

## Standard BIO.7

<p>BIO.7 The student will investigate and understand how populations change through time. Key concepts include</p> <ol style="list-style-type: none"> <li>evidence found in fossil records;</li> <li>how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;</li> <li>how natural selection leads to adaptations;</li> <li>emergence of new species; and</li> <li>scientific evidence and explanations for biological evolution.</li> </ol>	
<p style="text-align: center;"><b>Essential Understandings</b></p>	<p style="text-align: center;"><b>Essential Knowledge and Skills</b></p>
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none"> <li>A fossil is any evidence of an organism that lived long ago. Scientists have used the fossil record to construct a history of life on Earth. Although there is not a complete record of ancient life for the past 3.5 billion years, a great deal of modern knowledge about the history of life comes from the fossil record.</li> <li>Populations are groups of interbreeding individuals that live in the same place at the same time and compete with each other for food, water, shelter, and mates. Populations produce more offspring than the environment can support. Organisms with certain genetic variations will be favored to survive and pass their variations on to the next generation. The unequal ability of individuals to survive and reproduce leads to the gradual change in a population, generation after generation over many generations. Depending on the selective pressure, these changes can be rapid over few generations (i.e., antibiotic resistance).</li> <li>Genetic mutations and variety produced by sexual reproduction allow for diversity within a given population. Many factors can cause a change in a gene over time. Mutations are important in how populations change over time because they result in changes to the gene pool.</li> <li>Through his observations, including those made in the Galapagos Islands, Charles Darwin formulated a theory of how species change over time, called natural selection. Natural selection is a process by which organisms with traits well suited to an environment survive and reproduce at a greater rate than organisms less suited to that environment, and is governed by the principles of genetics. The change in frequency of a gene in a given population leads to a change favoring maintenance of that gene within a population and if so, may result in the emergence of a new species. Natural selection operates on populations</li> </ul>	<p>In order to meet this standard, it is expected that students will</p> <ul style="list-style-type: none"> <li>determine the relative age of a fossil given information about its position in the rock and absolute dating by radioactive decay.</li> <li>differentiate between relative and absolute dating based on fossils in biological evolution.</li> <li>recognize that adaptations may occur in populations of organisms over a period of time.</li> <li>describe the impact of reproductive strategies and rates on a population's survival.</li> <li>describe how genetic variation can lead to gradual changes in populations and the emergence of new species over time.</li> <li>predict the impact of environmental pressures on populations.</li> <li>explain how natural selection leads to changes in gene frequency in a population over time.</li> <li>compare and contrast punctuated equilibrium with gradual change over time.</li> </ul>

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  - emergence of new species; and
  - scientific evidence and explanations for biological evolution.

### Essential Understandings

over many generations.

- Depending on the rate of adaptation, the rate of reproduction, and the environmental factors present, structural adaptations may take millions of years to develop.
- Adaptations sometimes arise abruptly in response to strong environmental selective pressures, for example, the development of antibiotic resistance in bacterial populations, morphological changes in the peppered moth population, and the development of pesticide resistance in insect populations.
- Stephen Jay Gould's idea of punctuated equilibrium proposes that organisms may undergo rapid (in geologic time) bursts of speciation followed by long periods of time unchanged. This view is in contrast to the traditional evolutionary view of gradual and continuous change.

### Essential Knowledge and Skills

#### Directions:

1. Read the "Essential Understandings" and "Essential Knowledge and Skills."
2. On a separate sheet of paper, write 15 questions a teacher could put on a quiz or a test.
3. Write a key (the answer for each question).

#### Example:

**Q – What is the difference between Stephen Jay Gould's idea of "punctuated equilibrium" and the traditional evolutionary view of gradual and continuous change?**

**A – Punctuated equilibrium describes evolution as rapid, followed by long periods of no change.**