

## Natural and Artificial Selection

### Mechanism of Evolution: Biological Change in Wild & Domestic Animals

by Tami Port

Natural selection is the driving force of evolution. The environment selects the winners and losers. In artificial selection we are the shapers of other living things.

#### What Is Natural Selection?

Natural selection is the mechanism of evolution, the process in nature by which only the organisms that are best adapted to their environment tend to survive and transmit their genetic characteristics to the next generation. Individuals less well adapted to their environment tend to be eliminated, where *environment* represents the combined biological and physical influences.

#### Natural Selection Example: *The Peppered Moth*

The peppered moth (*Biston betularia*) is a temperate nocturnal moth species that provides us with a great example of natural selection.

##### *The Peppered Moth Pre-industrial Revolution*

The common color of peppered moths was light grey (*Biston betularia f. typica*), and this color type represented the predominant form in England prior to the beginning of the industrial revolution. The moth's light grey color closely matched the lichen-covered trees in their environment. (Lichens are a slow growing life form that you can find on the bark of many trees and in decomposing wood).

There was also a genetic color variant in the moth population that resulted in some very dark colored moths (*Biston betularia f. carbonaria*) but this dark-colored moth was relatively rare. Their numbers remained low because when these dark moths landed on the light grey lichen-covered trees, they were easy targets for predators.

##### *The Peppered Moth after the Advent of Industry*

Early coal-based industry was extremely dirty. Around large cities, everything was essentially covered in soot. This high level of pollution killed the light grey lichens on trees and the bark became much darker in appearance.

When the light-colored peppered moths landed on the same trees they had always landed on, they were extremely visible against the dark bark, and easy targets for predators. The dark colored moth variant was now harder for predators to spot and these darker trees more often lived long enough to reproduce.

Over generations, the polluted environment continued to favor darker moths, and they progressively became more common. By the late 19th century, 98% of the moths near cities were black.

*Biston betularia in an Era of Modern, Cleaner Industry*

Modern air pollution controls have cleaned up the environment compared to the early days of the industrial revolution. The cleaner environment has allowed the lichens to grow back, and the trees have returned to a lighter in color. Now, natural selection favors lighter moth varieties so they have become the most common and the dark-colored variant is again rare.

*Artificial Selection Example: Dog Breeding*

Artificial selection is when we, humans, act as the “environmental pressure.” An example is when we choose dogs with certain traits and breed them together to accentuate the traits we desire.

All modern domestic dogs, no matter how different they are in appearance, from Chihuahua to Great Dane, all belong to the same species, *Canis lupus familiaris*. The originator of today’s domestic dog was the gray wolf (*Canis lupus*), and by incrementally selecting for certain traits, we have created a variety of dogs that differ widely in appearance and temperament.

Name \_\_\_\_\_ Date \_\_\_\_\_

### Peppered Moth Worksheet

**Directions:** Answer each question in complete sentences.

1. What does variation mean?

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2. What variation in peppered moths does this article describe?

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3. Why were dark-colored peppered moths successful during the Industrial Revolution in England?

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4. What do you think would have happened to the peppered moth population during the Industrial Revolution if a dark variety of the species had not existed?

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5. Why are dark-colored peppered moths rare today?

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**Directions:** Answer the following question in a paragraph on a separate sheet of paper. Use the following words in your paragraph: **variation**, **adaptation**, and **natural selection**.

6. How is the peppered moth story an example of natural selection?