

Advisement Teacher & Room # _____

Biology Tutorial #17

Student Name _____ Tutor: _____

Biology Teacher's Name _____ Period _____

CA State Standard 8a: Students know how natural selection determines the differential survival of groups of organisms. 8b: Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment. 8d: Students know reproductive or geographic isolation affects speciation. 8e: Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

Evolution & Biodiversity: The biodiversity found on Earth today consists of many millions of distinct biological species, which is the product of nearly 3.5 billion years of evolution. Natural selection is the mechanism that causes evolution, or changes over a long period of time. It acts on physical traits (phenotype) and not on an individual's genes (genotype).

Natural selection is based upon four principles:

- Overproduction and competition. The individuals will compete for resources, and some individuals will survive to reproduce.
- Variation in a population's genes leads to different traits, through a mutation or through recombination.
- Adaptations are variations that are beneficial.
- Descent with modification is a principle which states that for natural selection to occur, the beneficial trait must be **heritable** (can be passed to and expressed in offspring).

Speciation is the evolutionary process by which new biological species arise, caused by Natural Selection pressures. A **species** is often defined as a group of organisms capable of interbreeding and producing fertile offspring. In order for **speciation** to occur, members of one species have to form separate populations and stop mating with one another. Several kinds of **barriers** can isolate populations and prevent mating.

1. Behavioral isolation is caused by differences in **courtship** or mating behaviors.
2. Temporal isolation occurs when **timing** prevents reproduction between populations. Increased competition for mates during the annual mating season may lead some members of a population to show signs of courtship at different times.
3. Geographic isolation involves physical barriers that divide a population into two or more groups. Natural physical barriers include mountains, rivers, lakes, and even human-made barriers.

Species Survival

Variation among species is critical for the **long-term survival** of different groups of organisms. Suppose the climate on Earth becomes very dry, even in the areas that were previously rainy. The decreased precipitation and humidity would select for individuals with traits that enabled them to thrive under dry conditions. A high level of diversity between different species increases the chance that at least some species will survive a major change.

Extinction events happen when the individuals within a species do not have adaptations that allow them to survive an environmental change. This information has been used to construct a scale of Earth's history based on major events, called the **geologic time scale**. In each of the four eras in the geologic time scale (Precambrian, Paleozoic, Mesozoic, and Cenozoic), new species have evolved while other species have become extinct. The **fossil record** includes all of Earth's fossils. By examining fossils from **extinct** species, scientists can study the history of life. Comparing fossils to existing species can provide clues about which species share common ancestors and about physical variations between species. The disappearance of many species from the fossil record in a relatively short period of time is called a **mass extinction**. There have been at least five mass extinctions in the last 600 million years. Most mass extinction events are followed by large-scale adaptive radiation and speciation events.

Answer the following questions:

1. What is the biological definition of "species"?
2. What is the definition of "evolution"?

3. List the 4 principles that allow Natural Selection to "work":

4. Overproduction is a reproductive strategy in which some animals have many offspring. With more offspring, it's more likely that some will survive to reproduce. Overproduction is a principle of
A) adaptation B) natural selection C) evolution D) mutation

5. According to natural selection, which kind of species will **most** likely survive environmental changes?
A) the smallest organisms B) the least mutated C) the best adapted D) the most important

6. Natural selection directly affects phenotypes, but indirectly affects _____.

7. The fossil record shows that two-thirds of burrowing lizard species survived a mass extinction. What is the best conclusion one could draw from this event?
A) Lizards generally had many advantages over other groups when circumstances
B) Diversity among lizard species' behaviors increased the chance that some species would survive.
C) Some species went extinct because they couldn't compete for resources.
D) The surviving species found new ways to survive the change in circumstances.

8. Two hypothetical apple tree species are closely related. However tree A produces fruit in August, while tree B begins fruiting in November and continues into the winter. Which of the following **barriers** *best* describes how these two species arose?
A) geographic isolation B) behavioral isolation C) temporal isolation D) emotional barriers

9. Name the eras of the geologic time scale:

10. In a sample fish population, can natural selection occur if the length of fins were NOT inheritable? Explain.

11. What is meant by the term diversity? What is meant by diversity of species?

12. Suppose a species of moth has light-colored and dark-colored phenotypes. The moths live in a forest in which the trees have mostly light-colored bark. Over time, human activities cause more and more soot to be produced, coating the trees and turning them darker. Using the principles of natural selection, explain how these environmental conditions might affect the phenotypes in the moth population.

13. Name another trait besides coloration that could be beneficial for a population of moths.