**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class period:\_\_\_\_\_\_\_**

**Evolution-** *The change of species over time*Living Environment

For thousands of years, humans have been choosing organisms with desirable traits to breed and reproduce. Through **selective breeding**, humans have in a way controlled the *evolution* of organisms. The greatest example of selective breeding is the evolution of all modern day dogs from the gray wolf. Humans *chose* the most friendly dogs, and killed the dogs who could not be tamed or bit the hand of the feeder. The humans controlled, or selected, the genes that were being passed from generation to generation. Over time, the gray wolf **branched** into many different breeds of dogs with many different traits.

1. What is selective breeding?
2. What are two examples of selective breeding that have occurred in history?
3. What does it mean when it says that the grey wolf “**branched**” into different breeds?

**Evolution** is the change of a species over time. New traits and characteristics that appear in organisms can lead to the formation of a new species. For this reason, *sexual reproduction creates the greatest variety among organisms*. During **meiosis** and **fertilization**, the genes from the male and female gametes mix and match. This **genetic recombination** creates a new organism, with *new and unique* traits. The variation, or differences, from organism to organism is called **diversity**. Slow change over billions of years has created incredible diversity on Earth.

1. What is evolution?
2. What type of reproduction creates the greatest variety in organisms?
3. What is the mixing and matching of DNA during meiosis and fertilization called?
4. What is diversity?

Perhaps the most important change to drive the evolution of a species is **mutation**. Mutations are *completely random*, although there are some factors that *could* *increase* the likelihood of a mutation. Mutations are *changes in the genetic code* of an organism. If the genetic code, or *sequence of DNA*, is **altered**, then the protein traits of an organism can be affected. Sometimes mutations go unnoticed and do not change the final protein trait. Sometimes mutations are dangerous or even deadly. But sometimes, mutations create a new, unique characteristic *that gives the organism an advantage.* **Advantageous mutations** increase the likelihood that an organism will survive.

1. What is a mutation?
2. What are some factors that can increase the likelihood of a mutation?
3. What do genes code for?
4. How are advantageous mutations beneficial?

For example, the ancient ancestor of today’s brown bear and polar bear was a single bear with dark fur that lived in a snowy environment. One day, *a mutation occurred in a gamete* of a bear. Remember, a **gamete** is a sex cell. This mutation *did not* code for the dark fur pigment. In a snowy environment, the *white fur gave the bear a considerable* ***advantage***. The white bear was able to *sneak up on* ***prey*** and was also able to *avoid* ***predators***. This bear lived longer and *was able to produce more offspring.*

1. What is a gamete?
2. How was the mutation for white fur advantageous?

It is important to note that the mutation occurred in the **gamete**, or sex cell of the bear. *For this reason, the mutation was able to be passed on to her offspring*. Mutations in body cells will **only** affect the body cells of that organism. For example, cancer is a mutation in the body cells of an organism. All cells created by mitosis from the mutated cell will inherit the mutation, but an individual with cancer will not give birth to a child with cancer. **The mutation will not be passed on, unless it is in the sex cell.**

1. What is the significance of a mutation in a gamete?
2. Why don’t body cell mutations get passed on to offspring?

Remember, in nature *it is all about reproduction*. Reproduction is not necessary for an individual to survive, but is necessary for the continuation of that species. Because the mutation occurred in the sex cell of the bear, through reproduction, this advantageous mutation was *passed on*. More and more white bears were created, who continued to have an advantage over dark bears in the snow. The **environment** of the bears *naturally* increased the likelihood that the white bears would survive, and *naturally* allowed the population of white bears to *increase over time*. The brown bear was pushed away and moved to a different environment, where it was **better adapted** to survive. **Natural selection** is the *process by which organisms that are best made for their environment survive and reproduce*. This is sometimes called “**survival of the fittest**.” Over time, the white bear, which was *better suited* for the snowy environment, evolved into the polar bear. The dark bear, which was *better suited* for a forest environment, evolved into brown bears and grizzly bears.

1. Why is reproduction necessary?
2. How did the environment affect the survival of the white bears?
3. Why did the brown bear leave the snowy environment?
4. What is natural selection?

*Mutation by chance, sexual reproduction, environmental conditions*, and *natural selection* has driven the evolution to not only create different species of bears, but to create all of the diversity of life on earth today! ☺

1. What are four factors that drive evolution?