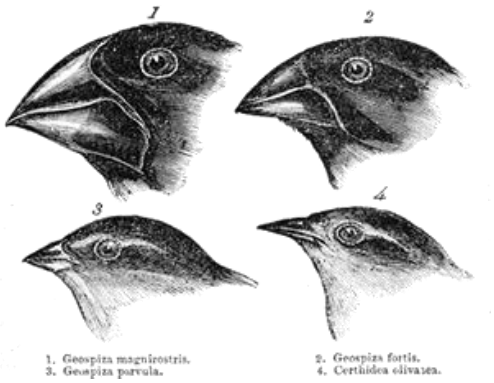
WEEK 3 Please read the following introduction to evolution before completing any assignments.

EVOLUTION

Look at the picture of an *Archaeopteryx*. Does it look similar to any other organisms on Earth? It appears to look similar to some modern day birds. *Archaeopteryx* has even been referred to as the earliest bird.

This creature is thought to have been a bridge between dinosaurs and modern birds.

Organisms like *Archaeopteryx* help scientists determine how today's organisms have developed. Charles Darwin, a British naturalist, had a theory about how organisms may have changed over time. In the 1900s, Darwin studied many plants and animals, including finches, from the Galápagos Islands of South America. He collected and studied different finches, comparing them to each other as well as those that were closer to the mainland of South America. At the time, Darwin assumed they were just different birds, but he realized that they were all different types of finches. In England, he studied their different features, such as beak size. He found that finches from different islands had different beak sizes, which scientists later concluded were a result of their differing diets. Birds with different beaks ate different foods.



The vegetarian finch has a curved beak that helped it pick large berries from branches. The cactus finch had a narrower beak that helped it to dig into small areas, such as holes, to find insects.

Darwin's observations helped shape his theory of evolution. **Evolution** is the process by which modern organisms descended and developed from older organisms. Evolution helped explain how the finches Darwin collected showed different traits. The birds on different islands evolved differently. In addition to his own observations, others also influenced Darwin's theory of evolution, which explained how populations of organisms could change over time. One influential idea that affected Darwin's thinking was **artificial selection**, or the practice of breeding animals or plants to have desired traits. In artificial selection, humans select for a desired trait by breeding two parents with that trait, for example chickens with small tail feathers. This produces offspring that are more likely to have small tail feathers, showing how traits change and spread in a population from generation to generation.

This chicken may have been bred to have large tail feathers.

Each of these birds looks very different, but they are all types of finches that evolved differently from the same ancestor.

Jean Baptiste Lamarck also influenced Darwin. He believed that organisms could acquire traits that they needed for survival and also pass those traits on to their offspring. For example, over time a dog could develop strong legs to run faster, and if running faster was beneficial for the dog's survival, it could pass the trait on to its offspring. This idea was disproved because acquired traits are not part of an organism's DNA and cannot be passed on to the offspring. However, the idea that organisms could change and acquire certain traits for survival greatly influenced Darwin's thinking.

Charles Lyell believed that over hundreds of millions of years, small changes in rock collected on the Earth. Darwin believed that since the Earth was very old, very small changes had enough time to add up.

Another idea about the Earth and environment also influenced Darwin. He read an essay by Thomas Malthus about population growth and factors that could limit population growth. He believed that the organisms that survived some of these factors, such as disease and competition for food, must have had traits that helped them survive. He believed that organisms passed these traits on to their offspring.

NATURAL SELECTION

Charles Darwin believed that organisms changed over time through evolution, but how exactly do organisms evolve? Darwin hypothesized that most organisms evolved through natural selection. **Natural selection** is the process by which well-adapted organisms survive and reproduce more successfully in an environment than less well-adapted organisms. There are four important parts of natural selection: overproduction, genetic variation, selection, and adaptation.

- As a result of *overproduction*, not all plants or animals that are born will survive to adulthood.
- *Genetic variation* can happen within a specific group of organisms when there are natural differences, or variations, that can be passed down from parent to offspring.
- During *selection*, these variations can be traits that are advantageous to survival of an organism. The helpful traits are "selected for" because organisms with the helpful traits are more likely to survive and pass the traits to their off spring. Over time, the traits become more likely to appear in the next generation.
- With *adaptation*, specific adaptations are inherited traits that help organisms survive. These can appear from one generation to the next.

Plants and animals oftentimes reproduce more offspring than the environment can handle, which causes overproduction. Only some of the offspring make it to adulthood. Of the offspring that do survive and make it to adulthood, only a few of them are able to successfully reproduce.

Within a population of organisms, there are variations, or natural differences, that can be passed down from parent to offspring. **Variation** is any difference among organisms of a particular species. For example, the tails of some spider monkeys may be longer than others. This difference could be due to change in genetic material, or a **mutation**. Genetic variations can change over time and as each new generation of offspring is produced, new genetic differences may be introduced into the population. More genetic variation means there is a higher chance of some individuals having traits that are more advantageous to survival.

These spider monkeys all survived to adulthood, but it is possible they may not all be able to reproduce and create new offspring.

CONVERGENT EVOLUTION

Organisms are grouped together with other organisms that have similar characteristics. However, organisms that are not related sometimes evolve similar characteristics, but they do not have a common ancestor. **Convergent evolution** is the process by which unrelated organisms evolve similar characteristics as a result of having to adapt to similar environments. For example, bats and butterflies both have wings, but their wing structures are very different. Bats and butterflies are unrelated organisms that both developed the ability to fly, but they do not have a common ancestor.

A bat and a butterfly evolved similar characteristics as a result of convergent evolution.

These questions are NOT required, however, they will help you check your own understanding.

EVOLUTION SECTION QUESTIONS;

1. What is an organism?
    a. A tool used to study individual forms of life
    b. An individual form of life
    c. A unit used to measure individual forms of life
    d. A man-made object
2. All of the birds in the picture on page 1 are types of finches, though they do not look the same. The different finches changed over time. The study of these finches led _____ to his theory of _____.
3. How did artificial selection influence Darwin's ideas about organisms?
    a. It showed that organisms could acquire (or get) traits and pass them on to their offspring
    b. It showed that traits could change and spread through populations
    c. It showed that organisms have traits that help them survive and can pass them onto their offspring
    d. It showed that the Earth was old enough for small changes in organisms to add up
4. What is artificial selection?
    a. The practice of breeding humans to have desired traits
    b. The practice of removing desired traits from an animal or plant embryo
    c. The practice of removing desired traits from a human embryo
    d. The practice of breeding animals or plants to have desired traits

NATURAL SELECTION SECTION QUESTIONS:

1. *Animal A* is very fast. It can catch and eat many organisms, as well as run away quickly from other animals that may try to harm it. *Animal B* is not very fast. It is not able to catch any animals to eat, and it is not fast enough to run away from animals that can harm it. Over time, *Animal A* produces many offspring that continue to reproduce, but *Animal B* dies out. This is an example of _____.
    a. Spontaneous generation
    b. Convergent evolution
    c. Natural selection
    d. Homeostasis
2. An adaptation is _____.
    a. A trait that is detrimental (bad) to an organism's survival
    b. A trait that disappears hallway through an organisms life
    c. A trait that an organism shares with its parents but not its offspring
    d. A trait that helps an organism survive and reproduce in its environment
3. True or False: A plant or animal offspring is guaranteed to survive and reproduce.

    _____

CONVERGENT EVOLUTION SECTION QUESTIONS:

1. Which set of pictures shows an example of convergent evolution?

2. Bats and mosquitoes both have wings, but their structures are different. What process explains how this happened?
   a. Artificial selection
   b. Natural selection
   c. Spontaneous generation
   d. Convergent evolution

3. Evidence suggests that giraffes once had short necks. How does natural selection explain why giraffes now have long necks?

_____
_____
_____
_____

OPTION 4

NAME: _____ PERIOD: _____

ADAPTATIONS ABOUND!

Directions: Pick an organism (plant or animal) and write about the adaptations it has that help it to survive. Please make sure to use complete sentences where necessary.

DRAW A PICTURE OF YOUR ORGANISM

NAME OF ORGANISM:

WHAT TYPE OF ORGANISM IS IT?

WHERE IS THIS ORGANISM FOUND?

WHAT PARTS DOES IT HAVE THAT HELP IT TO SURVIVE? (PHYSICAL ADAPTATION)

WHAT DOES IT DO THAT HELPS IT TO SURVIVE? (BEHAVIORAL ADAPTATION)

OPTION 5

A look at the role of homologous structures in evolutionary tree of life

By Heather Scoville, ThoughtCo., adapted by Newsela staff on 09.12.19
Word Count **729**
Level **840L**

Image 1. A humpback whale jumps in the water. Whales have flippers, which contain homologous structures to human legs and arms. Photo by: AlbertoLoyo/Getty Images

Have you noticed the similarities between a human hand and a monkey's paw? These are homologous structures. A homologous structure is an organ or body part in one species that closely resembles an organ or body part in another species. A species is a group of organisms that are able to successfully reproduce with one another.

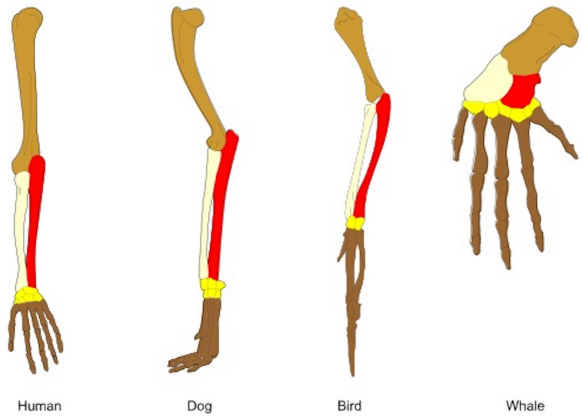
Homologous structures help scientists classify and organize animal life on this planet. Scientists say these similarities show that life on Earth shares a common ancient ancestor. Many or all other species evolved from this one ancestor over time. The development of homologous structures are evidence of this common ancestry.

Limb Structures

When organisms are closely related, their homologous structures can be very similar. For example, many mammals have similar limb structures. The flipper of a whale, the wing of a bat, and the leg of a cat are all very similar. They are also all similar to the human arm.

Each of these limb structures has one large upper "arm" bone. The lower part of the limb is made of two bones. There is a larger bone on one side and a smaller bone on the other side. These species also have a collection of smaller bones in the "wrist" area. In humans, these bones are called carpal bones. These carpal bones lead into the fingers.

These bone structures may be very similar in different species; however, the functions of these structures can be very different. Limbs can be used for flying, swimming or walking. Humans use their arms for many tasks. These functions evolved through natural selection over millions of years. Natural selection is an idea about the way living things have developed. It says that creatures with useful traits are more likely to survive and reproduce. When they reproduce, they pass their useful traits on to their offspring.



Taxonomy System

Carolus Linnaeus was a Swedish plant scientist who lived in the 1700s. He created a system of taxonomy. In biology, taxonomy is the science of naming and categorizing organisms. In Linnaeus' system, species were classified mainly based on their looks. As time passed and technology improved, the classifications changed. Homologous structures became more important in deciding the final placement of animals on the evolutionary tree of life. This tree shows relationships among different species.

Linnaeus' taxonomy system places species into broad categories. The broadest category in his system was "kingdom." An organism might belong to the plant kingdom or the animal kingdom, for example. The second broadest category is "phylum." In order from broad to specific, the next categories are class, order, family, genus and species.

As technology evolved, it allowed scientists to study life at the genetic level. Using genetic information, scientists updated the categories to include "domain." Today, domain is the broadest category in our taxonomy system. All organisms are grouped by domain. They are grouped according to genetic information found in their cells.

Technological Advances

Changes in technology have affected the way scientists categorize species. For example, whales were once classified as fish. Like fish, they live in water and have flippers. But it was discovered that those flippers were homologous to human legs and arms. Whales were then moved to a part of the tree more closely related to humans. Further genetic research has demonstrated that whales may be closely related to hippos.

Scientists originally thought that bats were closely related to birds and insects. Everything with wings was put into the same branch of the evolutionary tree. After the discovery of homologous structures, it became clear that not all wings are the same. All wings are designed to help animals get airborne; however, wings can be very different in their structures. For instance, the bat wing resembles the human arm in structure, but bird and insect wings are very different. Scientists realized that bats are more closely related to humans than to birds or insects.

Today, homologous structures are accepted as evidence of evolution. This was not always the case. In the past, researchers couldn't analyze and compare DNA between species. But today, researchers use DNA to confirm that species with homologous structures are related.

Short Response:

1. What does homologous mean?

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2. What are some body parts that humans have that are similar to other organisms?

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3. Why do we no longer classify whales as fish?

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Quiz

1 Read the section "Technological Advances."

Which sentence from the section shows why scientists use DNA to group different species of animals?

(A) Changes in technology have affected the way scientists categorize species.

(B) Further genetic research has demonstrated that whales may be closely related to hippos.

(C) In the past, researchers couldn't analyze and compare DNA between species.

(D) But today, researchers use DNA to confirm that species with homologous structures are related.

2 Read the paragraph from the section “Limb Structures.”

> *These bone structures may be very similar in different species; however, the functions of these structures can be very different. Limbs can be used for flying, swimming or walking. Humans use their arms for many tasks. These functions evolved through natural selection over millions of years. Natural selection is an idea about the way living things have developed. It says that creatures with useful traits are more likely to survive and reproduce. When they reproduce, they pass their useful traits on to their offspring.*

Which of the following is an accurate explanation of what this paragraph means?

(A) Homologous structures can be used for many different purposes and are passed down through genetic material.

(B) Homologous structures help animals survive and spread their genes to the next generation.

(C) Homologous structures are found in animals that live in similar environments even if the limbs are very different.

(D) Homologous structures are only found in mammals and animals that live on land.

3 The word "species" is essential to the understanding of homologous structures.

Which sentence from the article explains what "species" means?

(A) A homologous structure is an organ or body part in one species that closely resembles an organ or body part in another species.

(B) A species is a group of organisms that are able to successfully reproduce with one another.

(C) These bone structures may be very similar in different species; however, the functions of these structures can be very different.

(D) In order from broad to specific, the next categories are class, order, family, genus and species.

4 Read the following paragraph from the section "Technological Advances."

> *All wings are designed to help animals get airborne; however, wings can be very different in their structures. For instance, the bat wing resembles the human arm in structure, but bird and insect wings are very different. Scientists realized that bats are more closely related to humans than to birds or insects*

What is the meaning of the word "resembles" as it is used in the paragraph above?

(A) to be the same size

(B) to appear different

(C) to look like

(D) to have many parts