Course: Advanced Placement Biology

Unit Name: Evolution

Grade Level: 11– 12

Content Statements	**NJSLS**
Evolution	5.3.12.A.1 - 6
Natural Selection	5.3.12.C.1 - 2
Charles Darwin	RST.9-10.1.
Mutations in DNA	RST.9-10.2.
Allele frequency	RST.9-10.3.
Genetic variation in populations	RST.9-10.6.
Geology	RST.9-10.7.
Genetic engineering	RST.9-10.8.
Biotechnology	RST.9-10.10.
Morphological and genetic information	
Phylogenetic trees	
Geographical distribution of species	
Fossil record	
Overarching Essential Questions	**Overarching Enduring Understandings**
How is evolution responsible for the diversity of life on Earth?	The process of evolution drives the diversity and unity of life.
Unit Essential Questions	**Unit Enduring Understandings**
How do genetic changes affect species over time?	Change in the genetic makeup of a population over time is evolution.
How are organisms related to one another?	Organisms are linked by lines of descent from common ancestry.
Explain how life is affected by changing environments?	

How did life originate on Earth? How does DNA factor into the unity and diversity of life on Earth?	Life continues to evolve within a changing environment. The origin of living systems is explained by natural processes.
Unit Rationale Evolution and natural selection are primary to the basic understanding of biology as a whole. It is a topic that is interwoven throughout the course, and understanding the origin of life on Earth and the process of evolution is essential to the course.	**Unit Overview** Evolution is a change in the genetic makeup of a population over time, with natural selection its major driving mechanism.

Resources

Campbell Reece Biology - 8th Edition AP (text)

Chapters 1, 2, and 3

http://www.biology.arizona.edu

http://ed.ted.com

Classroom Web Site

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sunamasinc.com

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Current Events/News Media

Laboratory Activities

Suggested Student Activities

Students use construction paper to make models of atoms and molecules with magnetic backs in order to facilitate discussion and functionally explain, basic chemistry concepts including essential elements of life, bonding, ions, properties of water due to hydrogen bonding and how these properties impact living systems.

Science Project (Open inquiry of a biological topic of choice; Research topic to formulate a question; Hypothesize; Design a controlled experiment to test the hypothesis; Analyze data and make conclusions; Prepare a folder of the scientific work and prepare a visual representation).

Convert a data set from a table of numbers that reflect a change in genetic makeup of a population over time and apply mathematical methods and conceptual understandings to investigate the cause(s) and effect(s) of this change.

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

Apply mathematical methods to data from a real or simulate population to predict what will happen to the population in the future.

Evaluate data-based evidence that describes evolutionary changes in the genetic makeup of a population over time.

Connect evolutionary changes in a population over time to a change in the environment.

Use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and effects of selection in the evolution of specific populations.

Justify 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.

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

Evaluate evidence provided by data from many scientific disciplines that support biological evolution.

Pose scientific questions that correctly identify essential properties of shared, core life processes that provide insight into the history of life on Earth.

Describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms.

Pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that could extend or improve the phylogenetic tree.

Evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history and speciation. Use data from a real or simulated population(s), based on graphs or models of types of selection, to predict what will happen to the population in the future. Describe a model that represents evolution within a population. Evaluate given data sets that illustrate evolution as an ongoing process. Describe a scientific hypothesis about the origin of life on Earth. Evaluate the accuracy and legitimacy of data to answer scientific questions about the origin of life on Earth. Justify the selection of geological, physical, and chemical data that reveal early Earth conditions.

Course: Advanced Placement Biology

Unit Name: Biological Systems

Grade Level: 11 – 12

Content Statements	**NJSLS**
Living systems	5.1.12.A.1 - 6
Free energy	5.1.12.B.1 - 4
Growth and development	5.1.12.C.1 - 2
Reproduction	5.1.12.D.1 - 3
Autotrophs and heterotrophs	RST.9-10.2.
Photosynthesis and chemosynthesis	RST.9-10.3.
Cellular respiration and fermentation	RST.9-10.4.
ATP	RST.9-10.6.
Metabolic pathways	RST.9-10.7.
Carbon cycle	RST.9-10.8.
Surface-to-volume ratios	
Apoptosis	

Differentiation Cell membranes Selective permeability Osmosis, diffusion, and active transport Dynamic equilibrium Feedback mechanisms Homeostatic mechanisms	
Overarching Essential Questions How do living organisms grow, reproduce, and maintain dynamic homeostasis?	**Overarching Enduring Understandings** Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
Unit Essential Questions How do organisms grow, reproduce, and maintain a stable internal environment? What types of feeback mechanisms are utilized by organisms to maintain a stable internal environment? How does an organism's environment affect homeostasis within an organism?	**Unit Enduring Understandings** Growth, reproduction, and maintenance of the organization of living systems require free energy and matter. Growth, reproduction, and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments. Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic equilibrium. Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment. Many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination. Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.
Unit Rationale All living organisms require energy to maintain life. This unit examines the various systems and mechanisms to maintain life and reproduce.	**Unit Overview** Living systems require free energy and matter to maintain order, grow, and reproduce. Organisms

	employ various strategies to capture, use, and store free energy and other vital resources.

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Laboratory Activities

Suggested Student Activities

Explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow, and to reproduce.

Predict how changes in free energy availability affect organisms, populations, and ecosystems.

Use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store, and use free energy.

Calculate surface area-to-volume ratios of various cells.

Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination.

Justify the selection of data regarding the types of molecules that an animal, plant, or bacterium will take up as necessary building blocks and excrete as waste products.

Represent graphically or model quantiatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth, and reproduction.

Use representations and models to pose scientific questions about the properties of cell membranes and selective permeability based on molecular structure.

Construct models that connect the movement of molecules across membranes with membrane structure and function.

Investigate whether dynamic homeostasis is maintained by the active movement of molecules across membranes.

Explain how internal membranes and organelles contribute to cell functions.

Use representations and models to describe differences in prokaryotic and eukaryotic cells.

Connect how organisms use negative feedback to maintain their internal environment.

Make predictions about how organisms use negative feedback mechanisms to maintain their internal environments.

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.

Explain the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities, and ecosystems.

Analyze data to identify possible patterns and relationships between a biotic or abiotic factor and a biological system.

Identify phylogenetic patterns or relationships, showing that homeostatic mechanisms reflect both continuity due to common ancestry and change due to evolution in different environments.

Analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems.

Create representations and models to describe immune responses.

Create representations and models to describe nonspecific immune defenses in plants and animals.

Use a graph or diagram to analyze situations or solve problems that involve timing and coordination of events necessary for normal development in an organism.

Describe the role of programmed cell death in development and differentiation, the reuse of molecules, and the maintenance of dynamic homeostasis.

Show how timing and coordination of physiological events involve regulation.

Connect concepts that describe mechanisms that regulate the timing and coordination of physiological events.

Analyze data to support the claim that responses to information and communication of information affect natural selection.

Predict how environmental factors affect responses to information and change behavior.

Course: Advanced Placement Biology

Unit Name: Life Processes

Grade Level: 11– 12

Content Statements	**NJSLS**
Structure of DNA and RNA	5.3.12.D.1 - 3
Transmission of heritable information	5.3.12.E.1 - 4
Mutations	RST.9-10.1.
Replication, transcription, and translation	RST.9-10.4.
Biotechnology	RST.9-10.6.
Chromosomes	RST.9-10.7.
Cell cycle	RST.9-10.10.
Asexual and sexual reproduction	
Mendelian patterns of inheritance	
Gene expression	
Meiosis	

Cell communication Cell signaling pathways Natural selection and evolution Nervous system Organismal behavior	
Overarching Essential Questions How do organisms store, retrieve, and transmit information?	**Overarching Enduring Understandings** Living systems store, retrieve, transmit, and respond to information essential to life processes.
Unit Essential Questions What is heritable information, and how is it transferred to the next generation? What is involved in gene expression? What are sources of genetic variation? How do cells communicate?	**Unit Enduring Understandings** Heritable information provides for continuity of life. Expression of genetic information involves cellular and molecular mechanisms. The processing of genetic information is imperfect and is a source of genetic variation. Cells communicate by generating, transmitting, and receiving chemical signals. Transmission of information results in changes within and between biological systems.
Unit Rationale The discovery of DNA is perhaps that most important discovery in the history of man. This unit investigates the history of this disovery, its implications, and the future of DNA technology.	**Unit Overview** Genetics is the field of biology devoted to understanding how characteristics are transmitted from parents to offspring. This unit describes the genetic principles that resulted from the work of various scientists (ex. Gregor Mendel) through modern technology used in DNA fingerprinting, cloning, and genetic engineering.

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Suggested Student Activities

Construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, that RNA are the primary sources of heritable information.

Justify the selection of data from historical investigations that support the claim that DNA is the source of heritable information.

Describe representations and models that illustrate how genetic information is copied for transmission between generations.

Explain how genetic information is translated into polypeptides.

Justify the claim that humans can manipulate heritable information by identifying at least two commonly used technologies.

Predict how a change in a specific DNA or RNA sequence can result in changes in gene expression.

Describe the events that occur in the cell cycle.

Construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.

Represent the connection between meiosis and increased genetic diversity necessary for evolution.

Evaluate evidence provided by data sets to support the claim that heritable information is passed from one generation to another generation through mitosis, or meiosis followed by fertilization.

Connect the process of meiosis to the passage of traits from parents to offspring.

Pose questions about ethical, social, or medical issues surrounding human genetic disorders.

Apply mathematical routines to determine Mendelian patterns of inheritance provided by data sets.

Explain deviations from Mendel's model of the inheritance of traits.

Explain how the inheritance patterns of many traits can not be accounted for by Mendelian genetics.

Describe representations of an appropriate example of inheritance patterns that can not be explained by Mendel's model of the inheritance of traits.

Describe the connection between the regulation of gene expression and observed differences between different kinds of organisms.

Explain the connection between the regulation of gene expression and observed differences between individuals in a population.

Explain how the regulation of gene expression is essential for the processes and structures that support efficient cell function.

Describe how gene regulation influences cell products and function.

Explain how signal pathways mediate gene expression, including how this process can affect protein production.

Describe the mechanisms of the regulation of gene expression.

Predict how a change in genotype, when expressed as a phenotype, provides a variation that can be subject to natural selection.

Create a visual representation to illustrate how changes in a DNA nucleotide sequence can result in a change in the polypeptide produced.

Explain the connection between genetic variations in organisms and phenotypic variations in populations.

Compare and contrast processes by which genetic variation is produced and maintained in organisms from multiple domains.

Construct an explanation of the multiple processes that increase variation within a population.

Explain how viruses introduce genetic variation in host organisms. Describe how viral replication introduces genetic variation in the viral population. Describe the basic chemical processes for cell communication shared across evolutionary lines of descent. Generate scientific questions involving cell communication as it relates to the process of evolution. Use representations and appropriate models to describe features of a cell signaling pathway. Construct explanations of cell communication through cell-to-cell direct contact or through chemical signaling. Create representations that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling. Express 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. Explain how certain drugs affect signal reception and, consequently, signal transduction pathways. Describe how organisms exchange information in response to internal changes and external cues, and which can result in changes in behavior. Describe how organisms exchange information in response to internal changes or environmental cues. Explain how nervous sytems detect external and internal signals, transmit and integrate information, and produce responses. Describe how nervous systems transmit information. Explain how the vertebrate brain integrates information to produce a response. Create a visual representation of complex nervous systems to describe/explain how these systems detect external and internal signals, transmit and integrate information, and produce responses.

Course: Advanced Placement Biology

Unit Name: Interactions

Grade Level: 11– 12

Content Statements	**NJSLS**
Biological hierarchy	5.3.12.A.1 - 6
Ecology	5.3.12.C.1 - 2

Cellular organization Environmental conditions and changes Interactions among organisms Competition and cooperation Variations within biological systems Populations Adapting to changing environmental conditions	RST.9-10.3. RST.9-10.4. RST.9-10.6. RST.9-10.7. RST.9-10.9. RST.9-10.10.
Overarching Essential Questions How do biological systems interact, and how do complex properties factor into those interactions?	**Overarching Enduring Understandings** Biological systems interact, and these systems and their interactions possess complex properties.
Unit Essential Questions What interactions take place between biological systems? Explain how competition and cooperation are important aspects of biological systems? How do you explain the unity of diversity of life on Earth?	**Unit Enduring Understandings** Interactions within biological systems lead to complex properties. Competition and cooperation are important aspects of biological systems. Naturally occurring diversity among and between components within biological systems affects interactions with the environment.
Unit Rationale Ecology is the study of the interactions between organisms and the living and nonliving components of their environment. Each of the variety of organisms on Earth depends in some way on other living or nonliving things in the environment.	**Unit Overview** All biological systems are composed of parts that interact with each other. These interactions result in characteristics not found in the individual parts alone. In essence, "the whole is greater than the sum of its parts."

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Laboratory Activities

Suggested Student Activities

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.

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 models to analyze situations qualitatively to describe how interactions of subcellular structures, which possess specialized functions, provide essential functions.

Illustrate how interactions between external stimuli and gene expression result in specialization of cell, tissues, and organs.

Evaluate scientific questions concerning organisms that exhibit complex properties due to the interaction of their constituent parts.

Predict the effects of a change in a component(s) of a biological system on the functionality of an organism.

Illustrate biocomplexity due to interactions of the constituent parts.

Justify the selection of the kind of data needed to answer scientific questions about the interaction of populations within communities.

Apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways.

Predict the effects of a change in the community's populations on the community.

Apply mathematical routines to quantities that describe interactions among living systems and their environment, which result in the movement of matter and energy.

Use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.

Predict the effects of a change of matter or energy availability on communities.

Analyze data to identify how molecular interactions affect structure and function.

Use models to analyze how cooperative interactions with organisms promote efficiency in the use of energy and matter.

Use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and abundance.

Explain how the distribution of ecosystems changes over time by identifying large-scale events that have resulted in these changes in the past.

Predict consequences of human actions on both local and global ecosystems.

Explain how variation in molecular units provides cells with a wider range of functions.

Construct explanations of the influence of environmental factors on the phenotype of an organism.

Predict the effects of a change in an environmental factor on the genotypic expression of the phenotype.

Use evidence to justify a claim that a variety of phenotypic responses to a single environmental factor can result from different genotypes within the population.

Use theories and models to make scientific claims and/or predictions about the effects of variation within populations on survival and fitness.

Make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability.

Reapproved June 2017

Appendix

Differentiation	
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
Intervention & Modification	● Utilize “skeleton notes” where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors ● Graphic organizers
ELLs	● Pre-teach new vocabulary and meaning of symbols ● Embed glossaries or definitions ● Provide translations ● Connect new vocabulary to background knowledge ● Provide flash cards ● Incorporate as many learning senses as possible ● Portray structure, relationships, and associations through concept webs ● Graphic organizers
21st Century Skills	
● Creativity ● Innovation ● Critical Thinking	

- Problem Solving
- Communication
- Collaboration

Integrating Technology

- Chromebooks
- Internet research
- Online programs
- Virtual collaboration and projects
- Presentations using presentation hardware and software