

Advisement Teacher & Room # _____

Student Name _____ Tutor: _____

Biology *Tutorial #16*

Biology Teacher's Name _____ Period _____

CA State Standard 7a - Students know why natural selection acts on the phenotype rather than the genotype of an organism. 7b. Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool. 7d. Students know variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

Natural selection is a theory that states that the individuals that are best adapted to their environment will survive and reproduce most successfully. Natural selection acts on physical traits and not on an individual's genes.

Phenotype and Genotype

The physical expression of a trait in an individual is called its **phenotype**. A phenotype is usually produced through the interaction of the alleles of several genes with each other and with the environment. Organisms don't inherit "traits." Instead, they inherit genes that code for the traits. The group of alleles that interact and that code for a given trait is called a **genotype**. Natural selection works on phenotype rather than on genotype because it is the physical expression of a trait that can allow individuals to better survive and reproduce. Environmental influences, such as nutrition, can also affect individuals living in the same environment differently. Natural selection acts on different phenotypes in a population. **Populations evolve**, not individuals.

Genetic Disease

An individual's collection of alleles is called a genotype. **Homozygous** genotypes contain two identical alleles (RR or rr). But **heterozygous** genotypes have two different alleles, one dominant and one recessive (Rr). Together, these alleles produce an individual's phenotype, or the physical expression of that trait. Alleles that produce a genetic disease or cause death are called **lethal alleles**. If the lethal allele is recessive, it will only be expressed in individuals that are homozygous recessive for the allele (rr). This means that individuals that are heterozygous (Rr) or homozygous dominant (RR) will not get the disease because the dominant allele is expressed.

The **gene pool** is the collection of all of the alleles in a population. Suppose that a recessive allele (r) is lethal. If an individual expresses the disease, the individual will die and not reproduce successfully. By not reproducing, that individual will not pass along any genetic information to offspring. **Heterozygous carriers** do not express the lethal trait, but they carry the allele that causes it and might pass the allele on to their offspring.

Genetic Variation: Within a Species

Natural selection acts on variation of traits that already exists in a population. When environmental conditions change, one of these preexisting traits may be more beneficial than the others. The most advantageous trait will be selected for. **Variation** describes the differences in traits between individuals in a population. If a population has great variation, the population has many different traits. In order for natural selection to work, these traits must be heritable. A **heritable** trait is one that is produced by an allele and can be passed from one generation to another through reproduction. There is generally **more variation** in sexually reproducing species (meiotic mixing) than in asexual species (identical clones).

Variation is important for natural selection because natural selection works on traits that already exist. The measure of an individual's ability to survive and reproduce is called **fitness**. The more advantageous traits an individual has, the more fit the individual is. As long as environmental conditions select for the beneficial trait, it will be passed on to successive generations and become more common in the population. If the **environment changes**, different traits may become beneficial, and the individuals with those traits will become more common. The **greater the variation** in traits, the more likely it is that some individuals of a population can **survive in a changing environment**.

Questions:

1. Natural selection is the theory that individuals that are best adapted to an environment will survive and produce more offspring than the individuals that are less well adapted. What does natural selection act on?
a) genotypes b) phenotypes c) alleles d) environment

2. Which of the following best describes the difference between phenotype and genotype?
 - a) All phenotypes are acquired, while genotypes are inherited.
 - b) A phenotype is the way a trait is expressed, while a genotype is the combination of alleles that codes for it.
 - c) A phenotype is a physical trait, while a genotype can be a biochemical or behavioral trait.
 - d) A phenotype is inherited only under favorable conditions, whereas genotypes can be inherited under any conditions.

3. A gene pool includes all of the
 - a) individuals in a population
 - b) mating pairs in a population
 - c) alleles in a population.
 - d) families in a population.

4. The group of alleles that interact and that code for a given trait is called a(n):
 - a) genotype
 - b) adaptation
 - c) phenotype
 - d) mechanism.

5. Why aren't lethal recessive traits expressed in heterozygotes?
 - a) Heterozygotes are too healthy to be affected by the recessive allele.
 - b) Heterozygous individuals have higher fitness than recessives.
 - c) The dominant allele is masked by the lethal recessive allele.
 - d) The lethal recessive allele is masked by the dominant allele.

6. When the environmental conditions change, natural selection will select individuals that
 - a) have the traits that are most beneficial
 - b) mutate in response to changing conditions
 - c) move to a different environment.
 - d) join members of another species in the area.

7. The collection of different traits within a population is called:
 - a) fitness
 - b) heritability
 - c) variation
 - d) selection

Analyze, Identify and Explain

8. What is an organism's genotype? What is an organism's phenotype?

9. Which population is more likely to survive an environmental change, one with great diversity or one with little diversity? **Explain.**

10. Does natural selection act on genotype or phenotype? **Explain.**

11. In a population of birds, one individual bird has particularly long wings, which make it better than its fellow birds at catching prey. However, this bird is sterile.
 - Is natural selection likely to act in this population to increase the number of birds with this long-winged trait in future generations? **Explain.**