TIMEFRAME: 5 Weeks**
TOPIC: Natural Selection and Evolution	**CHAPTERS COVERED: Chapter 14, 15, 17 and 17**

UNIT SUMMARY/ UNIT RATIONALE:

Natural Selection and Evolution helps students formulate an answer to the question, "What evidence shows that different species are related? The LS4 Disciplinary Core Idea involves four sub-ideas: Evidence of Common Ancestry and Diversity, Natural Selection, Adaptation, and Biodiversity. Students can construct explanations for the processes of natural selection and evolution and communicate how multiple lines of evidence support these explanations. Students can evaluate evidence of the conditions that may result in new species and understand therole of genetic variation in natural selection. Additionally, students can apply concepts of probability to explain trends in populations as those trends relate to advantageous heritable traits in a specific environment. The crosscutting concepts of cause and effect and systems and system models play an important role in students' understanding of the evolution of life on Earth.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

ELA:

WHST.9-12.7 (HS-LS4-5): 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 onthe subject, demonstrating understanding of the subject under investigation.

SL.11-12.5 (HS- LS1-2): 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.

RST.11-12.8 (HS-LS4-5): 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.9-12.9 (HS-LS4-5): Draw evidence from informational texts to support analysis, reflection, and research.

RST.9-10.8. (HS-LS2-8): 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 (HS-LS2-8): 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 (HS-LS2-8): 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.

Math:

MP.2 (HS-LS4-5): Reason abstractly and quantitatively.

MP.4 Model with mathematics. (HS-LS4-2).

Standard 6.1 U.S. History :

America in the World. All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

Standard 6.2 World History:

Global Studies: All students will acquire the knowledge and skills to think analytically and systematically about how past interactions of people, cultures, and the environment affect issues across time and cultures. Such knowledge and skills enable students to make informed decisions as socially and ethically responsible world citizens in the 21st century.

ESSENTIAL QUESTIONS:

- What is the importance of genetic variation?
- What ties all current life on Earth to single-celled organisms that evolved billions of years ago?
- How do we know evolution occurs?
- What is the mechanism by which evolution occur?
- What does the term "fitness" mean?
- Why do some organisms go extinct and others survive?
- What evidence supports the theory of evolution?
- Are humans evolving?

NEW JERSEY STUDENT LEARNING STANDARDS:

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

[Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

HS-LS4-2: 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.
[Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has 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. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.]
HS-LS4-3: Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tends to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]
HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
[Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation 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.
[Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving

9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately

Content: What information do students need to know?

Evidence of Common Ancestry and Diversity

- Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary amongspecies, 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.

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 commonin the population.

Adaptation

- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increasein 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

Process: What will students be able to do with the information?

- Engage in argument from evidence to explain how evolution occurs through natural selection.
- Compare and contrast the structure and function of mitochondria and chloroplast with bacteria to explainthe endosymbiotic theory.
- Analyze and interpret data to explain how lines of evidence support evolutionary theory.
- Engage in argument from evidence to compare and contrast Darwin and Lamarck's Theory of evolution andexplain why Darwin's theories are still accepted today.
- Construct explanations to identify selective pressures and adaptations given an example (e.g. pepperedmoth or Galapagos finches).
- Develop and use models, such as phylogenetic trees, to analyze the evolution of organisms based on anatomical traits/DNA/amino acid sequences.

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 conditionschange. • 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 thespecies' evolution is lost. **Natural Hazards** ● Natural hazards and other geologic events have shaped the course of human history; [they] havesignificantly altered the sizes of human populations and have driven human migrations. **Global Climate Change** ● Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.	● Construct an explanation to show that while natural selection explains evolutionary modifications within lineages, speciation explains evolutionary branching and diversification.
Modifications:	

Special Education	**ESL**	**At-risk**	**Gifted and Talented**
Word walls Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Visual aides Answer masking Answer eliminator Highlighter Color contrast Extended time	Scaffolding Word walls Read aloud Bilingual dictionaries Bilingual translation Sentence frames Key vocabulary Annotation guides Think-pair-share Visual aides	Teacher tutoring Peer tutoring Study guides Graphic organizers Modified assignments Extended time	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Collaborative team work Higher level questioning Critical/Analytical thinking tasks Self-directed activities Independent research/inquiry

CONTENT VOCABULARY:

- adaptation
- speciation
- species
- competition
- mutation
- gene recombination
- evolution
- theory
- fossil
- natural selection
- artificial selection
- vestigial structures
- homologous structures
- analogous structures
- comparative embryology
- molecular homology
- paleontologist
- biogeography
- natural variation
- artificial selection
- struggle for existence
- fitness
- adaptation
- survival of the fittest
- natural selection
- descent with modification
- common descent
- homologous structure
- vestigial structure
- analogous structure
- embryology
- gene pool
- founder effect
- single-gene trait

- polygenic trait
- directional selection
- Hardy-Weinberg Principle
- stabilizing selection
- disruptive selection
- genetic drift
- relative (allele) frequency
- genetic equilibrium
- isolating mechanisms
- migration (genetics)
- paleontologist
- fossil record
- endosymbiotic theory
- mass extinction
- macroevolution
- adaptive radiation
- convergent evolution
- co-evolution
- punctuated equilibrium
- gradualism
- taxonomy
- biological species concept
- prezygotic barriers
- postzygotic barriers
- reproductive isolation
- temporal isolation
- habitat isolation
- behavioral isolation
- hybrid sterility

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Sample Performance Tasks:

Evolution and Selection POGIL: This is a student driven programwhere students work in small groups to work through evidenceshown in the POGIL activity.

Earth: Planet of Altered States: Watch a segment of a NASAvideo and discuss how the earth is constantly changing.

Deep History of Life on Earth: Interactive timeline via HHMI mayassist with above.

Pocket Mouse evolution:

Use videos and explanation sheet from below http://www.hhmi.org/biointeractive/pocket-mouse-evolution

http://serendip.brynmawr.edu/sci_edu/waldron/pdf/NaturalSelecti onProtocol.pdf\

Peppered Moth Simulation: Simulate changes in moth populationdue to pollution and predation, and observe how species can change over time(or other Natural Selection Simulations)

Adaptations of Darwin's Finches Lab: Students "prey" on various foods and then use the data they generate to examine how environmental pressures affect the phenotype (and gene pool) of agiven population.

Creating a Cladogram: students examine fictional organisms "in order to identify shared characteristics" and "to make inferencesabout the evolutionary history of the group."

Summative assessment:

Do-Nows
Exit Tickets
Question and answer/reflections
Group/individual discussion
End of chapter Quiz
End of Unit Test
One Project related to the Unit
Benchmark 4 Exam

Alternative assessments:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual

aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

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Resources on Edulastic

Teacher created hands on activities.

Student resources on Google classroom.

Teacher created hands on activities.

Student resources on Google classroom.

Biology lab manual

TECHNOLOGY RESOURCES:

Individual student Chromebook

Smart Board

Online access to internet websites and readings required

Prepared by: Nabaneeta Mukherjee

Approved by the AUL Board of Trustees on: _____