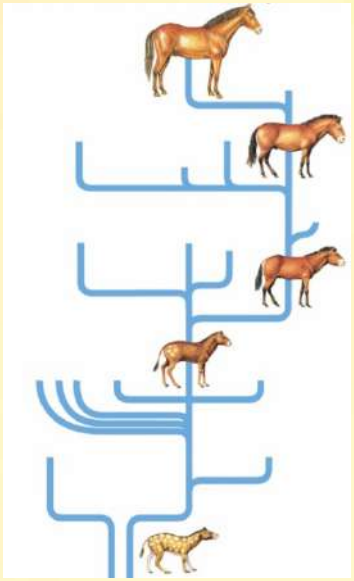
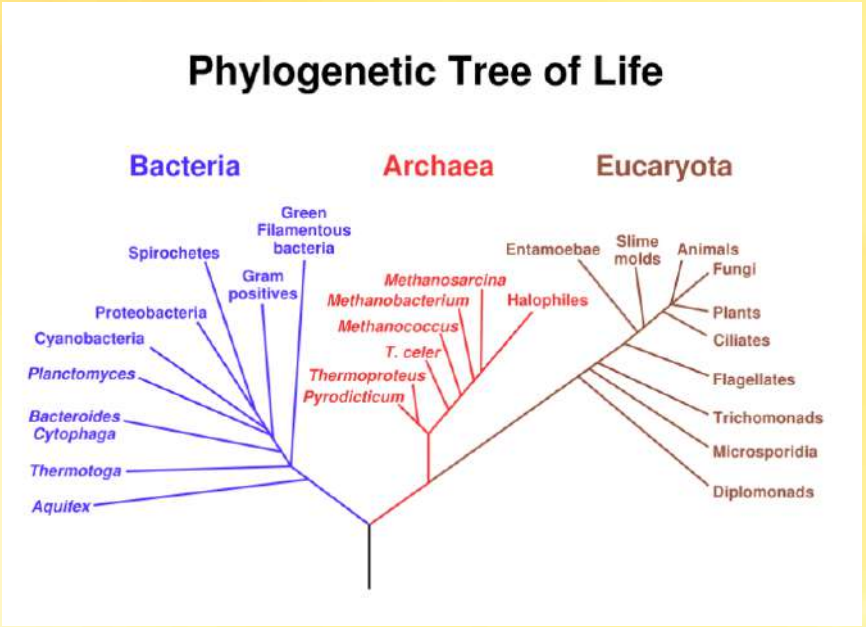
Patterns of Evolution

Introduction

- Macroevolution refers to the large-scale evolutionary changes that take place over long periods of time.
- Includes- **Speciation and extinction**



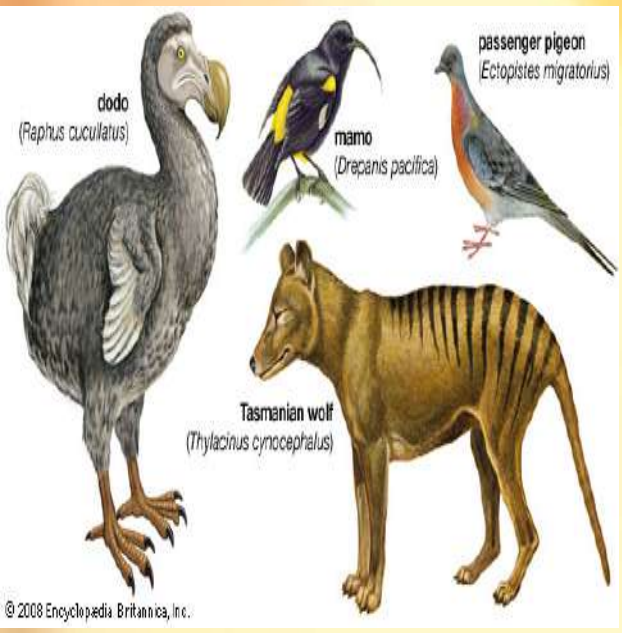


Six important topics in macroevolution are:

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

Summarize the information for each and write inside boxes

Extinction



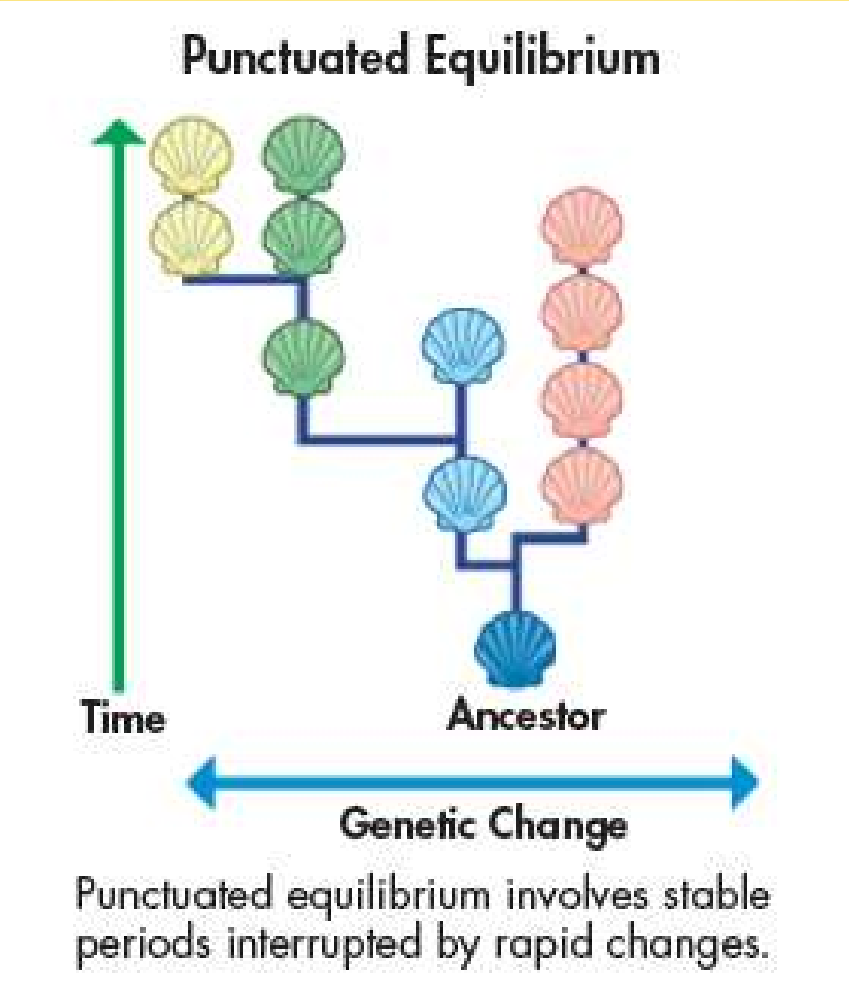
- The dying out or termination of a species.
- Extinction occurs when species are diminished because of environmental forces (habitat fragmentation, global change, overexploitation of species for human use) or because of evolutionary changes in their members (genetic inbreeding, poor reproduction, decline in population numbers).

Punctuated Equilibrium and Grandualism

- Both describe…
  - **Rates of evolution**

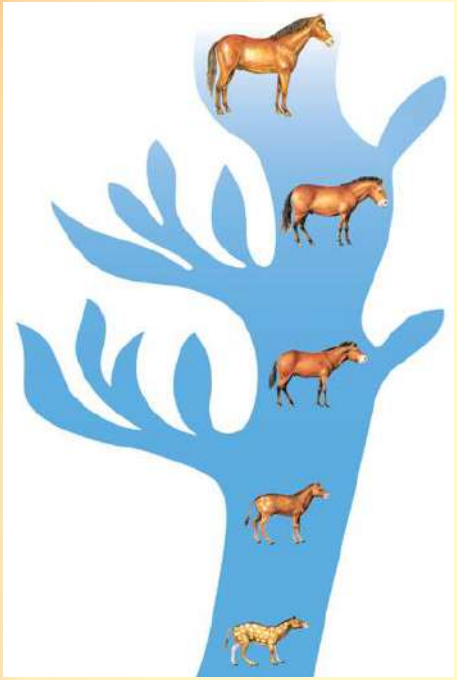
Punctuated Equilibrium

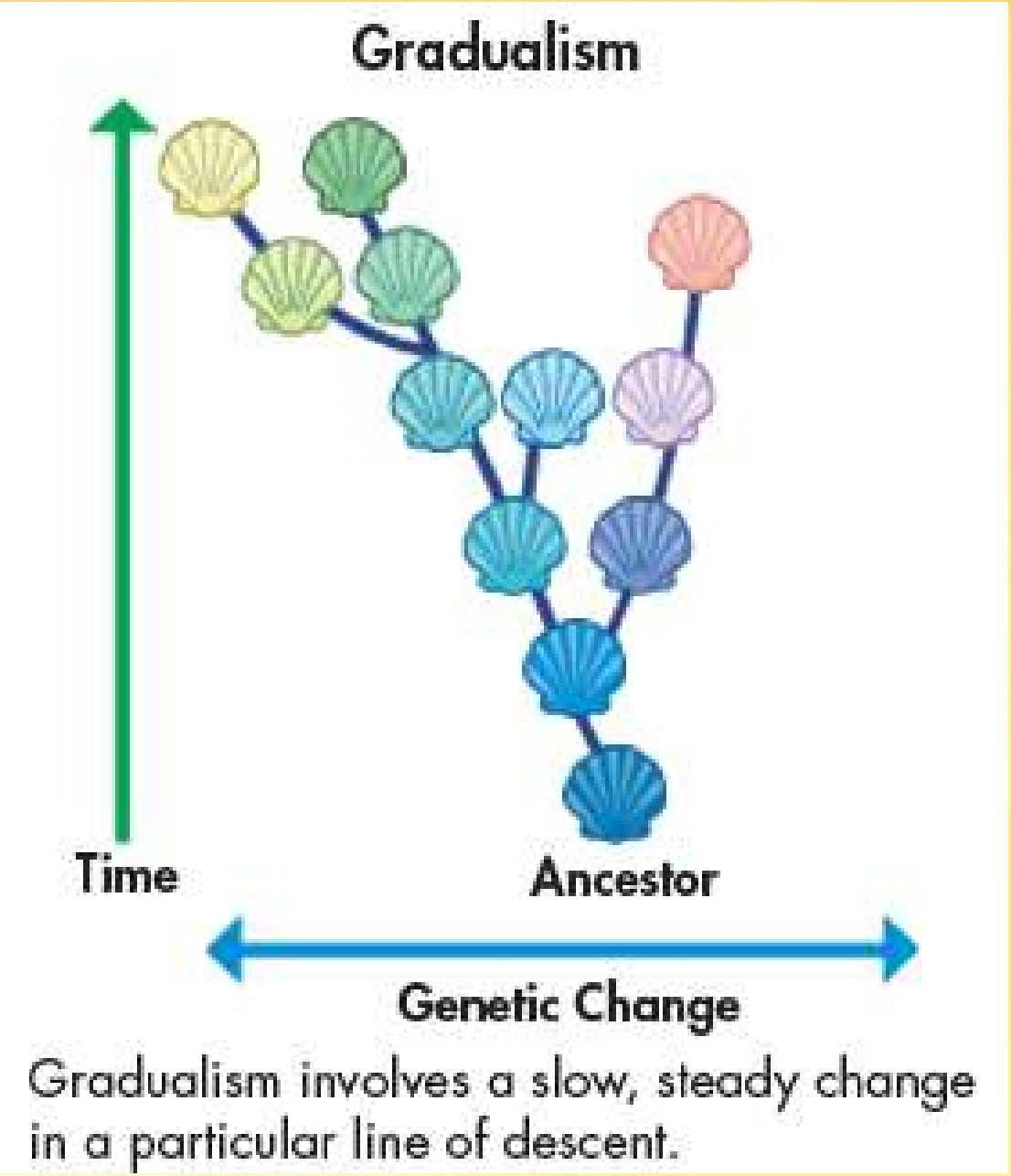
- *Punctuated Equilibrium* describes a pattern of **long, stable** periods interrupted by brief periods of more **rapid change**



Gradualism

- How quickly does evolution operate?
- Does it always occur at the same rate?
  - Darwin felt that biological change was slow and steady, also known as gradualism.
  - ***There is evidence found in the fossil record to support the idea that populations of organisms did change gradually over time.***





Gradualism involves a slow, steady change in a particular line of descent.

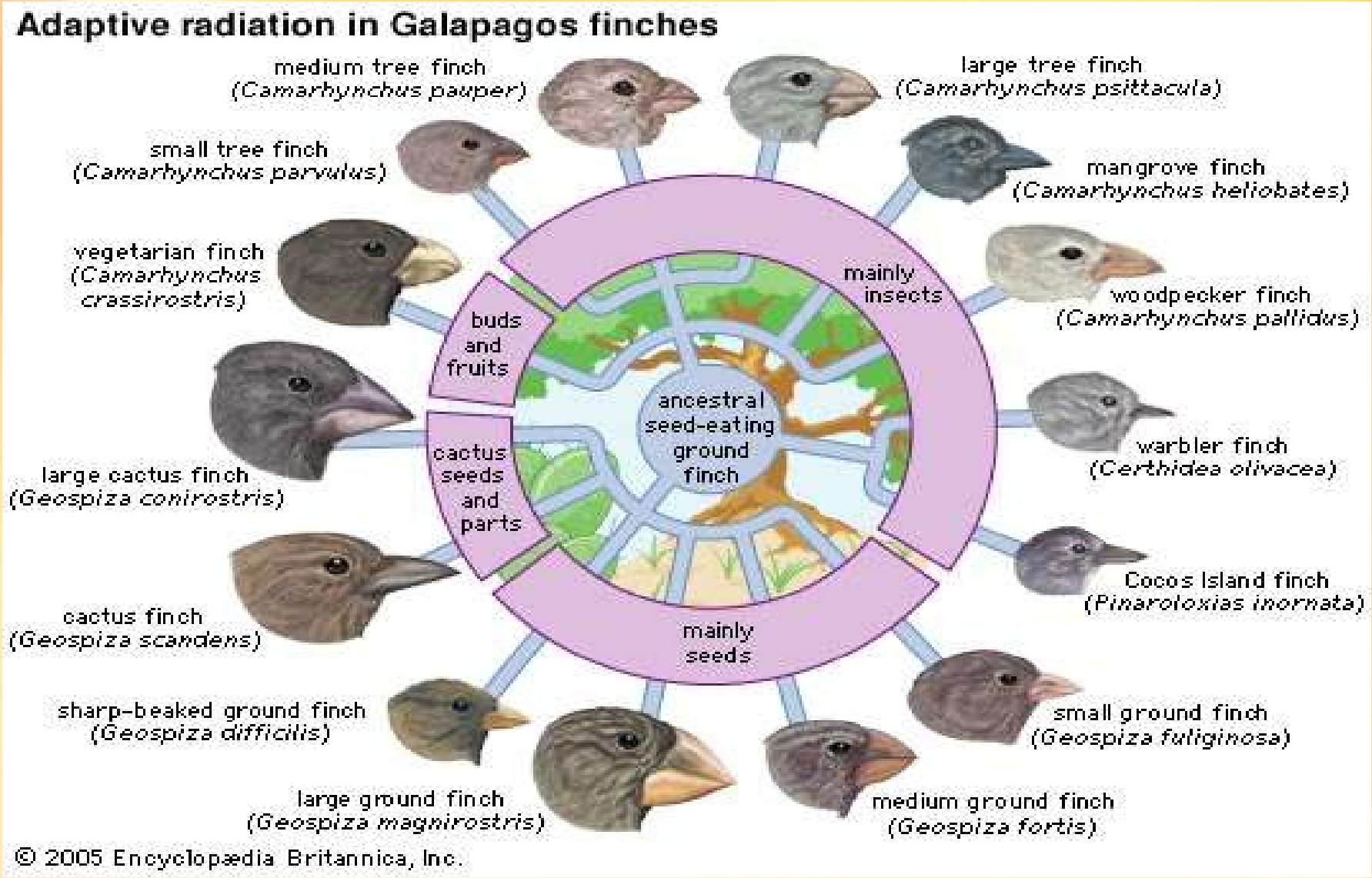
Adaptive Radiation

- Is…
- **process by which a single species evolves over a short time into several different forms that live in different ways**
- Can occur when…
- **a part of a population moves to a new place or when other organisms become extinct**

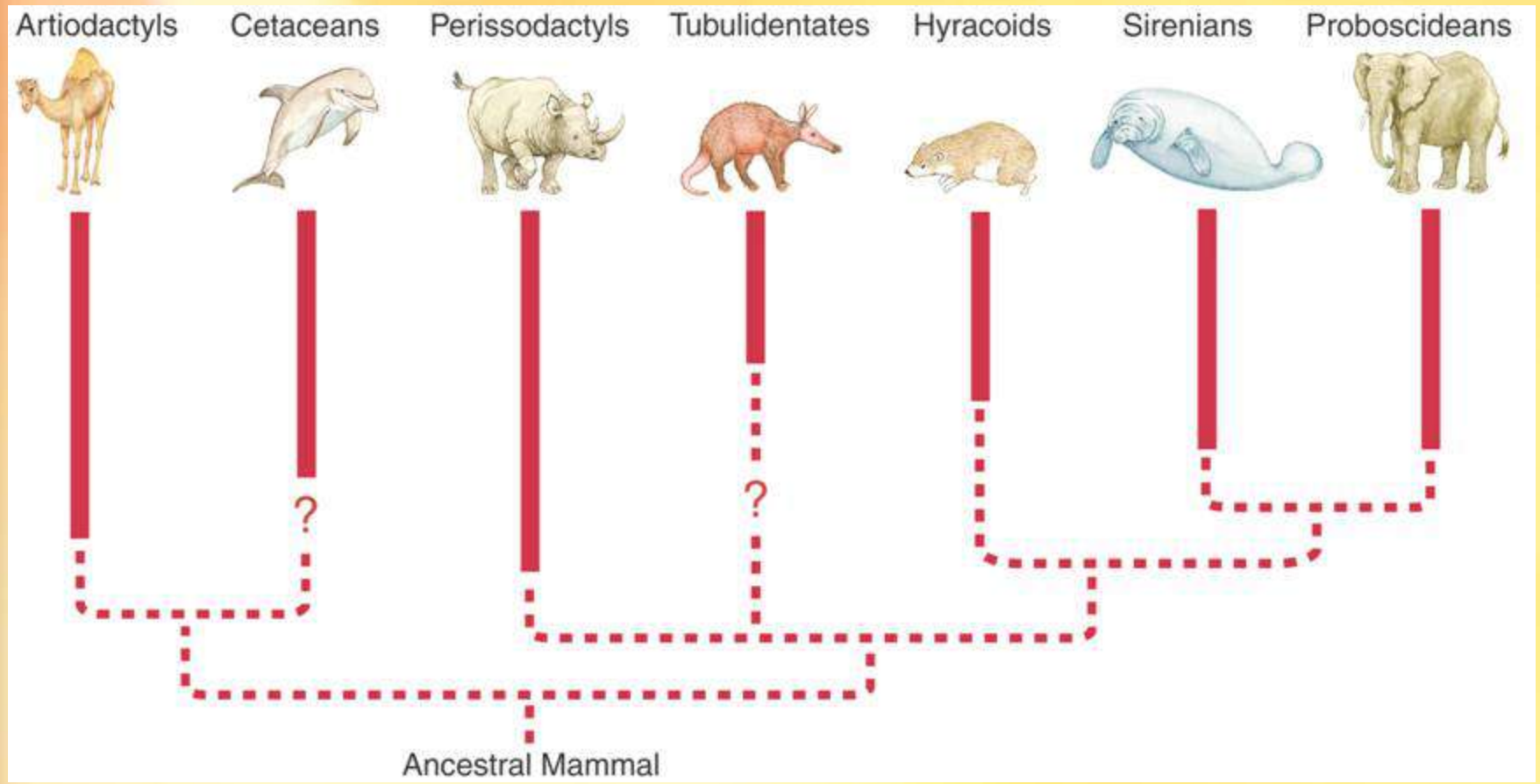
Adaptive Radiation

- Studies of fossils reveal that a single species or a small group of species has evolved into several different forms that live in different ways.
- This is known as Adaptive Radiation
- Example: Darwin's finches

Adaptive Radiation



Adaptive Radiation of Mammals

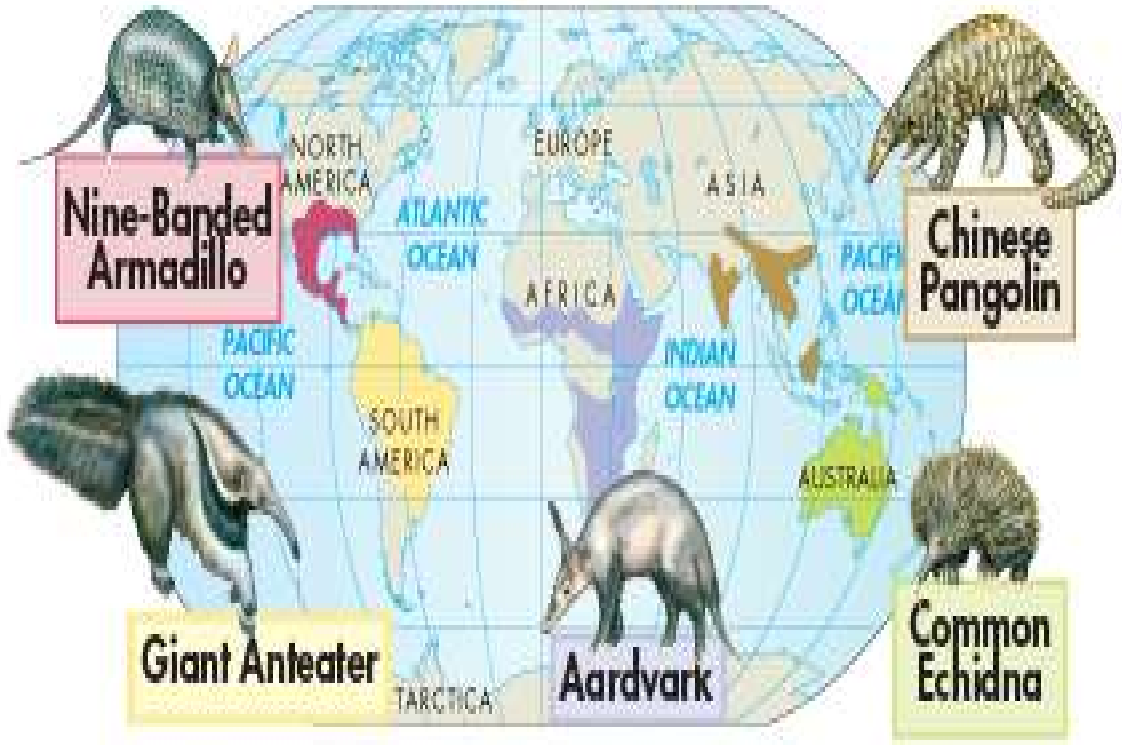


Convergent Evolution

- Is…
- **the process by which unrelated organisms evolve into forms that resemble each other.**
- Occurs when
- **the organisms face similar environmental changes**

Convergent Evolution

- The process by which **unrelated organisms** come to **resemble one another**



Convergent Evolution

- *How does this happen?*
  - Groups of different organisms undergo **adaptive radiation** in different places or at different times but in ecologically similar environments



Convergent Evolution

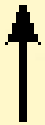
- Natural selection may mold different body structures, such as arms and legs, into modified forms such as wings or flippers.
- The wings and flippers function in the same way and look very similar.

Convergent Evolution

Falcon

Bat

Pteradactyl

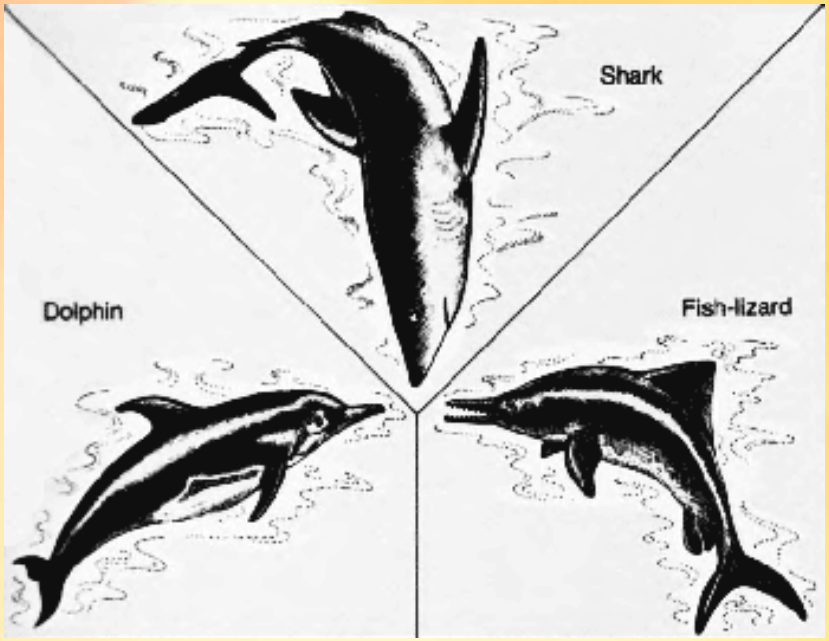


Ancestral bird

Ancestral mammal

Ancestral reptile

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

Coevolution

- Is…
- **when two species evolve in response to changes in each other**
- Occurs when…
- **the relationship between two organisms is so specific that neither can live without the other.**
- Examples are…
- **Flowers and pollinators, plants and herbivorous insects.**

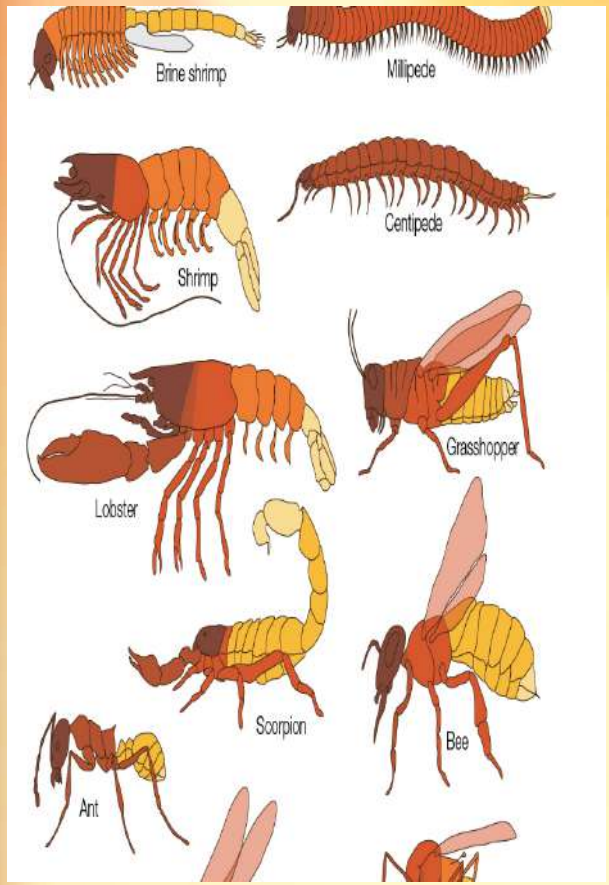
COEVOLUTION

- The process by which two species evolve in response to changes in each other over time
- The relationships between plants and plant-eating insects
  - Insects have been feeding on flowering plants; over time plants have evolved poisonous compounds that prevent insects from feeding on them.

Coevolution

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

changes in developmental genes and body plans



. A large amount of animal diversity is built on two simple ideas: bodies made up of repeating units (or segments), and genetic programs for building structures.

Just within arthropods (shown on the left), variations on this theme have given rise to an enormous diversity of body types. And in fact, in many cases, domains of Hox gene activity parallel the different types of structures that grow out of the animals' body segments.

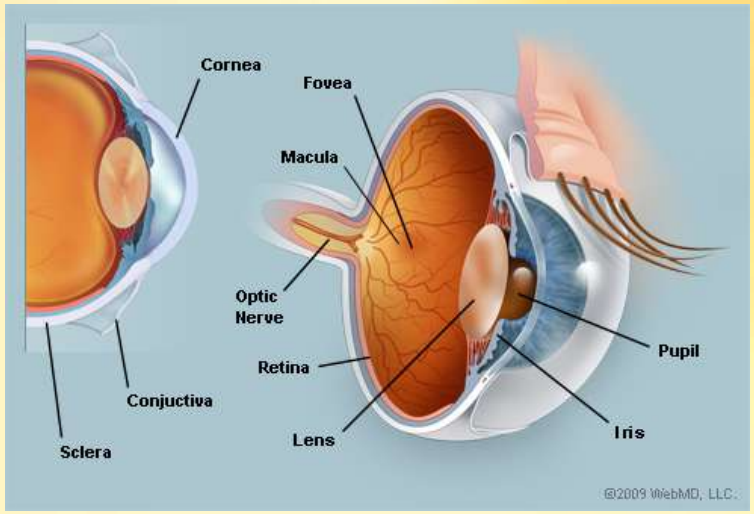
ON THE LEFT SIDE….

- In your groups, figure out what pattern of evolution is illustrated.
- Summarize the example and clearly write down why did your group choose that pattern

1

Match the pattern of **macroevolution** with its description….

- Although the eyes of the octopus, and vertebrates have evolved entirely independently, each has a retina, a cornea, an iris, a lens, and a fluid-filled interior. These similarities of structure, despite different origins, provide a classic example of …….



2

Match the pattern of **macroevolution** with its description….

- Insects and birds are far removed from one another, yet at a glance it is difficult to tell the difference between a humming bird and a humming moth. Both are the same in size, and both live off nectar in flowers, and hover in flight. This is a classic example of...

3

Match the pattern of **macroevolution** with its description….

- Of burrowing animals, probably the best known is the common earthworm – a long, slender creature with no notable structures projecting from its surface. Animals from other groups that have taken up a burrowing mode of life often possess an identical shape. For instance, there are the slow-worms and skinks (really lizards) and the cecilians (really amphibians). The shape and general appearance of the snakes also suggests that they have evolved from a burrowing group.
  This is a classic example of..

4

Match the pattern of **macroevolution** with its description….

- In American deserts, cacti are characteristic plants. Their stems are swollen with water-storing tissues; they are covered in protective spines and do not carry leaves. Very similar in all these respects are the euphorbias, native to Africa. But despite the cactus-like appearance, euphorbias are not closely related to cacti.

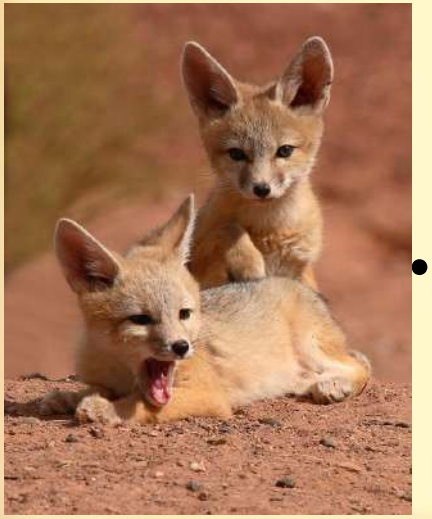
5

Match the pattern of **macroevolution** with its description….

- Long snouts and powerful claws give these two burrowing animals a remarkably similar appearance an example of …

6

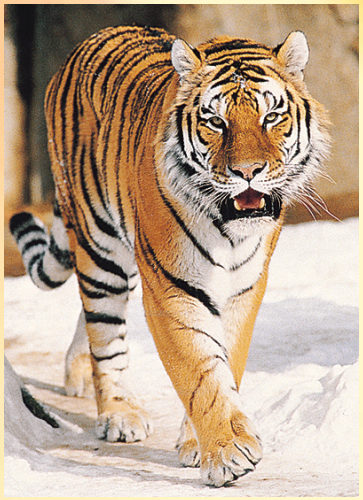
Match the pattern of **macroevolution** with its description….



- The red fox lives in mixed farmlands and forests, where its red color helps it blend in with surrounding trees. The kit fox lives on the plains and in the deserts, where its sandy color helps conceal it from prey and predators. The ears of the kit fox are larger than those of the red fox. The kit fox's large ears are an adaptation to its desert environment. The enlarged surface area of its ears helps the fox get rid of excess body heat. Similarities in structure indicate that the red fox and the kit fox had a common ancestor.
- This is an example of…..

7

Match the pattern of **macroevolution** with its description….



- The cat evolved into the miniature size since that aided its survival near human settlements, while the tigers remained big, which aided their survival in the wilderness of Africa and Asia. This is an example of….

8

Match the pattern of **macroevolution** with its description….

- The apple maggot fly once infested the fruit of a native Australian hawthorn tree. In the 1860s some maggot flies began to infest apples. They multiplied rapidly because they were able to make use of an abundant food supply. Now there are two distinct species, one that reproduces when the apples are ripe, and another that continues to infest the native hawthorn tree.
  This is an example of….

9

Match the pattern of **macroevolution** with its description….

- Beetle-pollination must have been more efficient than wind for some species, so there was natural selection for plants that attracted insects.
- This is an example of….

10

Match the pattern of **macroevolution** with its description….

- Snapdragons and specific pollinators (insects, bats, etc). The pollinator gets a reward such as nectar for pollinating the plant. Moth-pollinated plants often have spurs or tubes the exact length of a certain moth's "tongue."
  This is an example of….

11

Match the pattern of **macroevolution** with its description….

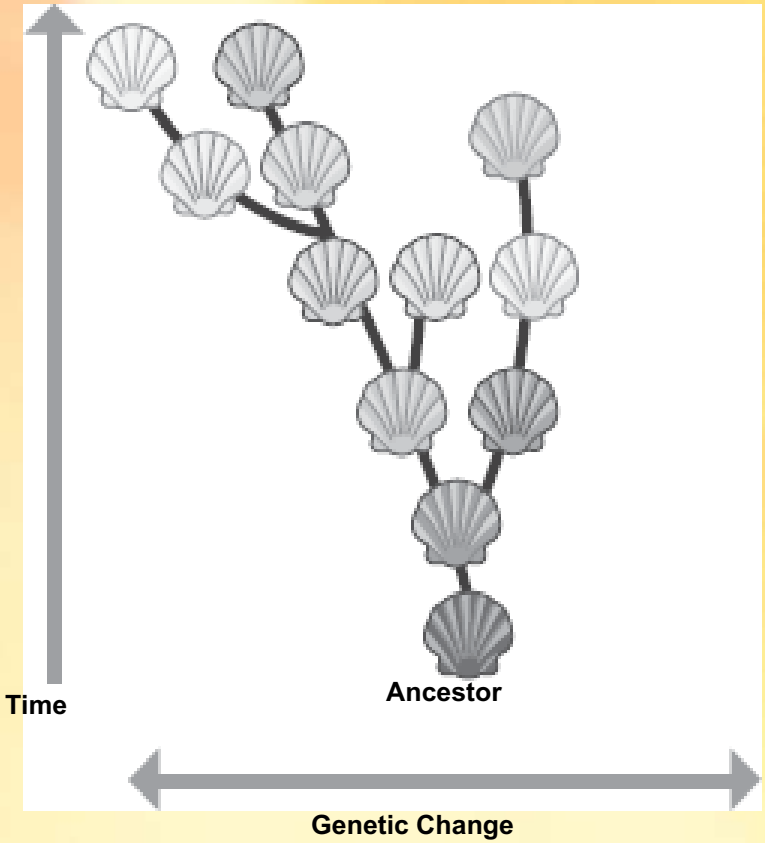
- The Common Garter Snake (*Thamnophis sirtalis*) have evolved a resistance to the toxins of their prey, newts of the genus *Taricha*. As the newts continue to evolve more potent toxins, the garter snakes evolve an increased amount of resistance to the poison. Anytime that one of the two species has an advantage, selection favors those individuals that can equalize that advantage…This is an example of….

12

Match the pattern of **macroevolution** with its description….

- Over the course of millions of years, the descendants of the pioneer plant the Hawaiian silversword evolved into 28 distinct species in three genera, occupying many different habitats. Scientists believe that the entire silversword family probably descended from a member of the sunflower family. This is an example of….

Identify the Pattern of Evolution



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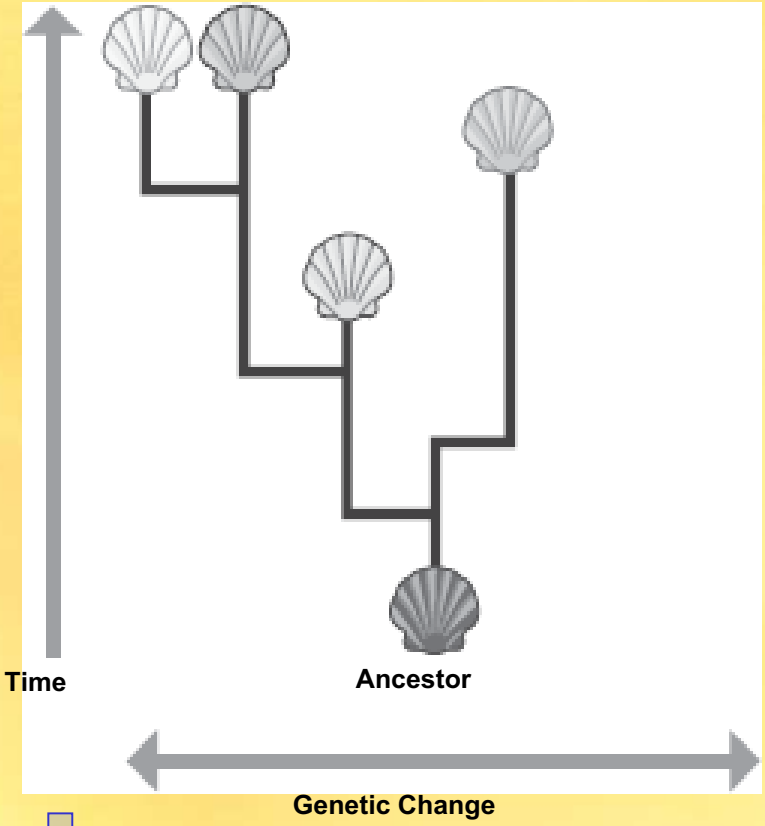

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