

Chapter 5-12: Adaptive Radiation

The forces of mutation, natural selection, gene flow, and other phenomena on our planet have been at work for over three billion years. They have shaped and molded the many life forms on Earth and have been responsible for the development of billions of species. A great number of these species have become extinct as conditions on Earth changed, and many left behind evidence of their existence in the form of fossils. By studying the fossil record, scientists have pieced together the histories of many of these creatures.

Repeatedly, scientists have found that organisms move into and colonize new habitats, utilize new resources, and occupy new geographic areas. These movements give rise to an evolutionary pattern known as adaptive radiation. In this plate, we will describe this process.

Notice that we are presenting a series of now-extinct species as well as the species into which they evolved. You should use bold colors such as reds, greens, blues, and purples for this plate, since these structures are relatively large.

Some adaptations involve the movement of organisms into new geographic areas where they may find more resources and fewer predators. This is referred to as adaptive radiation. As the species spread out they discover niches that suit them and exploit new areas for growth and reproduction. The processes of speciation and isolation lead to the introduction of species into areas.

This plate describes adaptive radiation as it occurred in prehistoric times to create creatures that are now extinct. The pattern begins in one corner of the art with an **ancestral reptile (A)**, and in the opposite corner, with an **ancestral mammal (B)**. As we see in the plate, the ancestral reptile and the ancestral mammal gave rise to similar animals that existed in similar environmental niches.

The **adaptive radiation (C)** of both the ancestral reptile and the ancestral mammal are indicated by the curved arrows. Note that the ancestral reptile gave rise to a creature that successfully invaded the air. This creature is the **pterosaur (D₁)**. When the pterosaur and its relatives became extinct, this geographic niche was left open and the ancestral mammal, the **bat (D₂)**, took it over.

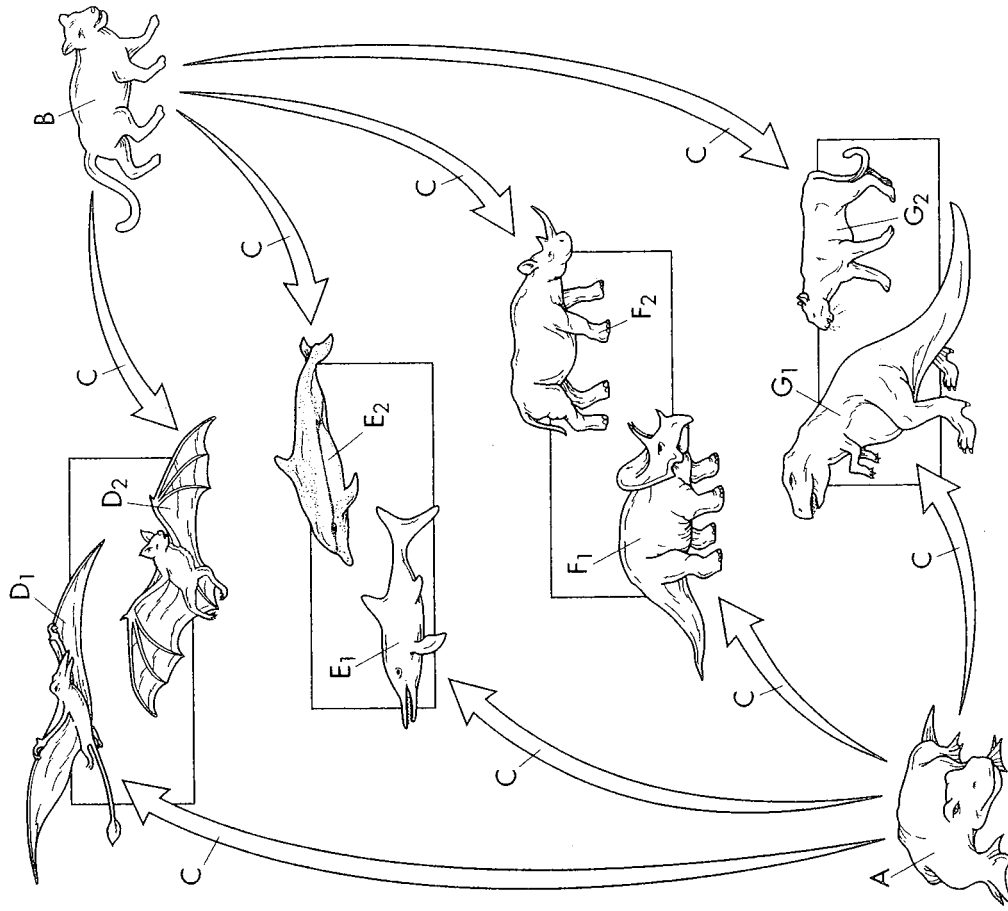
We have begun our study of adaptive radiation by showing how both an ancestral mammal and reptile gave rise to animals that filled a geographic niche available in the air. We now continue with other examples of adaptive radiation.

The ancestral reptile and the ancestral mammal both gave rise to animals that inhabited the sea. The ancestral reptile gave rise to an animal called the **ichthyosaurus (E₁)**. When the ichthyosaurus became extinct and its niche was available, the ancestral mammal gave rise to the **porpoise (E₂)**. Modern animals that share this niche include the dolphin, shark, seal, penguin, and fish. All of the animals that evolved to inhabit the ocean share some characteristics—the evolution of similar characteristics that enables animals to inhabit the same environment is called convergent evolution. Because they were subjected to the same environmental forces, the porpoise (a mammal), shark (a fish), penguin (a bird), and seal (a mammal) independently evolved similar shapes. For instance, they all possess streamlined bodies that enable them to move quickly through water.

Adaptive radiation also occurred from the ancestral reptile to yield a **triceratops (F₁)**, which was a plant-eating animal. After it became extinct, its environmental niche was left open, and the ancestral mammal gave rise to the **rhinoceros (F₂)**.

We have now shown that adaptive radiation leads to the evolution of new species, and that convergent evolution produces organisms that, though they are different species, share certain characteristics. We will now look at a final example of adaptive radiation.

One ancestral reptile gave rise to the familiar dinosaur **tyrannosaurus rex (G₁)**. *T. rex* was a carnivore (a meat-eating animal) and after it became extinct, about 65 million years ago, its niche was left open. Adaptive radiation eventually gave rise to an animal that filled the niche of *T. rex*, the **lion (G₂)**. Note that much convergent evolution did not occur; the lion is not nearly the size of *T. rex*; however, it performs the same function in the community because it is a carnivore.



Adaptive Radiation

☐ Ancestral Reptile.....A	☐ Bat.....D ₂	☐ Rhinoceros.....F ₂
☐ Ancestral Mammal.....B	☐ Ichthyosaurus.....E ₁	☐ Tyrannosaurus rex.....G ₁
☐ Adaptive Radiation.....C	☐ Porpoise.....E ₂	☐ Lion.....G ₂
☐ Pterosaur.....D ₁	☐ Triceratops.....F ₁	

5.12 Adaptive Radiation

- What has happened to a lot of species as Earth changed over the years?
- What evidence have these species left behind?
- When organisms move into & colonize new habitats, utilize new resources & occupy new geographic areas:
- Adaptive radiation (speciation & isolation) leads to the formation of new:
- Why do some organisms move to new geographical areas?
- The ancestral reptile gave rise to what four animals shown?
- The ancestral mammal gave rise to what four animals shown?
- The evolution of similar characteristics that enables animals to inhabit the same environment: