Objective: 8.L.4.1

Evidence of Biological Evolution

Key Words • homologous structures • analogous structures • vestigial structure • embryology • embryo

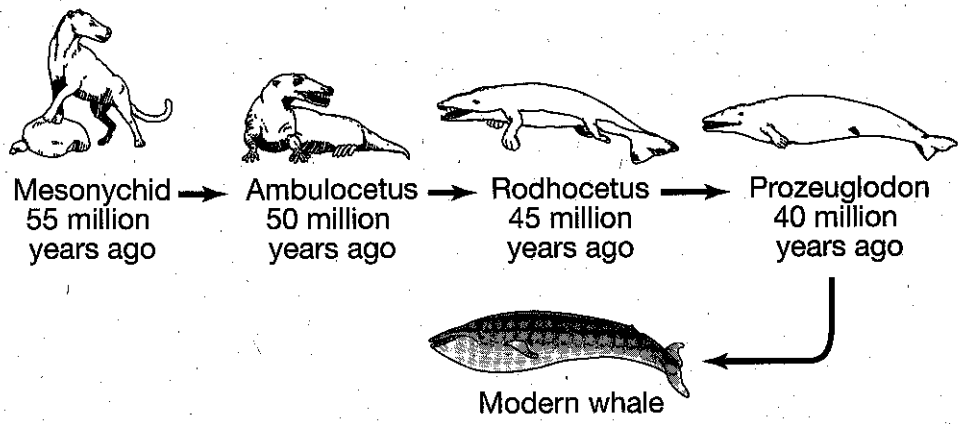
Getting the Idea

Scientists look at many kinds of data to try to piece together the evidence of the evolution of organisms. In part, these data come from observing fossils, examining genetic information, and studying different species. These data help scientists learn how and why adaptations arise, how new species develop, and why many species are now extinct.

Fossil Evidence for Evolution

Recall from Lesson 28 that fossils are the preserved remains or evidence of organisms that lived in the past. You learned that scientists often use fossils to determine when rock layers formed. The opposite is also true. If scientists know how old rock layers are, they can draw conclusions about the ages of fossils formed in those layers.

A series of related fossils found in different rock layers can show how organisms changed over time. Whales are descended from land animals related to deer and hippos. The fossil record shows how whales adapted to live in the water. Over many generations, their legs shrank and then disappeared. The legs were replaced by flukes, which whales use to swim. Whales also became more streamlined, which helps them move through water. Their nostrils moved toward the top of the head, so whales can breathe at the surface of the ocean.



Chapter 7 • Lesson 31

Objective: 8.L.4.1

Evidence of Biological Evolution

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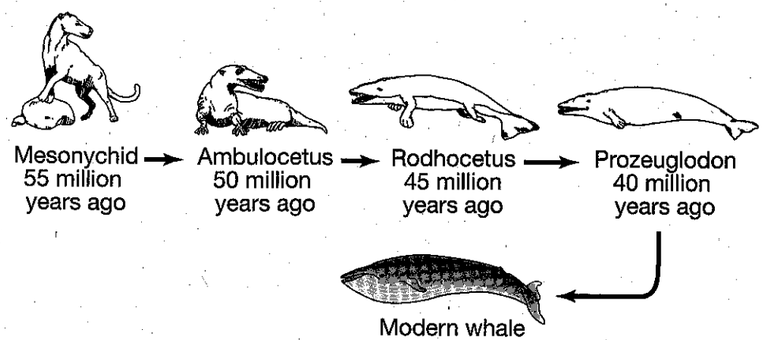


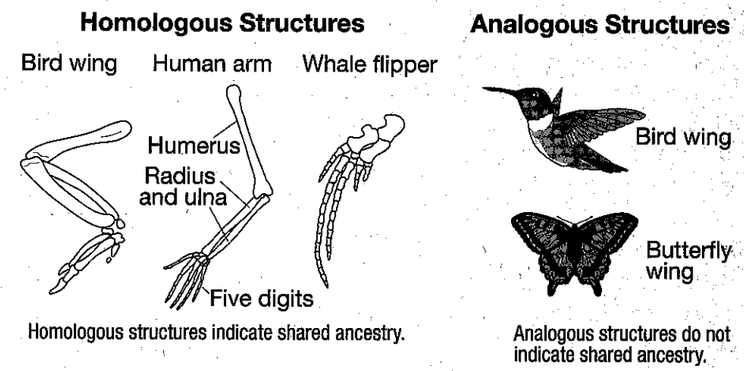
Duplicating any part of this book is prohibited by law.

Fossil evidence also suggests an evolutionary relationship between birds and dinosaurs. Living birds, fossils of birds, and the fossils of a group of dinosaurs called *theropods* have some similar physical structures. Based on this evidence, most scientists have concluded that modern birds evolved from theropods.

Structural and Developmental Evidence for Evolution

Many species of organisms have similar structures. For example, both turkeys and blue jays have feathers. The presence of feathers suggests that the two animals are related in some way. Scientists often study the physical features and structures of organisms to try to discover how organisms are related.

Homologous structures are body parts of different organisms that have a similar structure but not necessarily a similar function. Look at the left side of the diagram below. It shows that the human arm, the wing of a bird, and the flipper of a whale are homologous structures. Although they are used in different ways, they are all composed of very similar bones. Homologous structures indicate that organisms have evolved from a common ancestor.



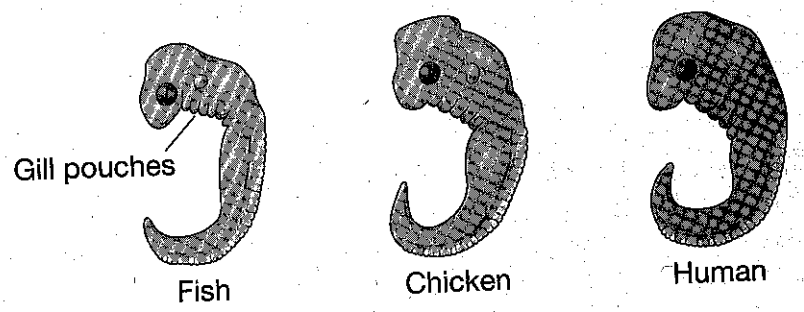
Homologous structures indicate shared ancestry.

Analogous structures do not indicate shared ancestry.

Analogous structures are body parts that have a similar function but not a similar structure. Analogous structures, like those shown on the right side of the diagram above, do not indicate shared ancestry. The wing of a bird is supported by bones. The wing of a butterfly does not have any bones. This difference shows that flight evolved separately in unrelated organisms.

Scientists also examine vestigial structures. A **vestigial structure** is a body part that does not seem to play a role in the body functions of an organism. Rats have an appendix that appears to function in digestion. Humans also have an appendix, but its function is unknown and it is not essential for survival. The human appendix is an example of a vestigial structure. The presence of an appendix in both rats and humans suggests that these organisms evolved from a common ancestor.

Embryology is the study of embryos. An **embryo** is an early stage in the development of an organism. The embryos of related organisms develop in similar ways. Often, embryos have structures that are not present in the adult form of the organism. The diagram below shows that the embryos of fish, chickens, and humans look very similar. They all have folds called gill pouches in the neck region. These folds develop into gills in adult fish. Although adult chickens and humans do not have gills, the similarities in their embryos suggest that the organisms are related.



Genetic Evidence for Evolution

Scientists have also learned about evolution by analyzing DNA. You have learned that DNA is a very large molecule made of repeating units. The order of units is a code that determines an organism's traits. Similarities in DNA sequences can be used to show common ancestry. The more similarities found in the DNA sequences of two species, the more recently the species evolved from a common ancestor.

Distribution of Organisms

The places where related species are found are also evidence of evolution. When organisms travel to new environments, they may evolve into new species. The plants and animals of the Galápagos Islands are examples.

Recall that Darwin traveled to the Galápagos Islands. Many species of plants and animals he found closely resembled the ones on the nearest mainland. Darwin concluded that mainland species migrated to the islands, where they eventually evolved into new, distinct species. Only animals that could fly or survive in salt water could make the trip from the mainland. Seeds of mainland plants may have been carried to the islands by wind or water.

Scientists think that Earth's lithosphere was once one giant landmass. The movement of tectonic plates has resulted in the landmasses we know today. Many species on different landmasses once had a common ancestor. They evolved differently when they became separated.

Areas such as Australia, New Guinea, and New Zealand have been separated from other landmasses for millions of years. They have distinct sets of organisms not found in other areas of the world. Australia has large populations of egg-laying mammals, called *monotremes*, and pouched mammals, called *marsupials*. Monotremes and most species of marsupials are found only in Australia and New Guinea.