



Honors Biology - Unit 5 - Mechanisms of Evolution

Unit Focus

The final unit brings together several concepts studied during the year. As students engage in applying their understanding of genetics and inheritance to the mechanisms of evolution, they will explore the genetic basis of natural selection as well as the scientific evidence for evolution. As students analyze phylogenetic trees, adaptations, and examples of natural selection, they will be synthesizing their knowledge of molecular biology, inheritance, and populations. In order to demonstrate their understanding of the dynamic process of evolution, students will analyze examples of natural selection in species to make and justify scientifically-based claims regarding the mechanisms that drove the evolution of the species.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Next Generation Science Standards Performance Expectations: High School Life Sciences - 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-LS3-2) - Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (HS-LS3-3) - Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (HS-LS4-1) - 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-LS4-2) - 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-LS4-3) - Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (HS-LS4-4) - 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. (HSLS4-5)	<i>Students will be able to independently use their learning to...</i> T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 The variation and distribution of traits in a population depend on genetic and environmental factors. U2 The distribution of traits in a population, as well as species expansion, emergence or extinction, can change when conditions change. U3 Natural selection occurs only if there is variation in the genes and associated traits between individuals in a population. Traits that positively affect survival can become more common in a population. U4 Natural selection leads to organisms with adaptations (anatomical, behavioral, and physiological) that are well suited to survival and reproduction in a particular environment. U5 Evolution has resulted in physical and behavioral adaptations that increase an organism's chance of survival and reproduction	<i>Students will keep considering...</i> Q1 How do genetic and environmental factors influence populations over multiple generations? Q2 How do survival and reproduction drive evolution? Q3 How do we scientifically explain the evidence and mechanisms for biological evolution?

Stage 1: Desired Results - Key Understandings

Next Generation Science Standards (DCI)

Science: 9

- Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (LS4.9.A1)
- 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. (LS4.9.B1)
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (LS4.9.B2)
- 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. (LS4.9.C1)
- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (LS4.9.C2)
- Adaptation also means that the distribution of traits in a population can change when conditions change. (LS4.9.C3)
- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (LS4.9.C5)

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- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

U6 Scientists examine evidence to formulate interesting questions and solve problems.
U7 Conclusions can only be as strong as the quality of the evidence and the relevancy to the original question or problem.

Acquisition of Knowledge and Skill

Knowledge

Students will know...
K1 Theories regarding the suitability of organisms in their environment have changed over time based on scientific evidence.
K2 Evolutionary lines of descent can be inferred by comparing DNA sequences, amino acid sequences, and anatomical and embryological evidence of different organisms.
K3 Ecosystem dynamics impact the evolution of species.
K4 Genetic variation is the result of crossing-over, sexual reproduction, and genetic mutations.
K5 Evolution results primarily from natural selection: genetic variation of individuals in a species, competition for resources, and proliferation of organisms better able to survive and reproduce.
K6 Adaptations are a result of evolution.
K7 Key vocabulary: Acquired characteristics, Adaptations, Adaptive radiation, Analogous structures, Artificial Selection, Coevolution, Convergent evolution, Embryology, Evolution Theory, Fitness, Fossils, Gradualism, Homologous structures, Isolation (geographic, ecological, behavioral), Natural Selection, Origin of Species, Punctuated equilibrium, Species/ Speciation, Stasis, Variations, Vestigial structures

Skill(s)

Students will be skilled at...
S1 Apply understanding of biochemistry, genetics and genetic variation to explain the mechanisms of evolution.
S2 Analyze data and evidence to form conclusions about the mechanisms of evolution and justify claims with evidence and reasoning.