

Instructional Notes
Stability and Change In Populations Over Time
GSE: SB1a, SB4a, SB4c, SB6a, SB6b, SB6c, SB6d, SB6e

Anchoring Phenomenon:
 Antibiotics do not work on viruses and may become less effective on bacteria over time.

Topic	Focus	Lesson Phenomenon	GSE/Notes/Language
Virus Evolution	Brief overview of how viruses can change over time in response to selection pressures.	The flu vaccine is updated annually in response to the changing flu virus.	SB6e Viral structure--protein capsid and nucleic acid Overview of fitness and adaptations
Viruses vs Bacteria (and other living organisms)	Viruses are nonliving particles. Brief overview to compare the two structures to help review terms {cell wall, prokaryote} from 7th Grade Life Science. Compare human cells with bacteria to help review terms {nucleus, eukaryote}.	Viruses do not respond to antibiotics.	SB4c SB1a/SB4a--Key characteristics to define differences: cell wall, nucleus, cell membrane Emphasis: Viral structure includes: <ul style="list-style-type: none"> • protein capsid and nucleic acid Bacterium structure includes: <ul style="list-style-type: none"> • cell wall, cell membrane, prokaryote, no nucleus, DNA Human cell structure includes: <ul style="list-style-type: none"> • cell membrane, eukaryote, nucleus, DNA Viruses are not made of cells. Viruses cannot reproduce without a host cell. Antibiotics target prokaryotic cells.
Antibiotic Resistance	Random genetic variations allowed for natural selection to select for existing resistant bacteria.	Some staph infections (MRSA) do not respond to antibiotics.	SB6e MRSA Stay or MRSA Go? Antibiotic Resistant Exploration Activity with

	<p>Fitness/survival of the fittest</p> <p>Relate to pesticide resistance to demonstrate this concept is also seen all other organisms.</p>		<p>Skittles and Marshmallows</p> <p>Random genetic variations may be beneficial, harmful, or have no influence on fitness. This will be emphasized in Structure and Function of Molecular Genetics</p> <p>Fitness is the ability to be best adapted for survival in an environment.</p>
Genetic Drift	<p>Relate antibiotic resistance to a population bottleneck where non-resistant (less fit) alleles are removed from population.</p>	<p>The North American bison today are different from their wild ancestors.</p>	<p>SB6d/SB5a/SB5e</p> <p>Differentiate between resistance coming from natural selection where there was an advantage to the survival of some organisms, and genetic drift where survival is due to random chance alone.</p> <p>Lesson on Sickle Cell and Malaria</p> <p>Change with Me</p> <p>These concepts will be emphasized in the molecular genetics and heredity units.</p> <p>Gene pools are the traits available for reproduction in a particular area.</p> <p>Gene flow is the immigration or emigration of these traits into or out of a particular area.</p> <p>Bottleneck and founder effects can be seen in living organisms.</p> <p>Phenomena can be used as examples to teach</p>
	<p>Introduce the founder effect with genetic drift to make the connection between bottleneck events and natural selection with Darwin's finches.</p>	<p>The Amish have a high rate of polydactyly.</p> <p>The Fugates of Kentucky have blue-tinted skin.</p>	

			concepts of Mendelian Genetics in Patterns of Heredity
Speciation	Darwin's finches demonstrate the founder effect through adaptive radiation where natural selection caused speciation.	Birds have different types of beaks that are specific to the resources in their habitat.	<p>SB6a/SB5e</p> <p>Use stabilizing, directional, and disruptive selections to model trait shifts in populations.</p> <p>Include Darwin's theory, his influences (Lamarck and Malthus), and his theory of natural selection.</p> <p>Speciation occurs from reproductive isolation (geographic, temporal, or behavioral).</p> <p>Physical or behavioral adaptations and plant tropisms can increase fitness.</p> <p>Compare natural and artificial selection.</p>
	To speed up the process of natural selection, humans are now influencing speciation through the process of artificial selection.	Humans encouraged dogs to evolve from wolves.	
Patterns of Biodiversity	Major events in time cause major shifts in biodiversity; history of life; history of the Earth	When the dinosaurs became extinct, small mammals were then able to grow rapidly in size.	<p>SB6b/SB5a/SB5e</p> <p>Use an overview of the 5 mass extinctions in conjunction with the evidence of speciation (fossil record/comparative anatomy) to emphasize natural selection is the driving force of speciation and can cause great shifts in biodiversity.</p>
Evidence of Speciation	<p>Fossil record</p> <p>Use in conjunction with the 5 mass extinctions.</p>	The modern horse is physically different from its ancestor.	<p>SB6c</p> <p>Darwin concluded the first two evidences but did not have knowledge of DNA/biochemical</p>

	<p>Comparative anatomy; homologous structures through adaptive radiation; analogous structures through convergent evolution</p>	<p>Humans, dolphins, and bats are more closely related; however, dolphins resemble sharks and bats resemble birds more than they resemble humans.</p>	<p>evidence of evolution. DNA is emphasized in another unit so a brief overview is sufficient here.</p> <p>Modeling theories of evolution (gradualism and punctuated equilibrium) in cladograms and/or phylogenetic trees may be useful in connecting this instructional segment with Patterns in Living Systems,</p>
	<p>Embryology The embryos of vertebrates look very similar in the early stages of development. Vestigial structures</p>	<p>The embryos of snakes have leg buds; the embryos of whales have teeth; the embryos of humans have tails.</p>	
	<p>Biochemical evidence; more closely related organisms have more similar DNA.</p> <p>Use phenomenon to relate back to genetic drift of human populations.</p>	<p>Several companies exist that will sequence your DNA to determine genetic relatives.</p>	
<p style="text-align: center;">Anchoring Phenomenon:</p> <p style="text-align: center;">Antibiotics do not work on viruses and may become less effective on bacteria over time.</p> <p>Students will explain the phenomenon using the following concepts:</p> <ul style="list-style-type: none"> ● Antibiotics target bacteria which are prokaryotic cells. ● Antibiotics do not work on viruses because they do not contain the same structures as living cells. ● Antibiotics may become less effective on bacteria over time because of random variations that may increase their fitness and cause genetic drift in a population. ● Viruses are similar to bacteria because they demonstrate random variations that may increase their fitness and cause genetic drift in a population. ● Bacteria and viruses can evolve into different strains that are identified through the DNA evidence. 			