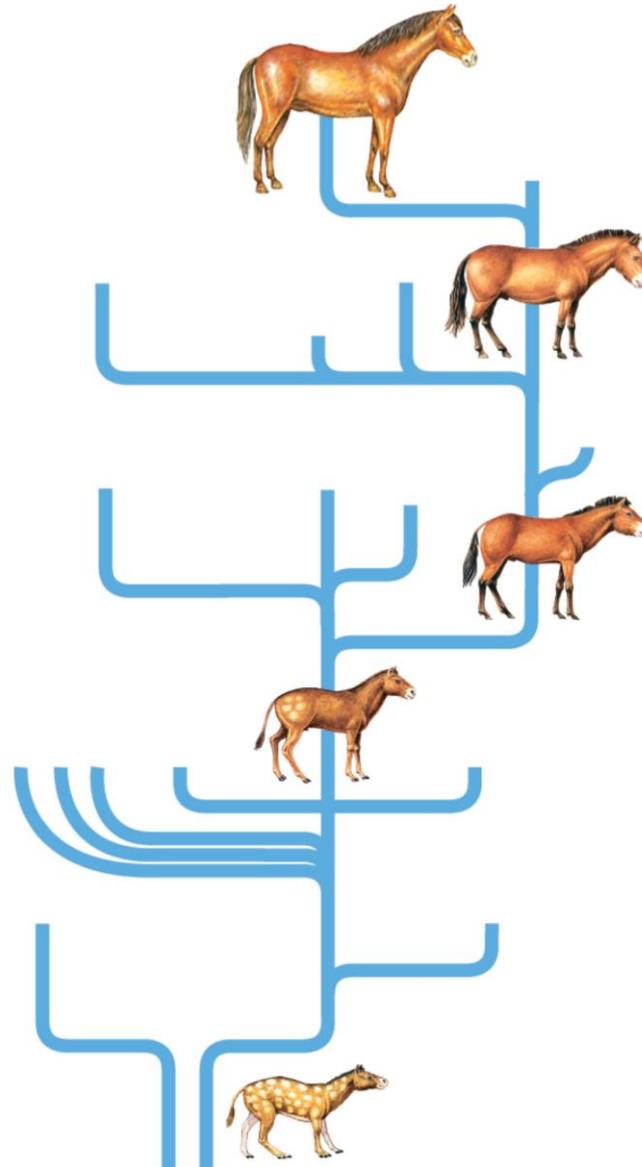


17-4 Patterns of Evolution



Macroevolution refers to large-scale evolutionary patterns and processes that occur over long periods of time.



Six important topics/patterns in macroevolution are:

- **extinction**
- **adaptive radiation**
- **convergent evolution**
- **coevolution**
- **punctuated equilibrium**
- **changes in developmental genes**

Extinction

More than 99% of all species that have ever lived are now extinct.

In the past, most researchers looked for a single, major cause for each mass extinction.

Many paleontologists now think that mass extinctions were caused by several factors.

What effects have mass extinctions had on the history of life? Mass extinctions have:

provided ecological opportunities for organisms that survived

resulted in bursts of evolution that produced many new species

Adaptive Radiation

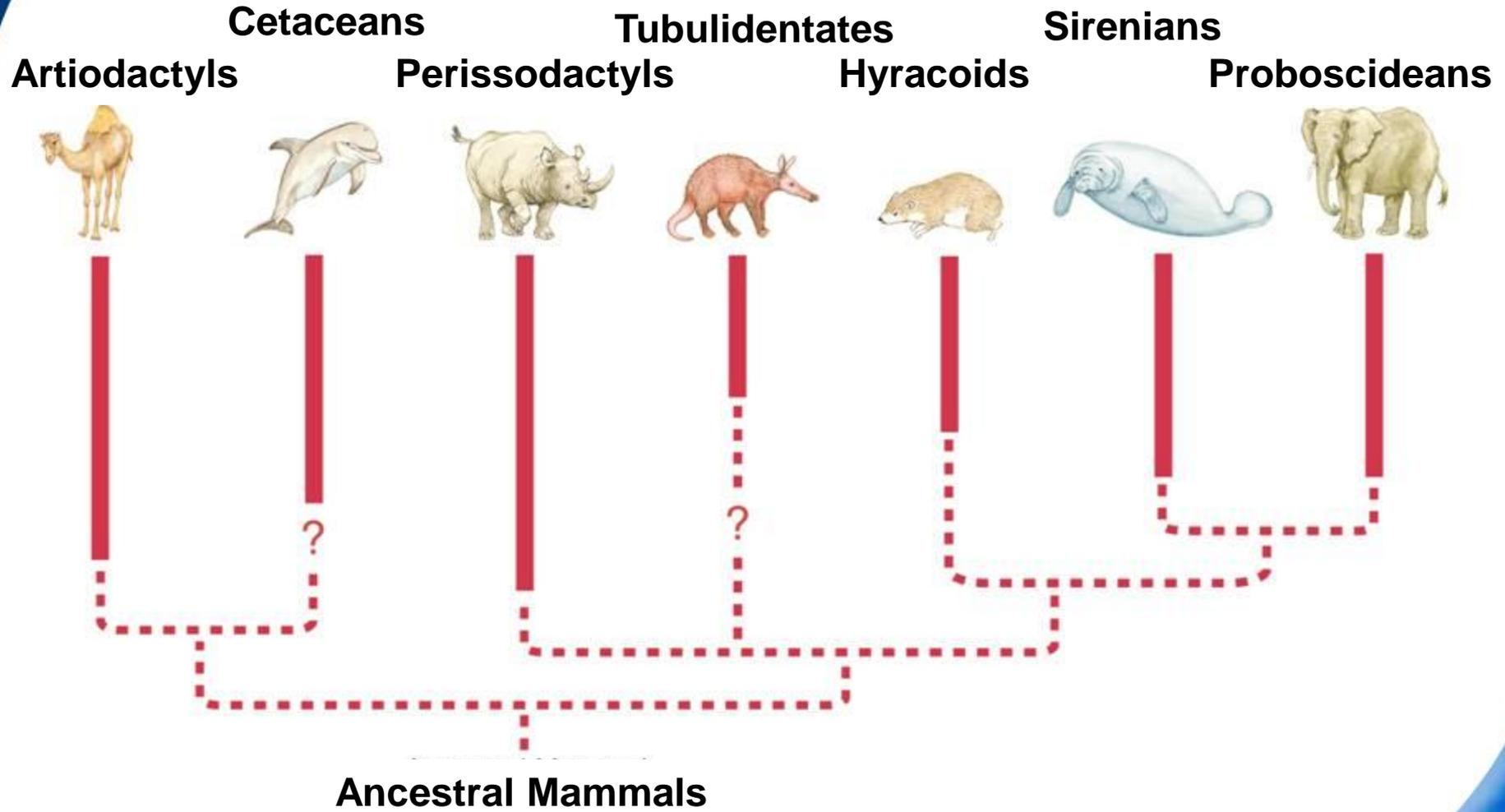
Adaptive radiation is the process by which a single species or a small group of species evolves into several different forms that live in different ways.

For example, in the adaptive radiation of Darwin's finches, more than a dozen species seem to have evolved from a single species.

Adaptive radiations can occur on a much larger scale.

The disappearance of dinosaurs then resulted in the adaptive radiation of mammals.

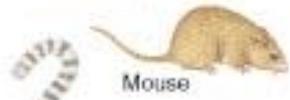
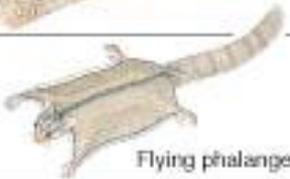
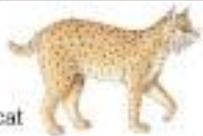
Adaptive Radiation of Mammals



Convergent Evolution

Different organisms undergo adaptive radiation in different places or at different times but in similar environments.

The process by which unrelated organisms come to resemble one another is called **convergent evolution**.

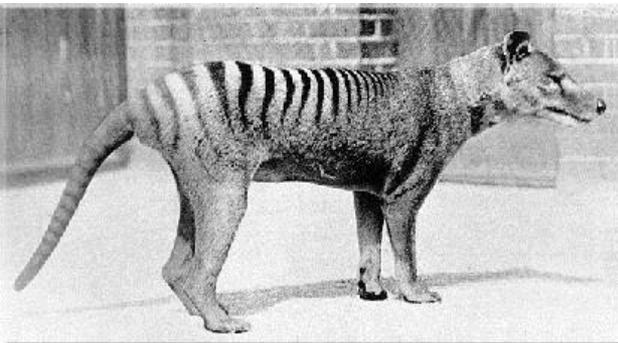
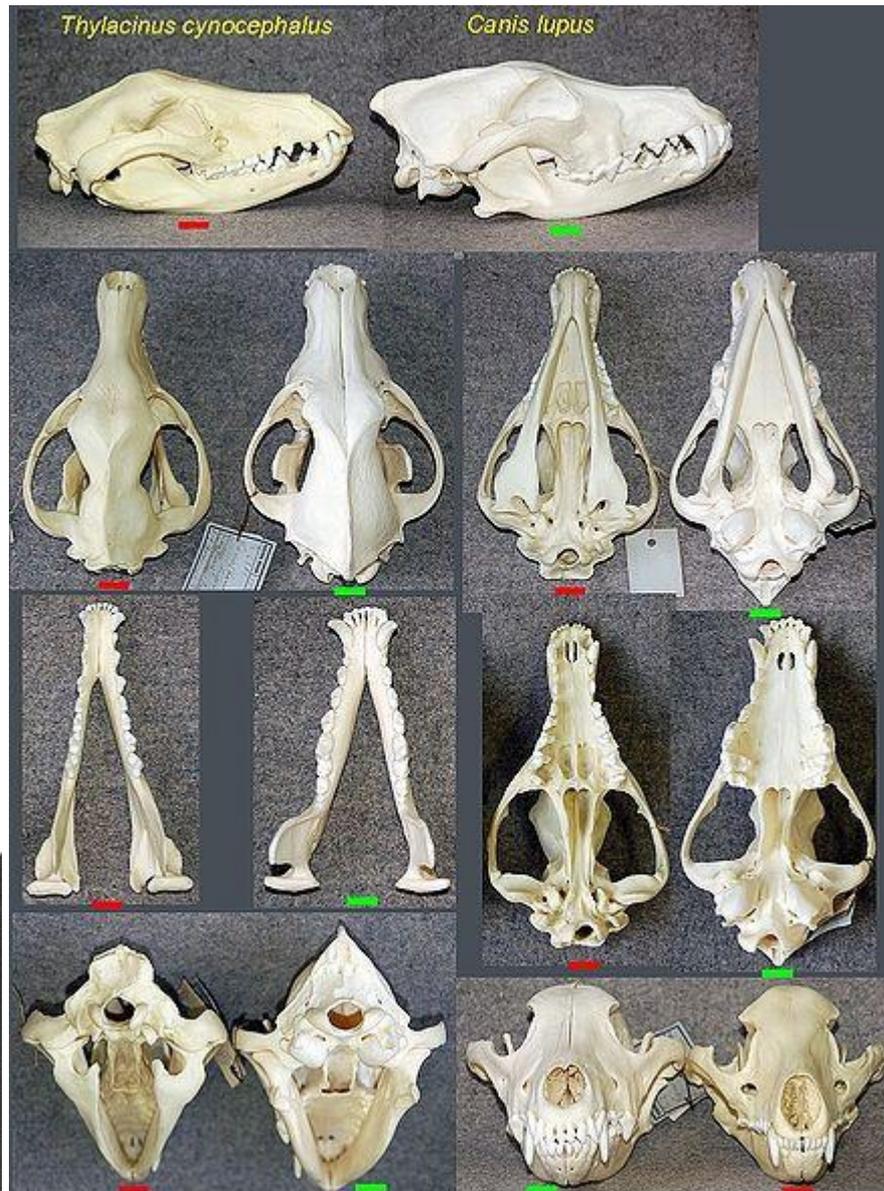
Niche	Placental Mammals	Australian Marsupials
Burrower	Mole 	Marsupial mole 
Anteater	Anteater 	Numbat (anteater) 
Mouse	Mouse 	Marsupial mouse 
Climber	Lemur 	Spotted cuscus 
Glider	Flying squirrel 	Flying phalanger 
Cat	Bobcat 	Tasmanian "tiger cat" 
Wolf	Wolf 	Tasmanian wolf 

Convergent evolution has resulted in sharks, dolphins, seals, and penguins.

Structures that look and function similarly but are made up of parts that do not share a common evolutionary history are called **analogous structures**.

A dolphin's fluke and a fish's tail fin are analogous structures.

17-4 Patterns of Evolution →



Coevolution

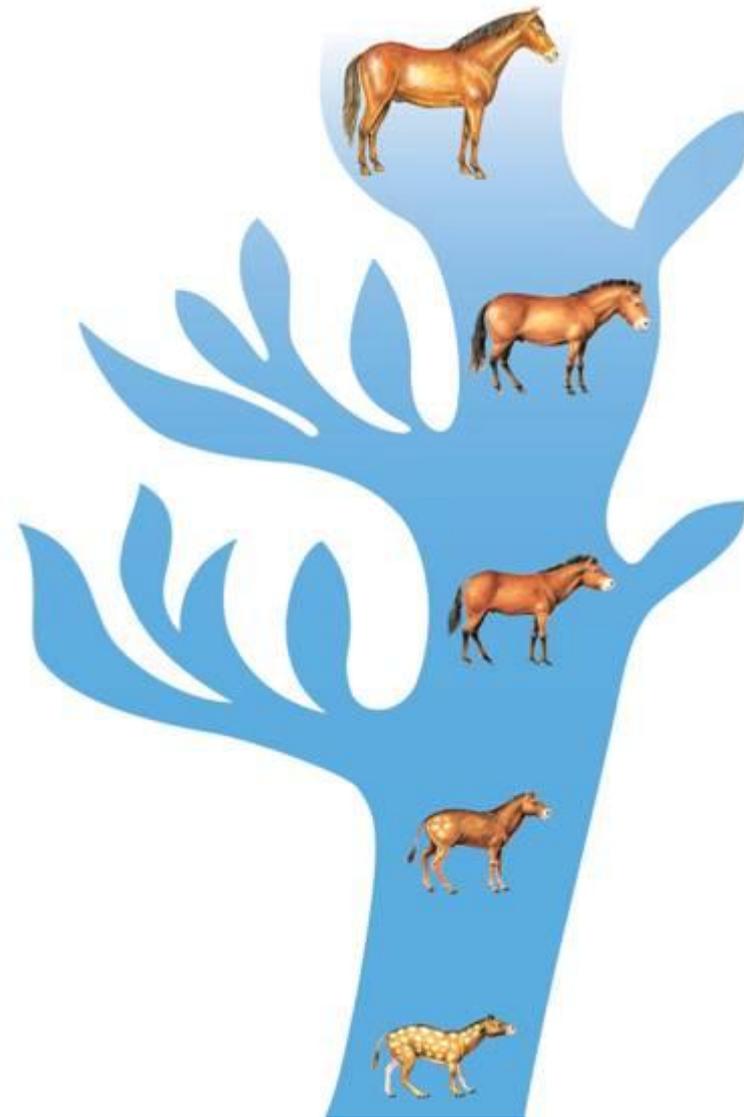
Sometimes organisms that are closely connected to one another by ecological interactions evolve together.

The process by which two species evolve in response to changes in each other over time is called **coevolution**.



Punctuated Equilibrium

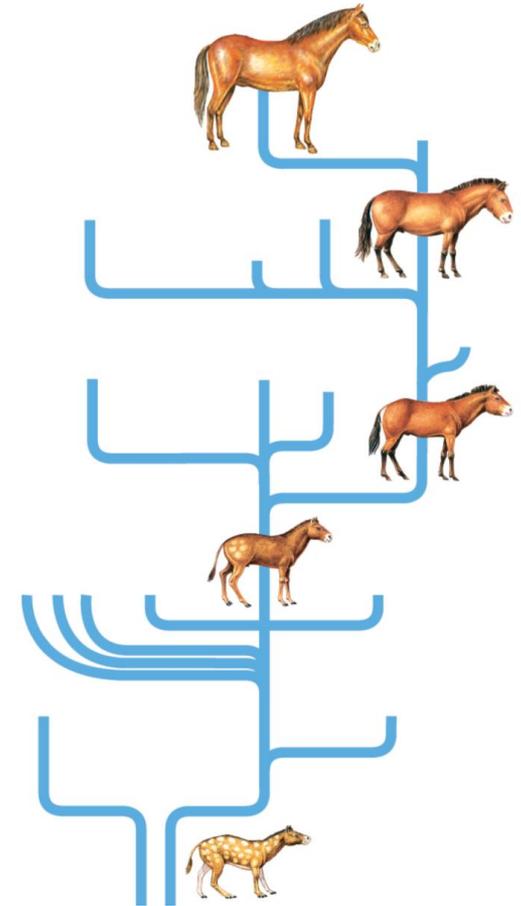
Darwin felt that biological change was slow and steady, an idea known as gradualism.



Punctuated equilibrium is a pattern of evolution in which long stable periods are interrupted by brief periods of more rapid change.

The concept of punctuated equilibrium has generated debate and is still controversial among some biologists today.

Evolution has often proceeded at different rates for different organisms at different times during the history of life on Earth.



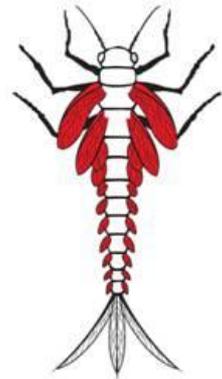
Developmental Genes and Body Plans

It is suspected that changes in genes for growth and differentiation during embryological development could produce changes in body shape and size.

Small changes in the activity of control genes (like hox genes) can affect many other genes to produce large changes in adult animals.

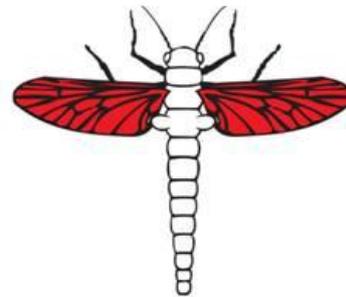
- Evolution of Wings in Insects

Ancient Insect

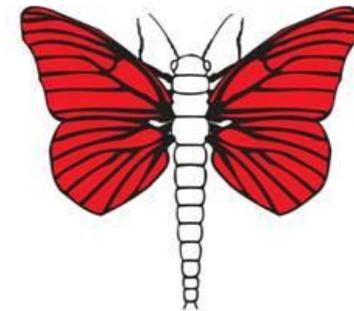


Pairs of wings
on many segments

Two Types of Modern Insects



One pair of wings



Two pairs of wings

Small changes in the timing of cell differentiation and gene expression can make the difference between long legs and short ones.

17-4 Section QUIZ

Continue to:

Section QUIZ

- or -

Click to Launch:



17-4 Section QUIZ

1 Darwin's species of finches were very similar but different in beak size and feeding habits. This is an example of

- a. convergent evolution.
- b. coevolution.
- c. adaptive radiation.
- d. stabilizing selection.

2 A slow steady change in a particular line of descent is called

a. coevolution.

b. gradualism.

c. punctuated equilibrium.

d. convergent evolution.

3 Master control genes are called

a. hox genes.

b. developmental genes.

c. embryonic genes.

d. regulatory genes.

17-4 Section QUIZ

4 Some evidence suggests that species do not change much over long periods of time and then undergo relatively short periods of rapid speciation. This kind of change is called

- a. coevolution.
- b. genetic equilibrium.
- c. adaptive radiation.
- d. punctuated equilibrium.

5 Fossil evidence shows that mass extinctions

- a. ended the existence of many species in a short period of time.
- b. occurred mainly when the dinosaurs disappeared.
- c. require an asteroid strike to occur.
- d. caused convergent evolution among animals.