

**Biology Frameworks Curriculum Pacing Guide
Stability and Change in Populations Over Time**

Crosscutting Concepts: Cause and Effect; Stability and Change; Patterns

Topics: Evolution of Viruses; Viruses vs Bacteria; Resistance; Genetic Drift; Speciation; Patterns in Biodiversity; Evidence of Evolution

6-week Instructional Segment

Anchoring Phenomenon	GSE	Sample Instructional Segment	Disciplinary Core Ideas	Science and Engineering Practices	Instructional Notes
<p>Antibiotics do not work on viruses and may become less effective on bacteria over time.</p> <p>Resources: CK12: This is an article titled “Evolution of Resistant Bacteria” that emphasizes the evolution of Superbugs</p> <p>By the end of this unit, students will explain the phenomenon using the following concepts:</p>	<p>SB1a SB4a SB4c SB5a SB5e SB6a SB6b SB6c SB6d SB6e</p>	<p><i>Use the Segment Topics with Focus Phenomena in Teacher Notes for more clarification.</i></p> <p><i>Topics that have links will connect to a sample lesson.</i></p> <p>Evolution of Viruses Viruses change over time in response to selection pressures from vaccines.</p> <p>Viruses vs Bacteria Viruses are structurally and functionally different from living organisms.</p>	<p><i>By the end of grade 12</i></p> <p>LS4A: Evidence of Common Ancestry and Diversity</p> <ul style="list-style-type: none"> Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps. Common ancestry is derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. <p>LS4B: Natural Selection</p> <ul style="list-style-type: none"> Natural selection occurs only if there is both: <ol style="list-style-type: none"> (1) variation in the genetic information between organisms in a population (2) variation in the expression of that genetic information—trait variation—that leads to differences in performance among individuals Traits that positively affect survival are more likely to be reproduced and are more common in the population. <p>LS4C: Adaptation</p> <ul style="list-style-type: none"> Natural selection is the result of four factors: <ol style="list-style-type: none"> (1) the potential for a species to increase in 	<p>Obtaining, evaluating, & communicating information</p> <p>Constructing explanations</p> <p>Engaging in argument from evidence</p> <p>Analyzing and interpreting data</p> <p>Developing and using models</p>	<p>See Teacher Notes</p> <p>By the end of this unit, students are using the following language in their speaking and writing during EXPLAIN or ELABORATE:</p> <ul style="list-style-type: none"> Structure and function Cause, effect, and mechanism Stability and change Cells Organelles System Homeostasis Clades Endosymbiosis Organism Virus Biodiversity Population Adaptation Evolution Speciation

<p>Antibiotics target bacteria, which are prokaryotic cells.</p> <p>Antibiotics do not work on viruses because they do not contain the same structures as living cells.</p> <p>Antibiotics may become less effective on bacteria over time because of random variations that may increase their fitness and cause a change in the genetics of the population over time.</p> <p>Viruses are similar to bacteria because they demonstrate random variations that may increase their fitness and cause a change in the genetics of</p>	<p>Antibiotic Resistance Random genetic variations allow for natural selection to select for existing resistant bacteria. MRSA Stay or MRSA Go?</p> <p>Genetic Drift Survival may depend solely on random chance. Sickle Cell and Malaria Change With Me</p> <p>Speciation The creation of a new species can result from natural selection or be influenced by humans.</p> <p>Patterns in Biodiversity Major events in time can cause major shifts in biodiversity.</p>	<p>number</p> <p>(2) the genetic variation of individuals in a species due to mutation and sexual reproduction</p> <p>(3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce</p> <p>(4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment</p> <ul style="list-style-type: none"> ● Natural selection leads to adaptation—to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. ● The survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. ● Adaptation also means that the distribution of traits in a population can change when conditions change. ● Changes in the physical environment 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. ● Species become extinct because they can no longer survive and reproduce in their altered environment. ● If members cannot adjust to change that is too 	<ul style="list-style-type: none"> ● Evidence of evolution ● Natural selection ● Genetic drift ● Biological resistance
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<p>the populations over time.</p> <p>Bacteria and viruses can evolve different strains that are identified through DNA evidence.</p>		<p>Evidence of Evolution Scientists use a variety of evidence to support the theory of evolution.</p>	<p>fast or too drastic, the opportunity for the species' evolution is lost.</p> <p>LS4D: Biodiversity and Humans</p> <ul style="list-style-type: none"> • Biodiversity is increased by the formation of new species and decreased by the loss of species. • Biological extinction, being irreversible, is a critical factor in reducing the planet's natural capital. <p>National Research Council. (2012). <i>A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.</i></p>		
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This instructional segment will segue into SB4 in Patterns in Living Systems by connecting the theories of evolution to modeling the classification of living organisms using cladograms and/or phylogenetic trees. Also it will connect to SB2 in Structure and Function of Molecular Genetics and SB3 in Patterns in Heredity and Selection by connecting the idea that natural selection occurs based on random genetic variations that code for traits that may increase fitness. These more fit traits can be passed to successive generations.