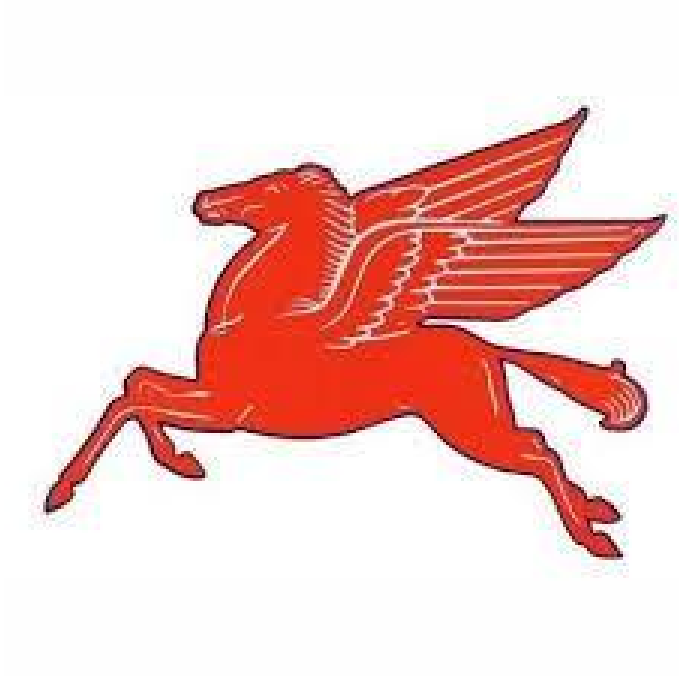
Curriculum Management System

PAULSBORO PUBLIC SCHOOLS



BIOLOGY II

UPDATED 2022

For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy.

Board Approved: 2022

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Paulsboro Public Schools

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Paulsboro Public Schools

Mission Statement

The mission of the Paulsboro School District is to work with students, parents, educators, and community to develop excellence in education while preparing each student to be viable and productive citizens in society. Our goal is to develop the unique potential of the whole student by creating a challenging and diverse learning climate that prepares students for the 21st Century and is rich in tradition and pride.

PACING CHART 2022 - 2023

TOPIC	# OF DAYS	DATES	COMMENTS
Chemistry of life	20 days	*9/7/2022 – 10/4/2022*	This unit will cover the concepts of water's characteristics and importance to living things, main types of organic molecules in organisms, free energy changes and the actions and limitations to enzymes
Cell Structure and Function	14 days	*10/5/2022 – 10/25/2022*	This unit will cover the concepts of the similarities, difference and evolutionary significance of prokaryotic and eukaryotic cells, sub-cellular organization,
Cell communication and the cell cycle	20 days	*10/26/2022 – 11/28/2022*	This unit covers the mechanisms of cell communication, signal transduction, cellular responses and feedback mechanisms, the cell cycle, its regulation and cell division
Cell Energetics/Energy	28 days	*11/29/2022 – 1/17/2023*	This unit will cover the concepts of fermentation, cellular respiration, photosynthesis and coupled reaction
Heredity	21 days	*1/18/2023 – 2/15/2023*	This unit covers the process and function of meiosis, the concepts genetic diversity, Mendel's laws and probability, Non-mendelian Inheritance, and factors affecting inheritance and gene expression
DNA and Inheritance	21 days	*2/16/2023 – 3/17/2023*	This unit covers the roles and functions of DNA and RNA, the mechanisms of gene expression, how genotype affects phenotype, mutations, genetic diversity, and natural selection, and genetic engineering and biotechnology
Natural selection and Evolution	28 days	*3/20/2023 – 5/1/2023*	This unit covers evidential support for evolution and common ancestry, the mechanisms of natural selection and speciation, environmental and human-caused factors in evolution, charting species ancestry through phylogenetic trees and

			cladograms, extinction, and models of the origin of life on Earth
Ecosystems: Interactions, Energy and Dynamics	28 days	*5/2/2023 – 6/9/2023*	Students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems.

Unit 1
Big Idea: Chemistry of Life

NJSLS - Science:

HS-LS1-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

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

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Related Interdisciplinary Standards:
College Board Essential knowledge 2.A.2: Organisms capture and store free energy for use in biological processes.

Critical Knowledge and Skills

Concept(s): In this unit, Students will be able to describe three subatomic particles and their significance; the types of chemical bonds and how they form; the importance of hydrogen bonding to the properties of water; the unique properties of water and how each contributes to life on Earth; how to interpret a pH scale; how changes in pH can alter biological systems; and the importance of buffers in biological systems. Students will be able to describe the properties of carbon that make it so important; the role of dehydration reactions in the formation of organic compounds and hydrolysis in the digestion of organic compounds; how the sequence and subcomponents of the four groups of organic compounds determine their properties; the cellular functions of carbohydrates, lipids, proteins and nucleic acids; How changes in these organic molecules would affect their function; the four structural levels of proteins and how changes at any level can affect the activity of the protein; how proteins reach their final shape, the denaturing impact that heat and pH can have on protein structure, and how these changes may affect the organism; and how directionality influences structure and function of polymers, such as nucleic acids and proteins.

Students are able to:

Students will be able to describe three subatomic particles and their significance; the types of chemical bonds and how they form

Students will be able to describe the importance of hydrogen bonding to the properties of water; four unique properties of water and how each contributes to life on Earth.

Students will be able to interpret a pH scale; how changes in pH can alter biological systems; and the importance of buffers in biological systems.

Learning Goal(s):

Explain the connection between the sequence and the subcomponents of a biological polymer and its properties.

Refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.

Use models to predict and justify that changes in the subcomponents of a biological polymer affect the functionality of the molecule.

College Board Essential knowledge 4.A.1: The subcomponents of biological molecules and their sequence determine the properties of that molecule.

College Board Essential knowledge 4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes.

College Board Essential knowledge 4.B.1: Interactions between molecules affect their structure and function.

9.1.12.A.1: Apply critical thinking and problem-solving strategies during structured learning experiences.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-12.7: 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

Students will be able to describe the properties of carbon that make it so important, the role of dehydration reactions in the formation of organic compounds, and hydrolysis in the digestion of organic compounds

Students will be able to explain how the sequence and subcomponents of the four groups of organic compounds determine their properties; the cellular functions of carbohydrates, lipids, proteins and nucleic acids; and how changes in these organic molecules would affect their function

Students will be able to investigate the four structural levels of proteins and how changes at any level can affect the activity of the protein; how proteins reach their final shape, the denaturing impact that heat and pH can have on protein structure, and how these changes may affect the organism; and how directionality influences structure and function of polymers, such as nucleic acids and proteins.

Students will be able to illustrate the dehydration and hydrolysis reactions

Students will be able to describe the induced fit model of enzyme function.
Students will be able to determine the substrate and active site for enzyme function.

Investigate the relationship between a model organism and its response to different environmental conditions; analyze data to collected in an experiment in order to identify possible patterns and relationships between environmental factors and a living organism; and work collaboratively with others in the design and analysis of a controlled experiment.

Use representations and models to communicate scientific phenomena and solve scientific problems.

Justify a scientific claim that free energy is required for living systems to maintain organization, to grow or to reproduce, but multiple strategies exist in different living systems.

subject, demonstrating understanding of the subject under investigation.

WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students with Disabilities:

Students will be able to name substrates and enzymes by using simple rules.

Students will be able to list four conditions under which proteins may be denatured.

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.khanacademy.org www.nature.com www.national geographic.com www.visiblebody.com Various question/answer worksheets Informational text worksheets

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

UNIT 2
Big Idea: Cell Structure and Function

NJSLS - Science:

Critical Knowledge and Skills

Concept(s): In this unit, students will be able to describe three differences between prokaryotic and eukaryotic cells; the structure and function of organelles common to

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

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

HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy

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

Related Interdisciplinary Standards:

College Board Essential knowledge 1.B.1: Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.

College Board Essential knowledge 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.

College Board Essential knowledge 1.D.1: There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.

plants and animal cells; how different types of cells show differences in subcellular components; how internal membranes and organelles contribute to cell functions; and how cell size and shape affect the overall rate of nutrient intake. Students will also be able to describe why membranes are selectively permeable; the role of phospholipids, proteins and carbohydrates in membranes; how water will move if a cell is placed in an isotonic, hypertonic or hypotonic solution and be able to predict the effect of different environments on the organism; how electrochemical gradients and proton gradients are formed and function in cells

Students are able to:	**Learning Goal(s):**
Students will be able to: describe the structural and functional adaptations for prokaryotic success.	Describe three differences between prokaryotic and eukaryotic cells
Students will be able to compare and contrast the three domains.	Describe the structure and function of organelles common to plants and animal cells and how different types of cells show differences in subcellular components
Students will be able to explain prokaryotic impacts on humans.	
Students will be able to explain the endosymbiotic theory as it pertains to eukaryotic evolution and energy organelles.	Explain how internal membranes and organelles contribute to cell functions and how cell size and shape affect the overall rate of nutrient intake
Students will be able to explain how the internal membranes and organelles contribute to cell function.	Construct models that explain the movement of molecules across membranes with membrane structure and function.
Students will be able to describe how the cell size and shape affect the overall rate of nutrient intake.	Use calculated surface area-to-volume ratios to predict which cell(s) might eliminate wastes or procure nutrients faster by diffusion.

College Board Essential knowledge 1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.
College Board Essential knowledge 2.A.1: All living systems require constant input of free energy.

College Board Essential knowledge 2.A.2: Organisms capture and store free energy

College Board Essential knowledge 2.B.1: Cell membranes are selectively permeable due to their structure.

College Board Essential knowledge 2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.

College Board Essential knowledge 2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.

College Board Essential knowledge 2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.

College Board Essential knowledge 4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes.

WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question

Students will be able to investigate how cell membranes are selectively permeable due to their structure.
Students will be able to explain how growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.

Students will be able to recognize that eukaryotic cells maintain internal membranes that partition the cell into specialized regions.

Students will be able to make predictions on how organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.

Students will be able to distinguish between peripheral and integral membrane proteins

Students will be able to describe and state the transport processes and provide examples for where they are used by life

Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination.
Evaluate data that show the effect(s) of changes in concentrations of key molecules on negative feedback mechanisms.
Make predictions about how negative feedback mechanisms are used to maintain an internal environment.

Make predictions about how positive feedback mechanisms amplify activities and processes in organisms based on scientific theories and models.

Justify that positive feedback mechanisms amplify responses in organisms.

Make a prediction about the interactions of subcellular organelles.

Construct explanations based on scientific evidence as to how interactions of subcellular structures provide essential functions.

Use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures, which

(including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.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.

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.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

possess specialized functions, provide essential functions.

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.khanacademy.org www.nature.com www.national geographic.com www.visiblebody.com Various question/answer worksheets Informational text worksheets

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Mathematics –
MP.2 Reason abstractly and quantitatively.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students with Disabilities:

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

UNIT 3
Big Idea: Cell Communication and Cell Cycle

NJSLS - Science:	Critical Knowledge and Skills
	Concept(s): Students will be able to describe 3 stages of cell communication; how a receptor protein recognizes signal molecules and starts transduction; how a cell signal is

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

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

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

Related Interdisciplinary Standards:

College Board Essential knowledge 2.B.1: Cell membranes are selectively permeable due to their structure.
College Board Essential knowledge 2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.

College Board Essential knowledge 2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.

College Board Essential knowledge 2.C.2: Organisms respond to changes in their external environments.

amplified by a phosphorylation cascade; an example of a second messenger and its role in a signal transduction pathway; how a cell response in the nucleus turns on genes, whereas in the cytoplasm it activates enzymes; what apoptosis means and why it is important to normal functioning of multicellular organisms. Also, students will be able to describe the structure of the duplicated chromosome; events that occur in the cell cycle; the role of cyclins and cyclin dependent kinases in the regulation of the cell cycle; ways in which the normal cell cycle is disrupted to cause cancer , or halted in certain specialized cells; and the features of mitosis that result in the production of genetically identical daughter cells including replication, alignment of chromosomes and separation of chromosomes.

Students are able to:	**Learning Goal(s):**
Students will be able to use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms	Describe basic chemical processes for cell communication shared across evolutionary lines of descent.
Students will be able to describe the fluidity components of a cell membrane and how it is maintained through environmental changes	Generate scientific questions involving cell communication as it relates to the process of evolution.
Students will be able to describe the six functions of membrane proteins.	Use representation(s) and appropriate models to describe features of a cell signaling pathway.
Students will be able to explain the role of membrane carbohydrates in cell-cell recognition.	Construct explanations of cell communication through cell-to-cell direct contact or through chemical signaling.
Students will be able to manipulate the water potential formula to explain the behavior of cells when placed in different solutions.	Create representation(s) that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling.

College Board Essential knowledge 2.E.2: Timing and coordination of physiological events are regulated by multiple mechanisms.

College Board Essential knowledge 3.D.1: Cell communication processes share common features that reflect a shared evolutionary history.

College Board Essential knowledge 3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.

College Board Essential knowledge 3.D.3: Signal transduction pathways link signal reception with cellular response.

College Board Essential knowledge 3.D.4: Changes in signal transduction pathways can alter cellular response.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response.

Justify claims based on scientific evidence that changes in signal transduction pathways can alter cellular response.

Describe a model that expresses key elements to show how change in signal transduction can alter cellular response.

Construct an explanation of how certain drugs affect signal reception and, consequently, signal transduction pathways.

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

Illustrate how in multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow.

Investigate that the organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic

WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students with Disabilities:

material (two variants of each chromosome pair) to both daughter cells.

Describe how 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.

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.khanacademy.org www.nature.com www.national geographic.com www.visiblebody.com Various question/answer worksheets Informational text worksheets

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

UNIT 4
Big Idea: Cell Energetics

NJSLS - Science:	Critical Knowledge and Skills

HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

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

HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-3: Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions

HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

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

Related Interdisciplinary Standards:

College Board Essential knowledge 1.B.1: Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.

Concept(s): In this unit, students will be able to give examples of endergonic and exergonic reactions; describe the key role of ATP in energy coupling; describe how enzymes work by lowering the energy of activation; explain the catalytic cycle of an enzyme that results in the production of a final product; describe factors that change enzyme shape and how they influence enzyme activity; explain how the shape of enzymes, their active sites, and interaction with specific molecules affect their function; and explain and give examples of how feedback inhibition is used to maintain appropriate levels of enzymes in a pathway. Furthermore, students will be able to give the summary equation of cellular respiration including the source and fate of the reactants and products; describe the difference between formation and cellular respiration; and the role of the mitochondrial membrane proton gradient and ATP synthase in generating ATP.

Students will also be able to summarize the equation of photosynthesis including the source of the reactants and products; describe how leaf and chloroplast anatomy relate to photosynthesis; how photosystems convert solar energy to chemical energy; and how linear electron flow in the light reactions results in the formation of ATP, NADPH, and oxygen.

Students are able to:	Learning Goal(s):
Students will be able to formulate a hypothesis for the rate of respiration in germinating seeds, and for the rate of photosynthesis in chloroplasts exposed to light.	Give examples of endergonic and exergonic reactions.
	Describe the key role of ATP in energy coupling; describe how enzymes work by lowering the energy of activation
Students will be able to design a plan for collecting data to show how various germinating seeds and animals respire when exposed to temperature differences.	Explain the catalytic cycle of an enzyme that results in the production of a final product
Students will be able to modify experimental design for lab extension	Give the summary equation of cellular respiration including the source and fate of the reactants and products

College Board Essential knowledge 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.

College Board Essential knowledge 1.D.1: There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.

College Board Essential knowledge 1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.

College Board Essential knowledge 2.A.1: All living systems require constant input of free energy.

College Board Essential knowledge 2.A.2: Organisms capture and store free energy

College Board Essential knowledge 2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions
College Board Essential knowledge 2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.

College Board Essential knowledge 4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes.

Students will be able to predict how changes in free energy availability affect organisms.

Students will be able to construct explanations of the mechanisms and structural features of cells that allow organisms to capture, store or use free energy.

Students will be able to name the three stages of cellular respiration and state the region of the eukaryotic cell where each stage takes place.

Students will be able to distinguish between substrate level phosphorylation and oxidative phosphorylation.

Students will be able to examine plant responses to environmental factors.

Students will be able to design an experiment to explore the effect of environmental factors on the rate of transpiration in different angiosperm plants.
Students will be able to evaluate data that show the effects of changes in concentrations of key molecules on negative feedback mechanisms.

Students will be able to explain how the exergonic slide of electrons down the electron transport chain is coupled to the endergonic production of ATP by

Describe the difference between formation and cellular respiration; and the role of the mitochondrial membrane proton gradient and ATP synthase in generating ATP.

Name the three stages of cellular respiration and state the region of the eukaryotic cell where each stage takes place.

Distinguish between substrate level phosphorylation and oxidative phosphorylation.

Summarize the equation of photosynthesis including the source of the reactants and products

Describe how leaf and chloroplast anatomy relate to photosynthesis

Describe how photosystems convert solar energy to chemical energy; and how linear electron flow in the light reactions results in the formation of ATP, NADPH, and oxygen.

Compare and contrast cyclic and noncyclic electron flow.

Compare and contrast C3, C4, and CAM photosynthesis

WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.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.

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.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

chemiosmosis in both respiration and photosynthesis.

Students will be able to calculate the efficiency of respiration in generating ATP.

Students will be able to trace the electron flow through photosystem 1 and 2.

Students will be able to compare and contrast cyclic and noncyclic electron flow.

Students will be able to compare and contrast C3, C4, and CAM photosynthesis

Students will be able to explain how a respiratory electron transport chain creates a proton gradient.

Students will be able to explain why ATP synthase is considered a molecular rotary motor.

Students will be able to explain what happens when chlorophyll or accessory pigments absorb photons.

Students will be able to list the components of a photosystem and explain their functions.

Students will be able to summarize the carbon-fixing reactions of the Calvin cycle.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

MP.2 Reason abstractly and quantitatively.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students with Disabilities:

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.Sciencedirect.com www.khanacademy.org www.nature.com www.national geographic.com www.visiblebody.com quizlet.com Various question/answer worksheets Informational text worksheets

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

UNIT 5
Big Idea: Heredity

NJSLS - Science:	Critical Knowledge and Skills

HS-LS1-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

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

HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

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

Related Interdisciplinary Standards:

College Board Essential knowledge 2.E.1: Timing and coordination of specific events are necessary for the normal development of an organism, and these events are regulated by a variety of

Concept(s): In this unit, students will be able to use the terms associated with genetics problems: P, F1, F2, dominant, recessive, homozygous, heterozygous, phenotype, and genotype; how to derive the proper gametes when working a genetics problem; the difference between an allele and a gene; how to read a pedigree; and how to use data sets to determine Mendelian patterns of inheritance. Also, students will be able to determine how the chromosome theory of inheritance connects the physical movement of chromosomes in meiosis to Mendel's laws of inheritance; the unique pattern of inheritance in sex-linked genes; how alteration of chromosome number or structurally altered chromosomes can cause genetic disorders, and how genomic imprinting and inheritance of mitochondrial DNA are exceptions to standard Mendelian inheritance.

Students are able to:	Learning Goal(s):
Students will be able to connect concepts in and across domains to predict how environmental factors affect responses to information and change behavior.	Illustrate how 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.
Students will be able to create a visual representation to illustrate how changes in a DNA sequence can result in a change in the polypeptide produced.	Identify how each chromosome consists of a single, very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA.
Students will be able to give experimental evidence to implicate proteins as a link between genotype and phenotype.	Explain that the instructions for forming species' characteristics are carried in the DNA.
Students will be able to describe representations that illustrate how genetic information is copied for transmission between generations.	Describe how all cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways.
Students will be able to use the terms associated with genetics problems: P, F1, F2,	Clarify that not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural

mechanisms.

College Board Essential knowledge 3.A.1: DNA, and in some cases RNA, is the primary source of heritable information.
College Board Essential knowledge 3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization.
College Board Essential knowledge 3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring.

College Board Essential knowledge 3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.

College Board Essential knowledge 3.B.1: Gene regulation results in differential gene expression, leading to cell specialization.

College Board Essential knowledge 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.

College Board Essential knowledge 3.C.1: Changes in genotype can result in changes in phenotype.

College Board Essential knowledge 3.C.2: Biological systems have multiple processes that increase genetic variation.

dominant, recessive, homozygous, heterozygous, phenotype, and genotype.

Students will be able to derive the proper gametes when working a genetics problem

Students will be able to explain the difference between an allele and a gene

Students will be able to read a pedigree

Students will be able to use data sets to determine Mendelian patterns of inheritance.

Students will be able to determine how the chromosome theory of inheritance connects the physical movement of chromosomes in meiosis to Mendel's laws of inheritance

Students will be able to explain the unique pattern of inheritance in sex-linked genes

Students will be able to describe how alteration of chromosome number or structurally altered chromosomes can cause genetic disorders, and how genomic imprinting and inheritance of mitochondrial DNA are exceptions to standard Mendelian inheritance.

functions, and some have, as yet, no known function.

Solve monohybrid and dihybrid crosses

Identify terms associated with Mendelian Genetics, such as P,F1,F2, genotype and phenotype.

Determine how the chromosome theory of inheritance connects the physical movement of chromosomes in meiosis to Mendel's laws of inheritance

Explain how environmental factors can cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrence of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors.

Describe how alteration of chromosome number or structurally altered chromosomes can cause genetic disorders, and how genomic imprinting and inheritance of mitochondrial DNA are exceptions to standard Mendelian inheritance.

College Board Essential knowledge 3.C.3: Viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events,

Students will be able to describe representations that illustrate how genetic information is translated into polypeptides.

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.Genome.gov Yourgenome.org www.Sciencedirect.com www.khanacademy.org www.nature.com www.national geographic.com www.visiblebody.com Various question/answer worksheets Informational text worksheets

scientific procedures/ experiments, or technical processes.

WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

WHST.9-12.1: Write arguments focused on discipline - specific content.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

MP.2 Reason abstractly and quantitatively.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students with Disabilities:

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

UNIT 6
Big Idea: DNA and Inheritance

NJSLS - Science:

HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding

Critical Knowledge and Skills

Concept(s): In this unit, students will be able to draw, identify and describe the structure of DNA; explain the impact of the work of Griffith, Avery Macleod, McCarty, Hershey and Chase, Wilkins and Franklin, and Watson and Crick to DNA knowledge; describe the process of semiconservative replication; describe the roles of DNA

the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3 -3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Related Interdisciplinary Standards:

College Board Essential knowledge 3.A.1: DNA, and in some cases RNA, is the primary source of heritable information.

College Board Essential knowledge 3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization.

College Board Essential knowledge 3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring.

polymerase, ligase, helicase, and topoisomerase in DNA replication; describe the general differences between bacterial chromosomes and eukaryotic chromosomes; and how DNA packaging can affected. Furthermore, students will be able to describe how RNA an DNA are similar and different and how this defines their roles; the differences between replication, transcription, and translation and the role of DNA and RNA in each process; how eukaryotic cells modify RNA after transcription; how genetic material is translated into polypeptides, and how mutations can change the amino acid sequence of a protein and be able to predict how a mutation can result in changes in gene expression. Students will also be able to describe how genes can be activated by inducer molecules, or they can be inhibited by the presence of a repressor as they interact with regulatory proteins or sequences; a regulatory gene is a sequence of DNA that codes for a regulatory protein such as a repressor protein; how the components of an operon function to regulate gene expression in both repressible and inducible operons; how positive and negative control function in gene expression; the impact of DNA methylation and histone acetylation on gene expression; how timing and coordination of specific events are regulated in normal development, including pattern formation and induction; the role of microRNA's in control of cellular Functions; and the role of gene regulation in embryonic development and cancer.

Students are able to:	Learning Goal(s):
Students will be able to explain how DNA differs from RNA.	Illustrate how 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.
Students will be able to trace the flow of information from gene to protein.	
Students will be able to differentiate between prokaryotic and eukaryotic transcription and translation.	Identify how each chromosome consists of a single, very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA.
Students will be able to list, describe, and give examples of point mutations.	Explain that the instructions for forming species' characteristics are carried in the DNA.

College Board Essential knowledge 3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.
College Board Essential knowledge 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.

College Board Essential knowledge 3.C.1: Changes in genotype can result in changes in phenotype.
Essential knowledge 3.C.2: Biological systems have multiple processes that increase genetic variation.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

MP.2 Reason abstractly and quantitatively.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students will be able to explain the significance of telomeres in aging and telomerase in healthy and cancerous cells.

Students will be able to justify the claim that humans can manipulate heritable information by identifying at least two commonly used technologies.

Students will be able to predict how change in specific DNA or RNA sequence can result in change in gene expression.

Students will be able to describe connections between the regulation of gene expression and observed differences between individuals in a population.

Students will be able to construct an explanation of how viruses introduce genetic variation in host organisms.

Students will be able to list advantages for using bacteria and yeast in the production of gene products.
Students will be able to describe how genes of interest can be identified with the use of a probe.

Students will be able to list and describe two major sources of genes for cloning.

Describe how all cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways.

Clarify that not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have, as yet, no known function.

Express that although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation.

Explain how environmental factors can cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrence of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.

Describe how 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.

List advantages for using bacteria and yeast in the production of gene products.

Students with Disabilities:

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

Describe how genes of interest can be identified with the use of a probe.

List and describe two major sources of genes for cloning

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction*

UNIT 7
Big Idea: Natural Selection and Evolution

NJSLS - Science:

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

Critical Knowledge and Skills

Concept(s): In this unit, students will be able to describe how Lamarck's view of the mechanism of evolution differed from Darwin's; explain several examples of evidence for evolution and how they each support how organisms have changed over time; describe differences between structures that are homologous and analogous and explain how this relates to evolution; describe the role of adaptations, variation, time, reproductive success, and heritability in evolution. Students will be able to describe how mutations

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

HS-LS4-3: Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to 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.

HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Related Interdisciplinary Standards:

College Board Essential knowledge 1.A.1: Natural selection is a major mechanism of evolution.

and sexual reproduction each produce genetic variation; list and describe the conditions for Hardy-Weinberg equilibrium and use the equation to calculate the allele frequencies to test whether a population is evolving; explain the effects of genetic drift, migration or selection may have on a population, and analyze data to justify predictions.
Students will also be able to describe the biological concept of species; discuss pre-zygotic and post-zygotic barriers that maintain reproductive isolation in natural populations; how allopatric and sympatric speciation are similar and different; explain why speciation rates are often rapid in situations when adaptive radiation occurs or during times of ecological stress; and explain the connection between a change in gene frequency, a change in the environment, natural selection or genetic drift and speciation

Students are able to:	Learning Goal(s):
Students will be able to describe how Lamarck's view of the mechanism of evolution differed from Darwin's	Justify the selection of geological, physical, and chemical data that reveal early earth conditions.
Students will be able to explain several examples of evidence for evolution and how they each support how organisms have changed over time	Pose scientific questions that identify essential properties of shared, core life processes that provide insights into the history of life on earth
Students will be able to describe differences between structures that are homologous and analogous and explain how this relates to evolution	Analyze how genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
Students will be able to describe the role of adaptations, variation, time, reproductive success and heritability in evolution.	
Students will be able to describe how mutations and sexual reproduction each produce genetic variation	

College Board Essential knowledge 1.A.2: Natural selection acts on phenotypic variations in populations.

College Board Essential knowledge 1.A.3: Evolutionary
change is also driven by random processes.

College Board Essential knowledge 1.A.4: Biological
evolution is supported by scientific evidence from many disciplines, including mathematics.

College Board Essential knowledge 1.B.1: Organisms share many conserved core processes and features
that evolved and are widely distributed among organisms today.

College Board Essential knowledge 1.B.2: Phylogenetic
trees and cladograms are graphical representations (models) of evolutionary history that can be tested.

College Board Essential knowledge 1.C.1: Speciation and extinction have occurred throughout the Earth's history.

College Board Essential knowledge 1.C.2: Speciation
may occur when two populations become reproductively isolated from each other.

Students will be able to list and describe the conditions for Hardy-Weinberg equilibrium and use the equation to calculate the allele frequencies to test whether a population is evolving; explain the effects of genetic drift, migration or selection may have on a population, and analyze data to justify predictions.

Students will be able to describe the biological concept of species

Students will be able to discuss pre-zygotic and post-zygotic barriers that maintain reproductive isolation in natural populations

Students will be able to describe how allopatric and sympatric speciation are similar and different

Students will be able to explain why speciation rates are often rapid in situations when adaptive radiation occurs or during times of ecological stress

Students will be able to and explain the connection between a change in gene frequency, a change in the environment, natural selection or genetic drift and speciation.

Students will be able to explain the scientific hypothesis about the origin of life on earth; explain the age of the earth and when

Describe how evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.

Describe how 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.

Explain how the traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

Detail how natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous

College Board Essential knowledge 1.C.3: Populations of organisms continue to evolve.

College Board Essential knowledge 1.D.1: There are several hypotheses about the natural origin of life
on Earth, each with supporting scientific evidence.

College Board Essential knowledge 1.D.2: Scientific evidence from many different disciplines
College Board Essential knowledge 3.C.2: Biological systems have multiple processes that
increase genetic variation.

RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.8: Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or

prokaryotic and eukaryotic life emerged; give the characteristics of the early planet and its atmosphere; and discuss evidence for endosymbiosis.

Students will be able to use bioinformatics as a tool to determine evolutionary relationships and to better understand genetic diseases.

Students will be able to use a set that reflects a change in genetic makeup of a population over time and to apply mathematical methods and conceptual understandings to investigate the cause and effect of this change

Students will be able to apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future
Students will be able to evaluate data based evidence that describes evolutionary changes in the genetic makeup of a population over time

Students will be able to use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and the effects of selection in the evolution of specific population

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.

Analyze how different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Illustrate how changes in the physical environment, whether naturally occurring or human induced, have 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.

Explain how species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.

Apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future; evaluate data based evidence that describes

trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.9-12.9: Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

MP.2: Reason abstractly and quantitatively.

MP.4: Model with mathematics.

MODIFICATIONS:

Advanced Learner:

Requirement for more analysis, more details in experiments, projects, open ended questions, and Students create questions for further investigation and study

Students will be able to describe a model that represents evolution within a population and evaluate data sets that illustrate evolution as an ongoing process.

Students will be able to explain how natural selection is a major mechanism of evolution, and in what ways does it act on phenotypic variations in a population

Students will be able to illustrate in what ways organisms share many conserved core processes and features, and how do phylogenetic trees and cladograms graphically represent or model evolutionary history

Students will be able to describe what changes in genotype may affect phenotypes that are subject to natural selection

evolutionary changes in the genetic makeup of a population over time; use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and the effects of selection in the evolution of specific populations.

Create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set.

Justify the selection of data that address questions related to reproductive isolation and speciation.

Predict how a change in genotype, when expresses as a phenotype, provides a variation
Evaluate evidence provided by data to qualitatively and quantitatively investigate the role of natural selection in evolution

Make predictions about the effects of genetic drift, migration, and artificial selection on the genetic makeup of a population.

Connect scientific evidence from many scientific disciplines to support the modern concept of evolution.

Students with Disabilities:

Provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, Students will use cooperative learning, peer tutoring, extended time, reteach in utilizing various methods. Utilize remediation resources which include assessment and intervention, in planning and instruction.

English Language Learners:

Utilize ESL and foreign language teachers. Permit the usage of native language/English dictionary, Google translate, and websites in native language. Provide word banks where appropriate. When necessary, provide simplified information, worksheets, etc. Use of gestures, TPR, pictures and realia. Provide hands on experience, in the classroom, via experiments.

Evaluate evidence provided by data to qualitatively and quantitatively investigate the role of natural selection in evolution

Formative/Summative Assessments	Primary & Supplementary Resources
Formative: participation in team activities, research, verbal communication, observations, experiments, www.edulastic.com, independent problems during lessons, lesson quizzes Benchmark/Summative: Topic assessments, formal lab sheets, experiments, essays, research simulation tasks	www.teacherpayteacher.com www.biologycorner.com www.youtube.com www.khanacademy.org www.nature.com www.national geographic evolution.berkeley.edu Various question/answer worksheets Informational text worksheets

UNIT 8
Big Idea: Ecosystems: Interactions, Energy and Dynamics

NJSLS - Science:

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Critical Knowledge and Skills

Concept(s): In this unit of study, students formulate answers to the question "how and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?" Secondary ideas include the interdependent relationships in ecosystems; dynamics of ecosystems; and functioning, resilience, and social interactions, including group behavior. Students also develop an understanding of how human activities affect natural resources and of the interdependence between humans and Earth's systems, which affect the availability of natural resources. Students use mathematical reasoning and models to make sense of carrying capacity, factors affecting biodiversity and populations, the cycling of matter and

HS-LS2-3: Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions

HS-LS2-4: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8: Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

flow of energy through systems. Students use *computational representations* to analyze how earth systems and their relationships are being modified by human activity.

Students are able to:	Learning Goal(s):
Students will observe and analyze how organisms respond to stimuli and attempt to maintain homeostasis.	Compare and contrast species interactions: predation, competition, symbiosis
Students will contrast the size and complexity differences among the levels of organization.	Use the scientific method to investigate how changes in populations: immigration, emigration, mortality, natality, affect the ecosystem
Compare and contrast food chains with food webs. They will be able to explain why food chains are not a realistic representation of a community of organisms.	Interpret growth curves/carrying capacity
Students will analyze changes in quantities of matter and energy that exist in an ecological energy pyramid.	Apply the scientific process to investigate 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.
Students will be able to design a plan for collecting data to show how systems are affected by biotic and abiotic interactions.	
Students will be able to predict the effects of a change in populations, communities, and ecosystems	Design a plan for collecting data to show that all biological systems are affected by biotic and abiotic interactions.
Students will be able to use data analysis to refine observations regarding the effect of population interactions on species distribution and abundance	Evaluate the severity of the issue of climate change through discussion, experimentation, and observation in order to further students understanding of the topic and the impact their own activities have on their surroundings.
Students will differentiate the interactions of predation, competition, and symbiosis.	
Contrast changes in populations when positive increases happen due to	Examine Biodiversity and its importance to life