Bio 11

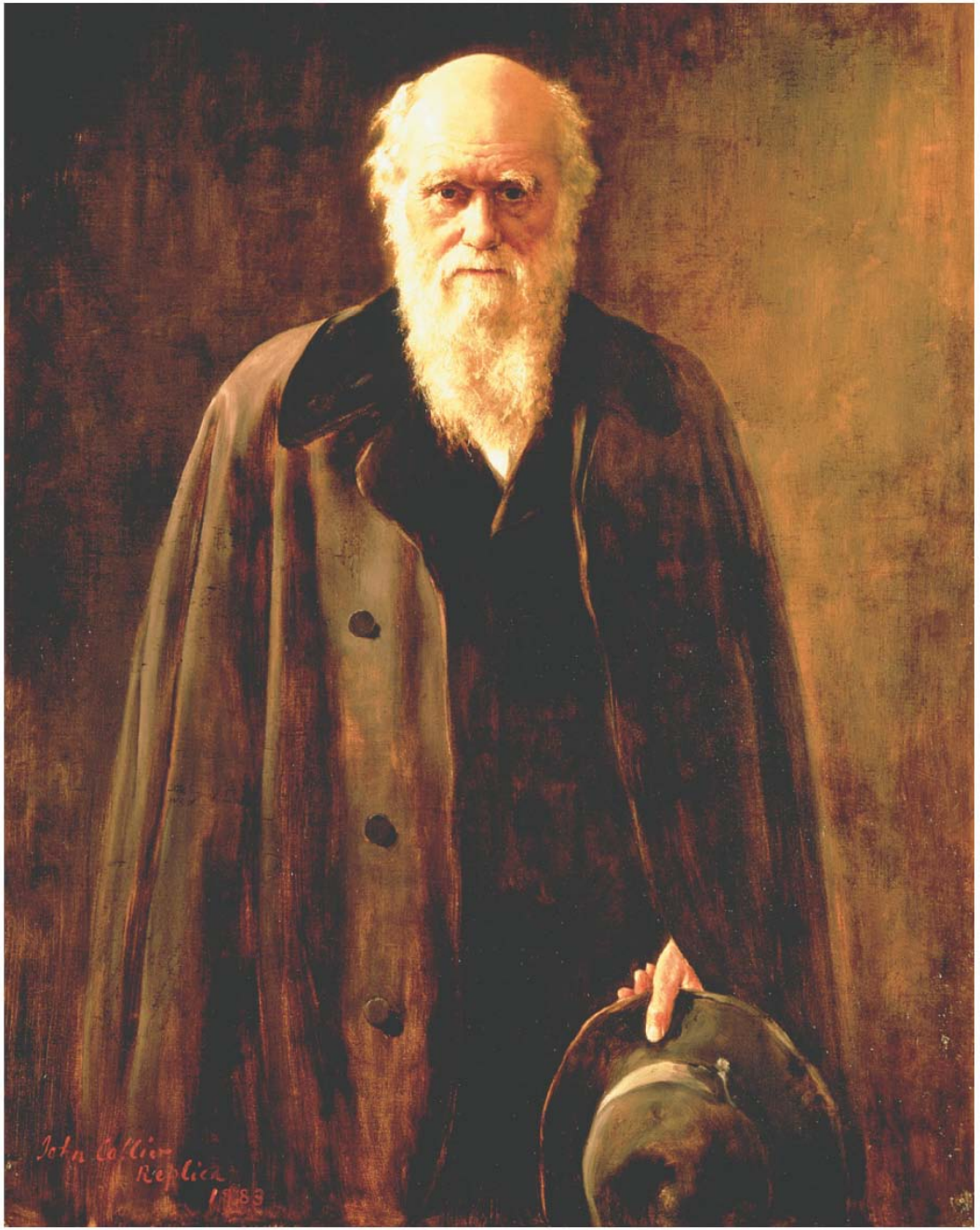
Evolution

Darwinian evolution

Some modern day examples

Example of survival of the fittest

- Moths in England
- Antibiotic resistance in bacteria



Charles Darwin

- From wealthy family
- Went to school and then took a trip around the world.
- Noticed the range of different species on the Gallapagos.

Darwin's trip

The famous finches

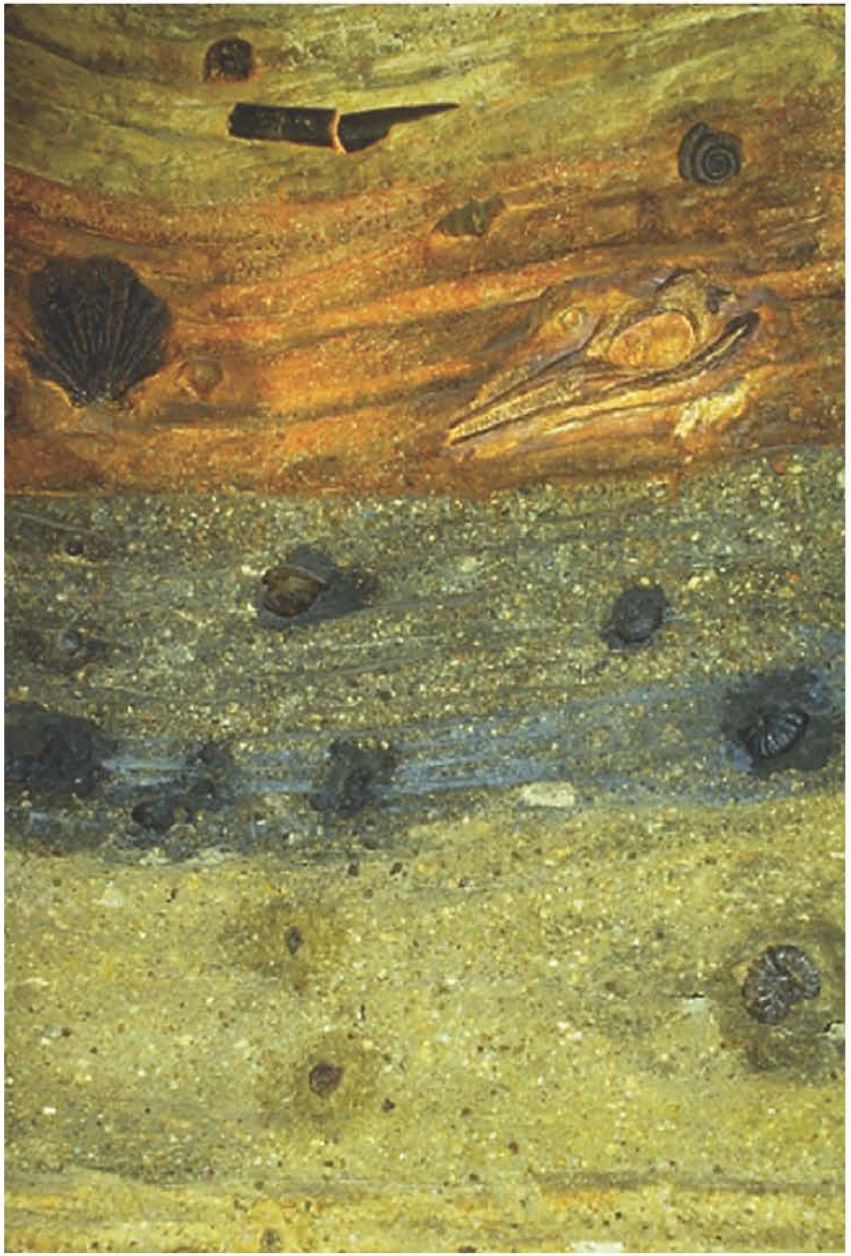
Darwin was not the only one

Alfred Russel Wallace

Why did they both come up with similar ideas?

- Plato--427BC to 348 BC --each life form is a temporary manifestation of the ideal form. . This view remained the top theory for close to 2000 years, otherwise known as creationism.
- William Smith (**1769-1839**) made an observation that fossils are found in layers. Went all over England collecting Fossils.

(a) Strata of sedimentary rock with fossils embedded



(b) Fossilized sea urchin, at least 65 million years old

Next thoughts in the evolution of evolution

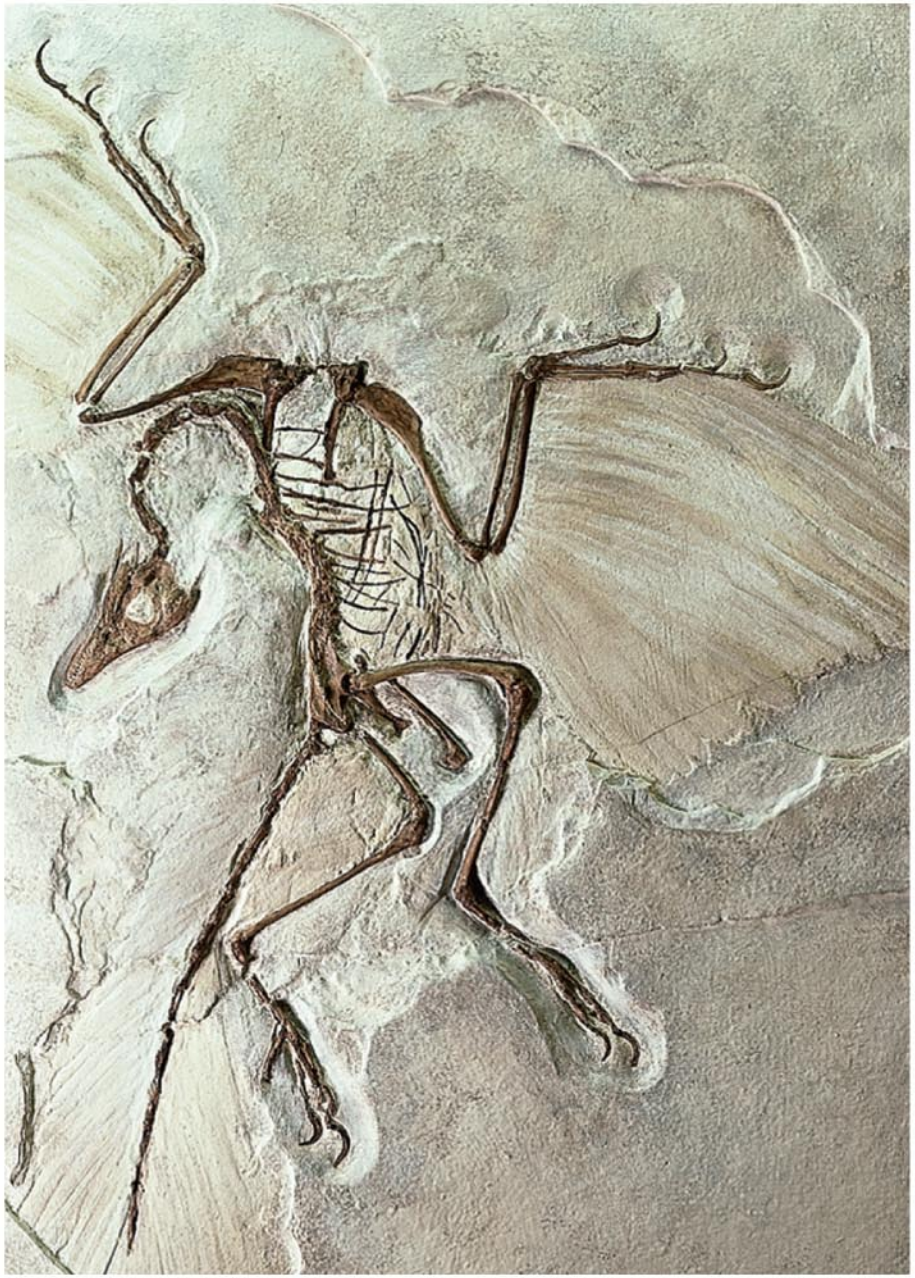
- **George Louis Leclerc or Compte de Buffon (1707-1788)** purposed that the original creation provided a relatively small number of founding species and that some of the modern species had been "conceived by nature and produced by time." Unfortunately he was widely ignored since he had no proof for his theory.

George Cuvier **1769-1832**

Proposed that all the species were created at the beginning of time -- the ones we currently have and the ones that have gone extinct. He established extinction as a fact. The extinctions happened through a series of disasters (**catastrophism)**. This is why we have the different layers of fossil rock. This was marrying creationism with the fossil evidence although he did not mention creationism in his work.

Argument against the Theory

Should see fossil remains of present day species and those that we currently have in the same layers.



Fossil

1807-1873 Louis Agassiz

Really took this theory one step further he suggested that at each catastrophe there was a new creation. Not in a direction that Curvier would probably approved of. And in order for his theory to fit the evidence he proposed at least 50 catastrophes and creations. What he is also know for is the theory of the ice age and how it could change the world.

James Hutton (1726-1797) developed the theory
Charles Lyle (1797-1875) supported theory

- Purposed that the layers of rock that were seen weren't necessarily due to catastrophes but could be explained by natural forces:
- Volcanoes
- Floods
- Earthquakes
- Otherwise known as the theory of **uniformitarism**. --a simple explanation

Jean-Baptiste de Lamarck (1744-1829)

- Believed that organisms evolved through the inheritance of acquired characteristics. he saw that older fossils tended to be simpler while newer fossils were more complex. He proposed that they acquired new characteristics from their parents. And that all organisms strive to perfection.

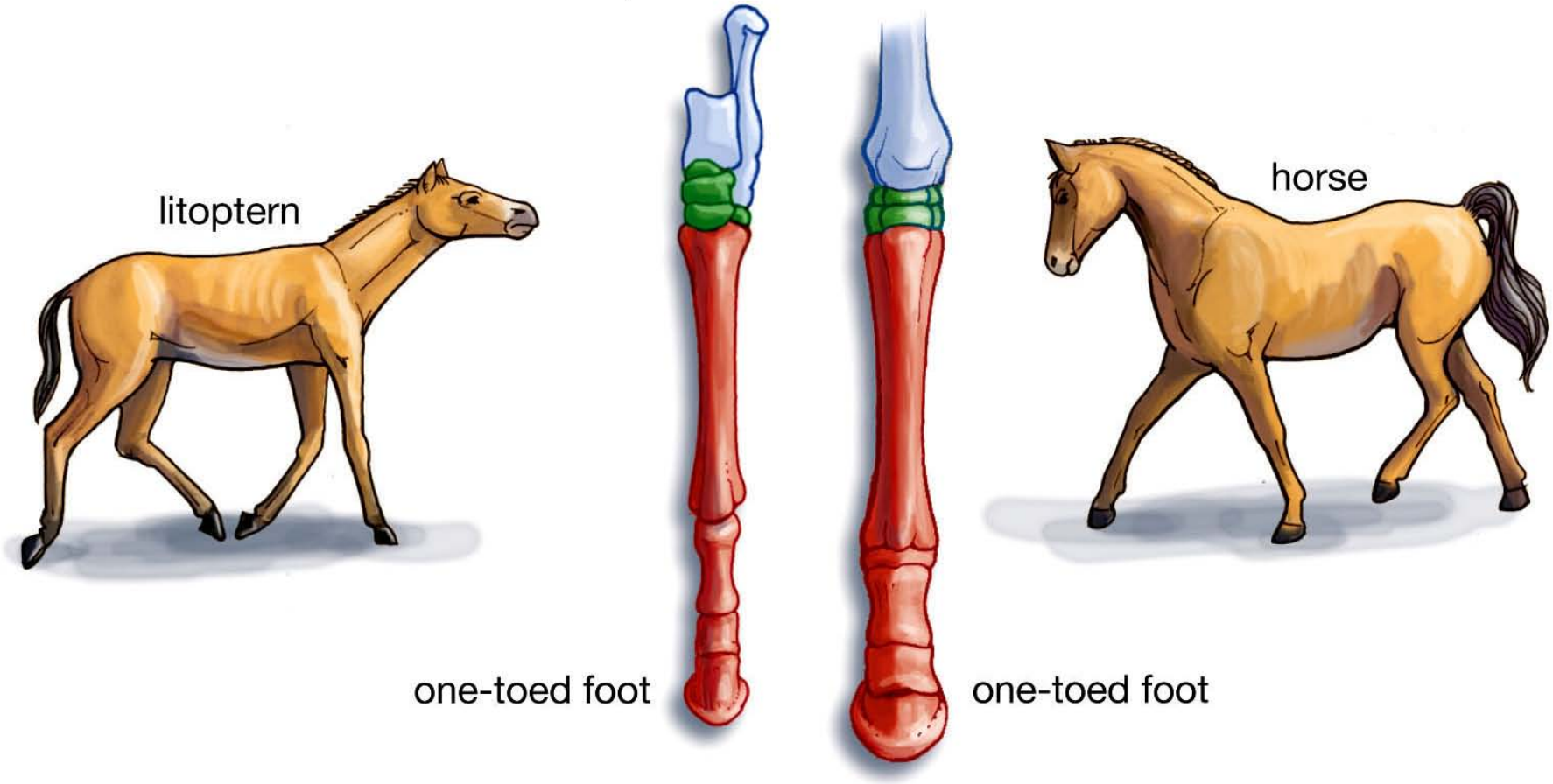
1809-1882 Charles Darwin
1823-1913 Alfred Russel Wallace

- Both came up with the theory that natural selection was the driving force behind evolution. In papers presented in 1858 both put forward their theories which were soundly ignored. The next year Darwin published *On the Origins of Species by Means of Natural Selection*. This gave Darwin the majority of the credit for the theory and started people discussing this theory.

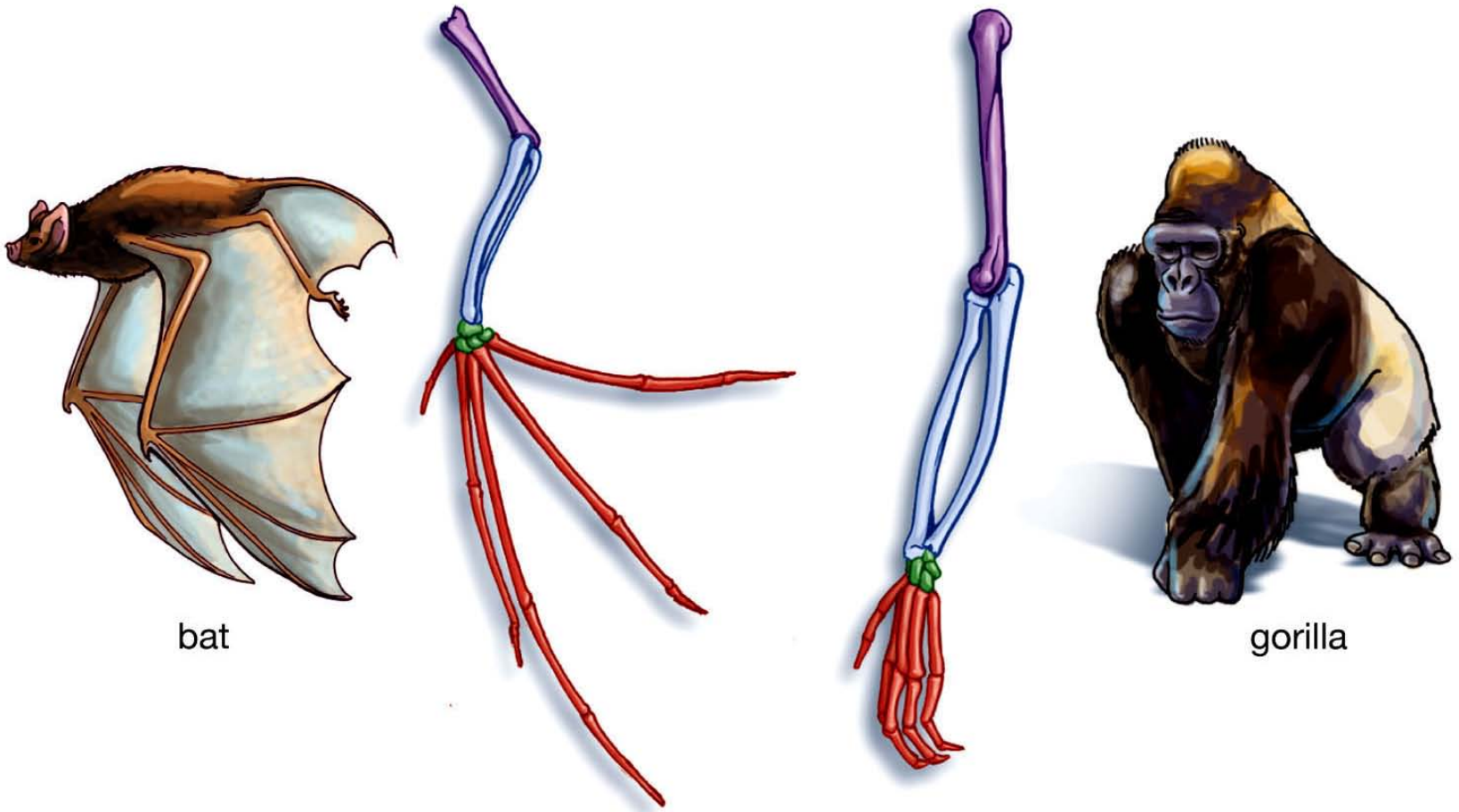
Some evolution term

- **Analogous structures --**functionally similar but completely unrelated--result through **convergent evolution**.
- **Homologous structures**: Internally the bone structure is very similar however the functions are very different. --- **Divergent evolution.**

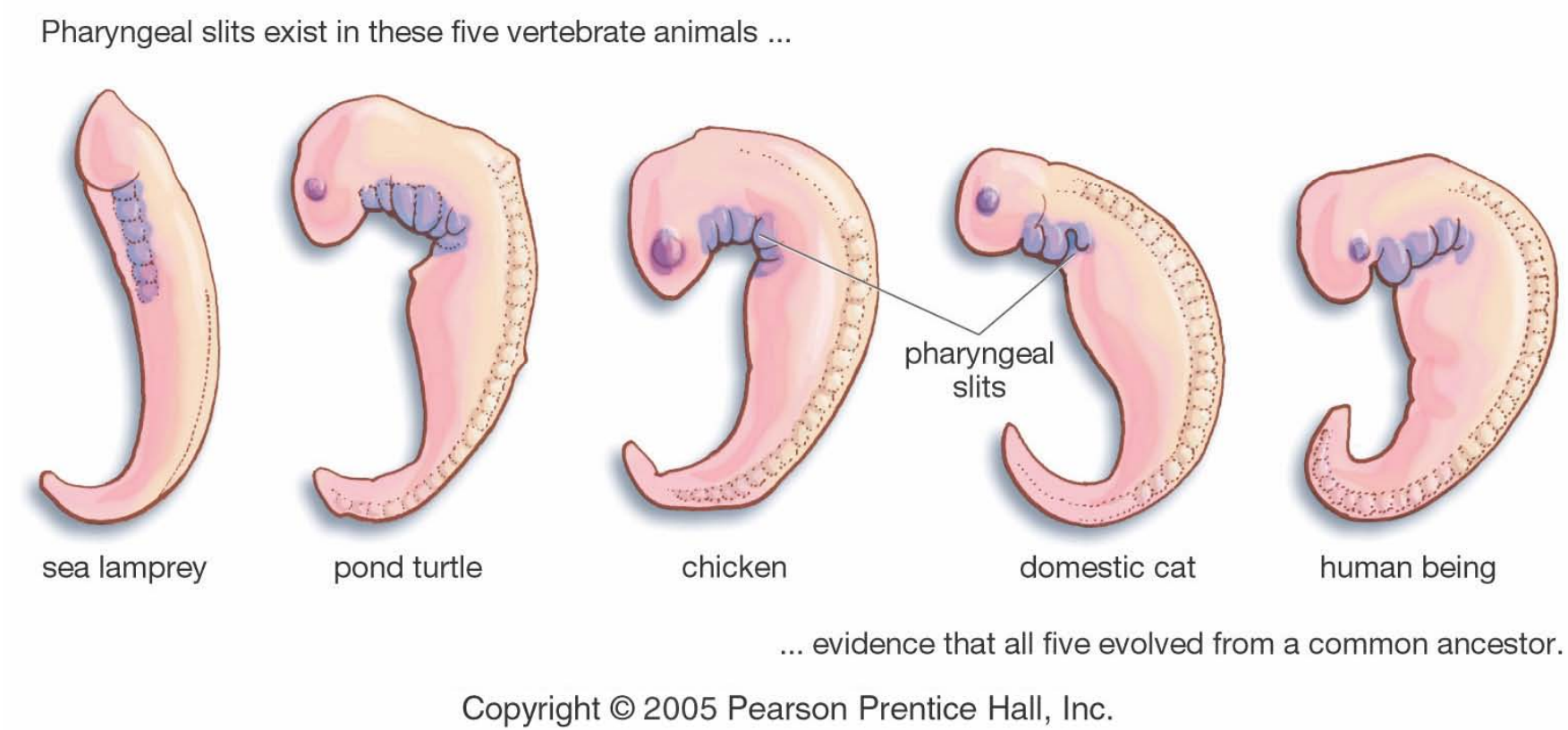
(b) Analogy: Characters of similar function and superficial structure that have *not* arisen from common ancestry



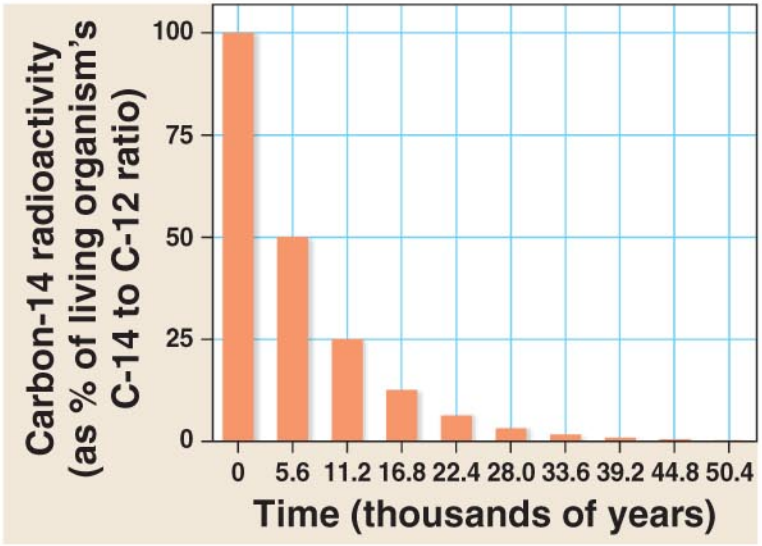
(a) Homology: Common structures in different organisms that result from common ancestry



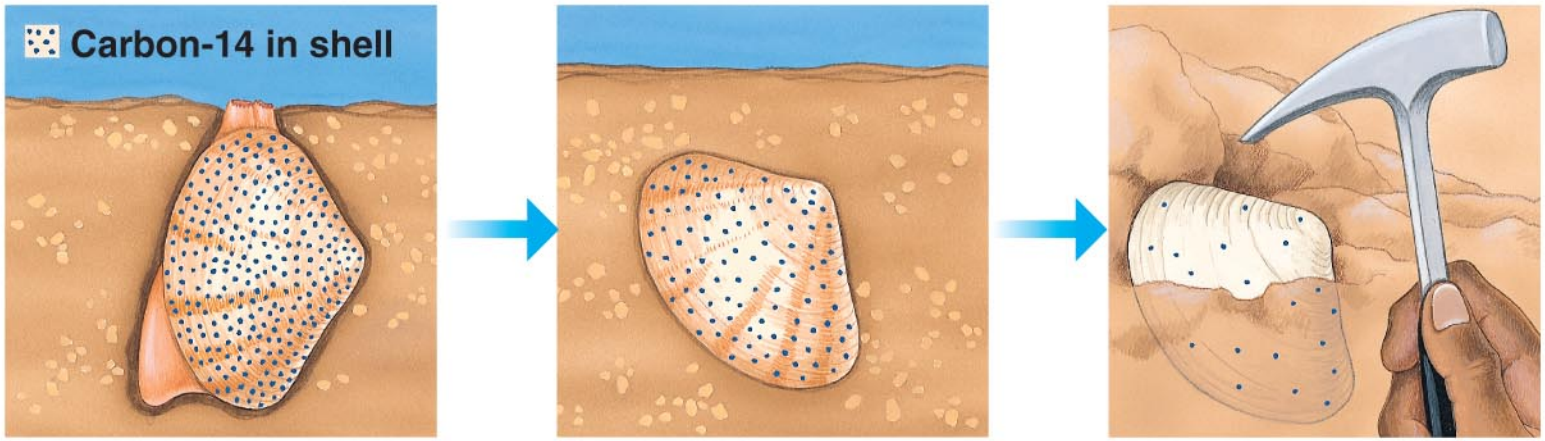
Embryonic development can also show relatedness.



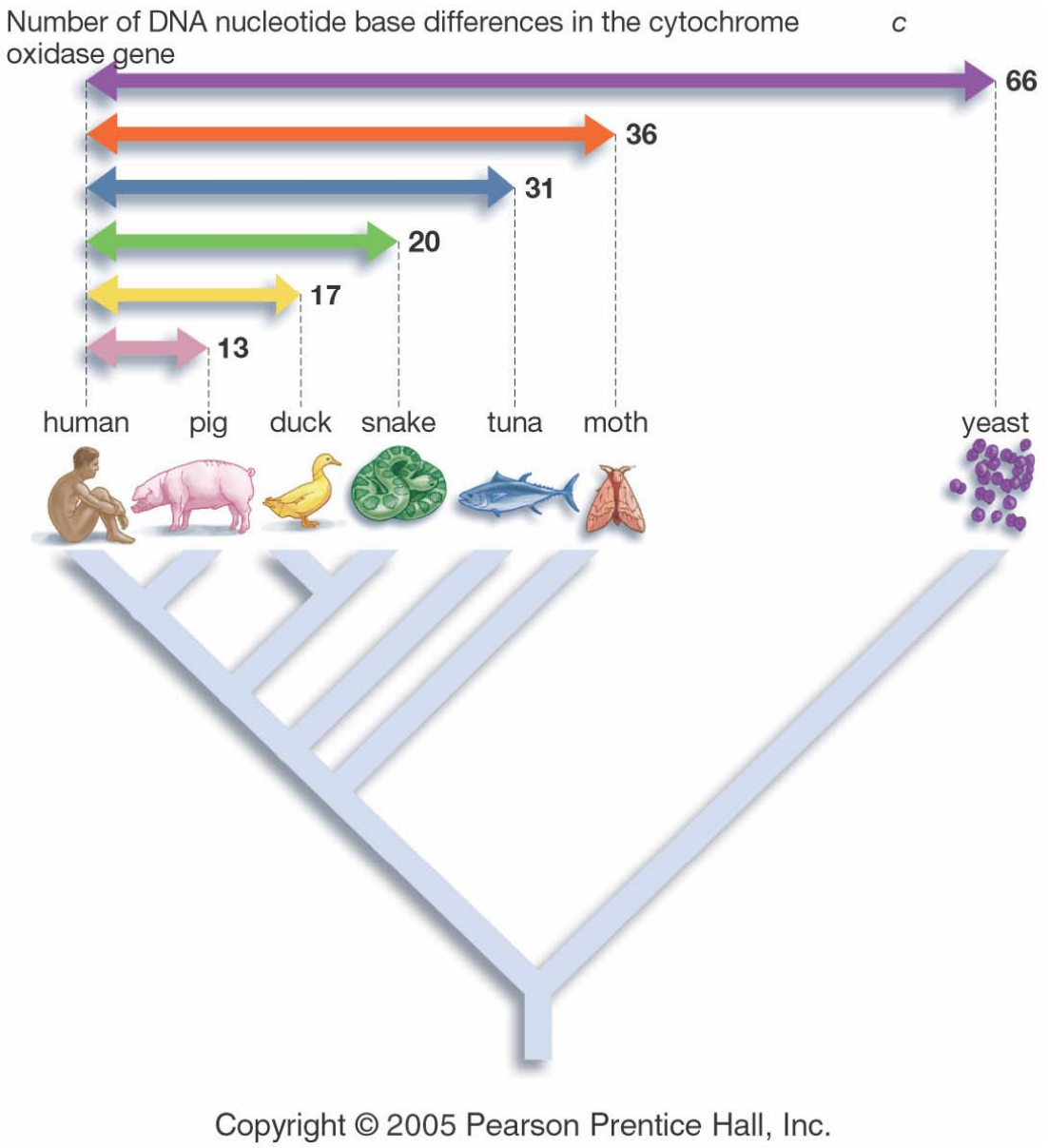
Radioactive decay of carbon-14



How carbon-14 dating is used to determine the vintage of a fossilized clam shell



DNA evidence is also used to show evolutionary similarities



What is a species?

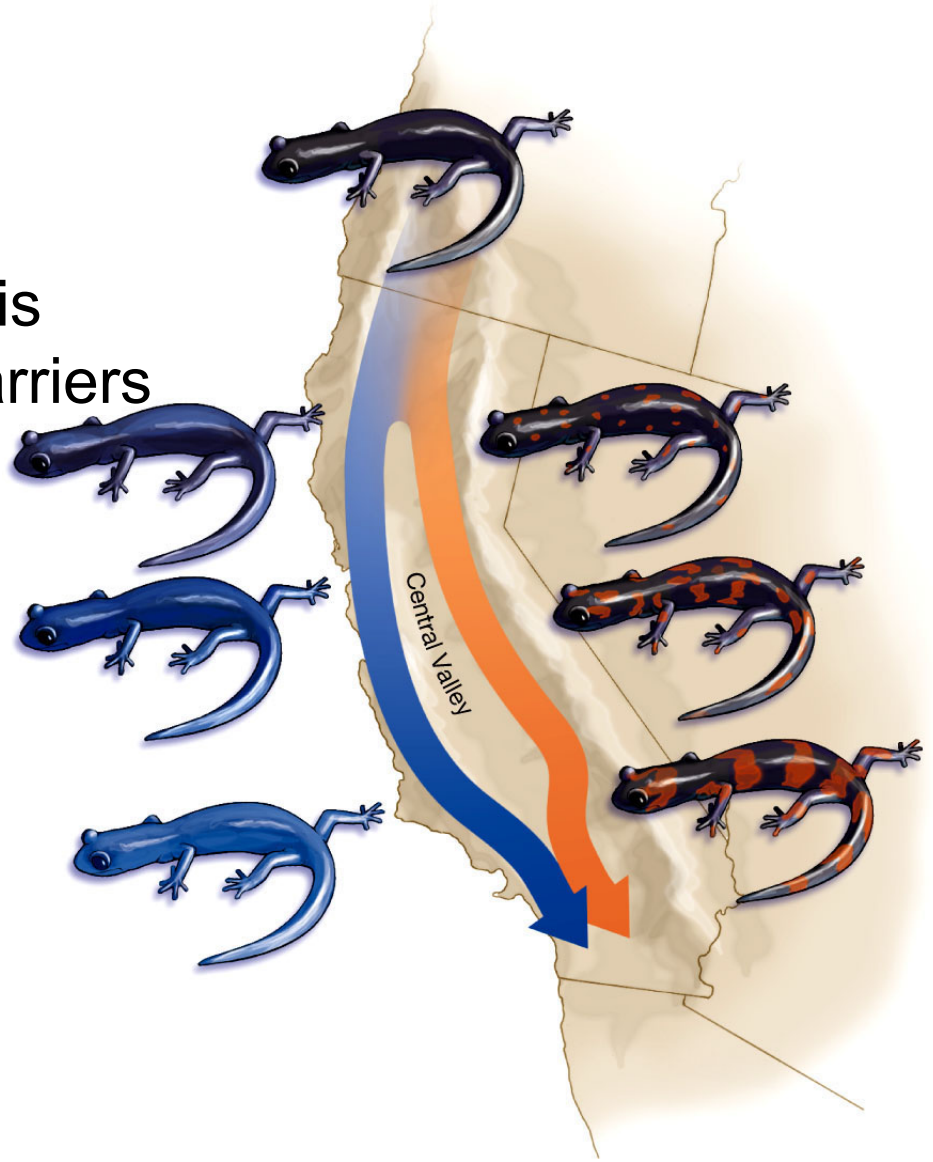
(a) Endangered species

(b) Not endangered

Species Definition

- Species are groups of actually or potentially interbreeding populations which are reproductively isolated from other such groups.

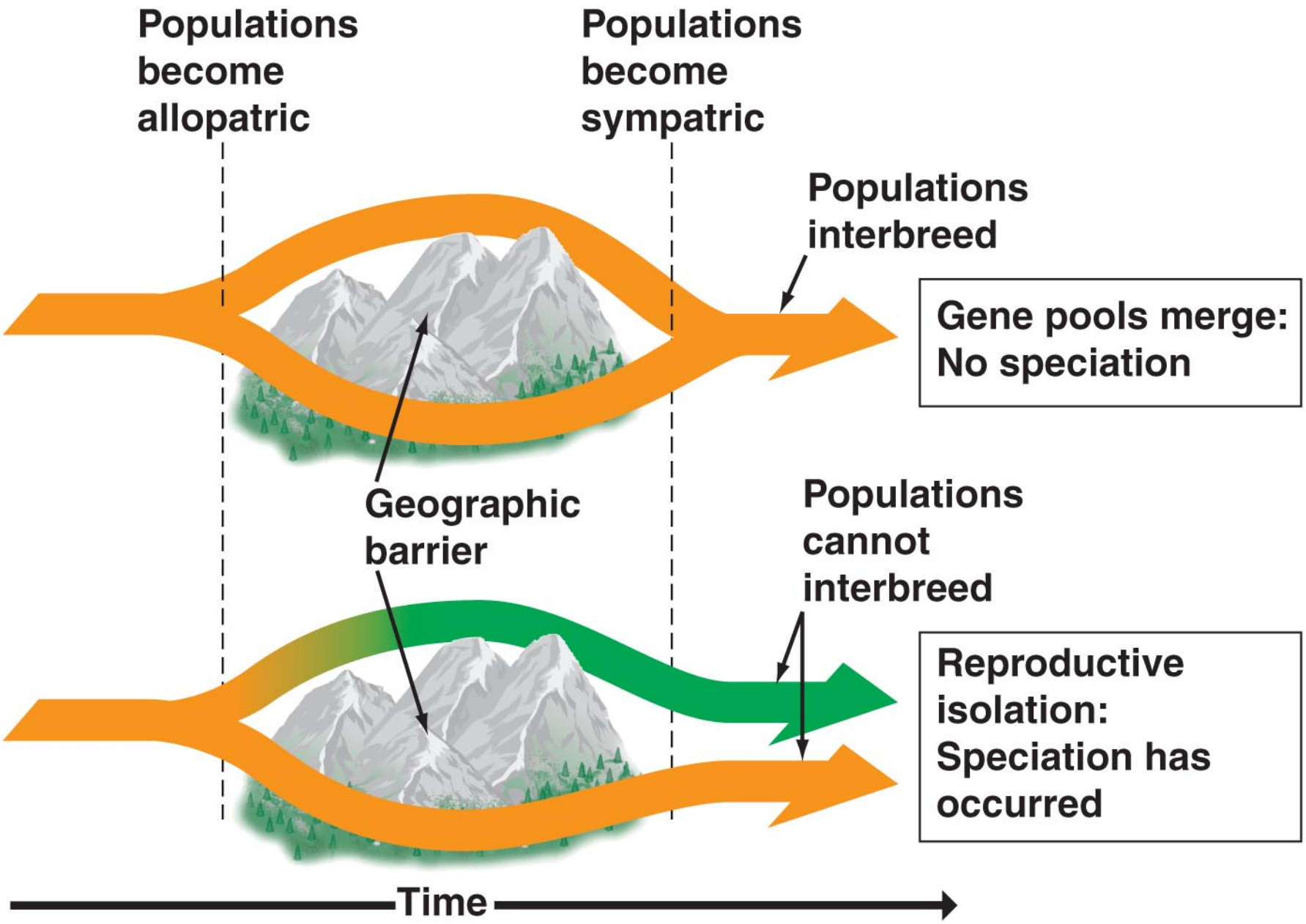
Speciation:
Example of Allopatric Speciation.--due in this Case to geological barriers



Another example

Ammospermophilus harrisii

Ammospermophilus leucurus



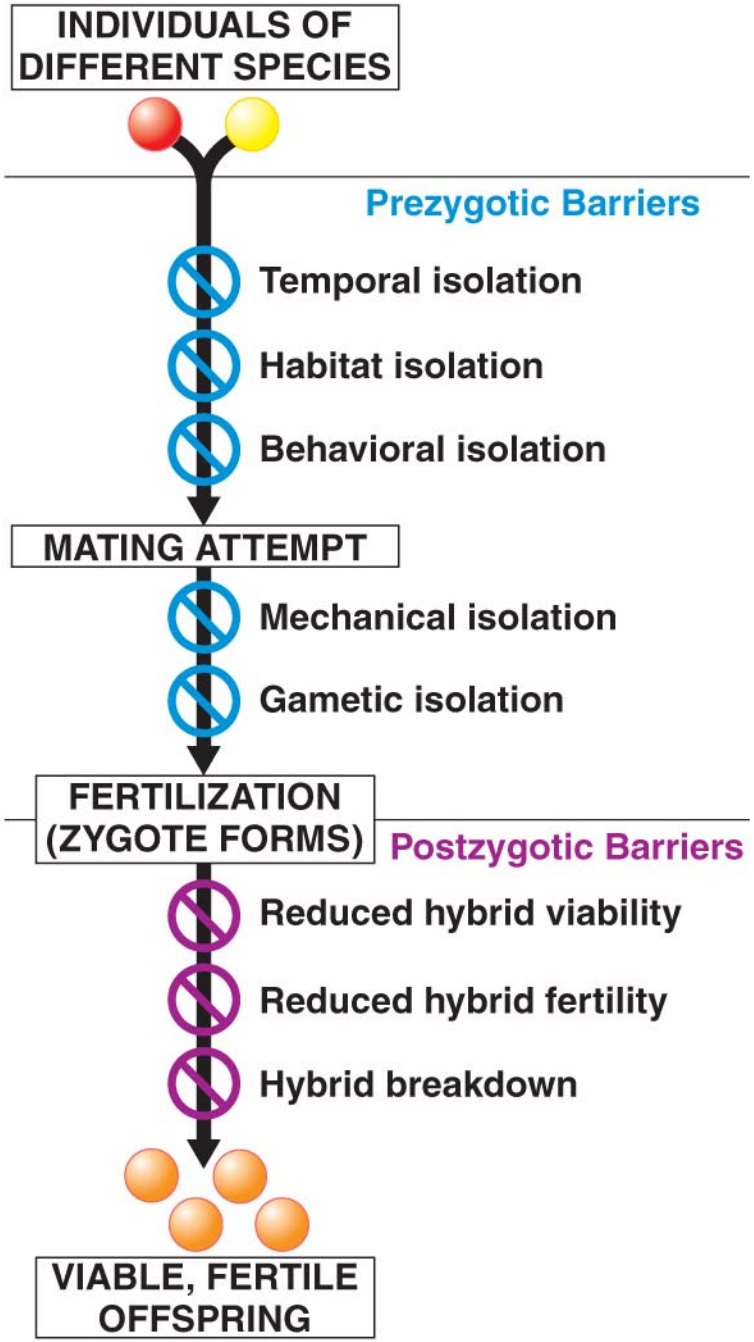


Table 18.1 Reproductive Isolating Mechanisms

Extrinsic isolating mechanism		**Geographic isolation** Individuals of two populations cannot interbreed if they live in different places (the first step in allopatric speciation).
Intrinsic isolating mechanisms		**Ecological isolation** Even if they live in the same place, they can't mate if they don't come in contact with one another.
		**Temporal isolation** Even if they come in contact, they can't mate if they breed at different times.
		**Behavioral isolation** Even if they breed at the same time, they will not mate if they are not attracted to one another.
		**Mechanical isolation** Even if they attract one another, they cannot mate if they are not physically compatible.
		**Gametic isolation** Even if they are physically compatible, an embryo will not form if the egg and sperm do not fuse properly.
		**Hybrid inviability or infertility** Even if fertilization occurs successfully, the offspring may not survive, or if it survives, may not reproduce (e.g., mule).

Example of infertile hybrid--mule from female horse and male donkey

Apple vs. Hawthron trees:
Rhagoletis pomonella
An example of sympatric speciation

Speciation through hybridization--shown below two of the parents.---This mechanism usually leads to sterility.

(a) Hybrid species

(b) One parental species

(c) Another parental species

300 million plus and still the same--a generalist
In its diet

(a) Modern horseshoe crab

(b) Fossilized horseshoe crab

100,000 years and 13 species have developed--
Each a specialist in its diet

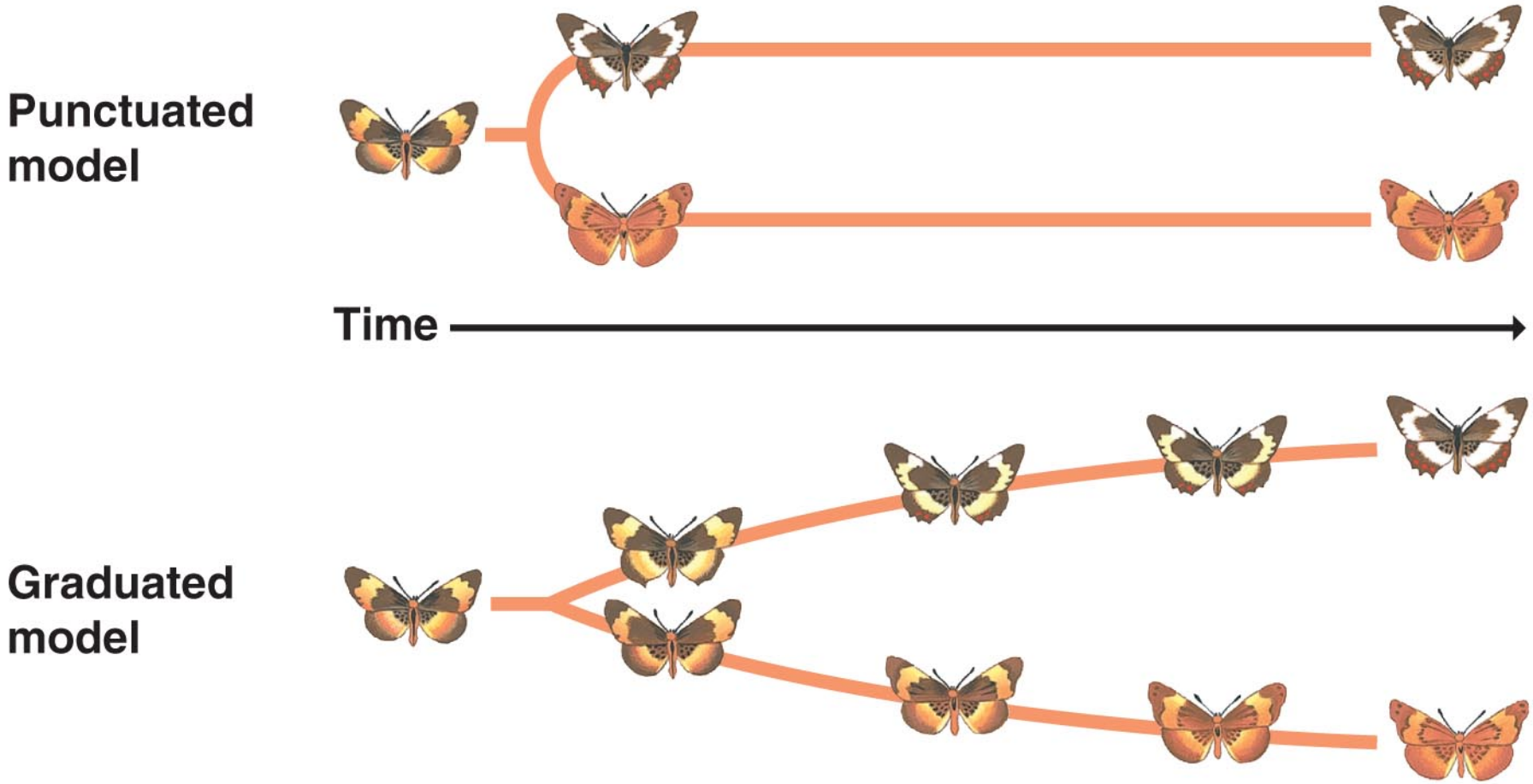
(c) Galapagos finch

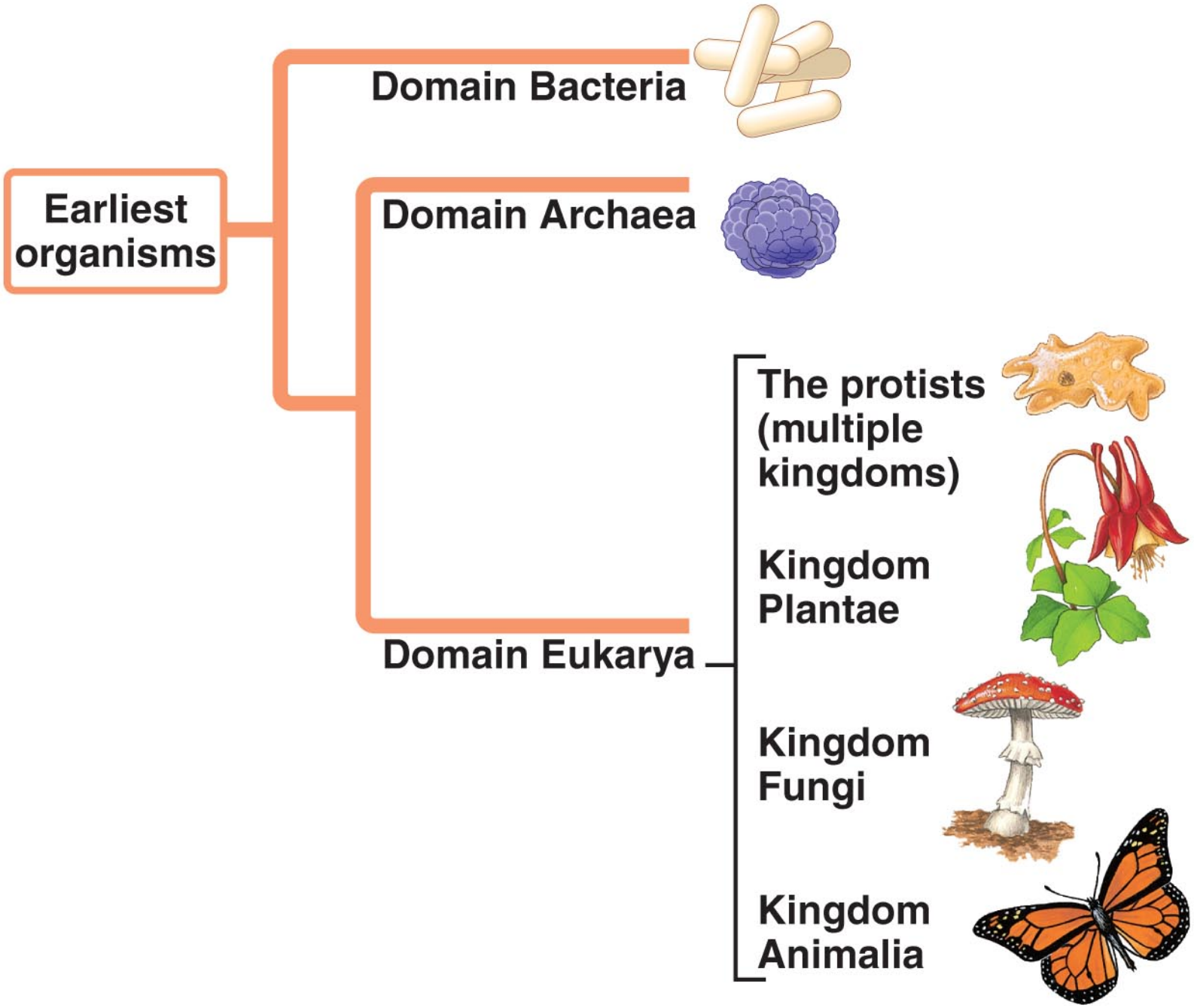
Adaptive radiation

- The rapid emergence of many species from a single species that has been introduced to a new environment.

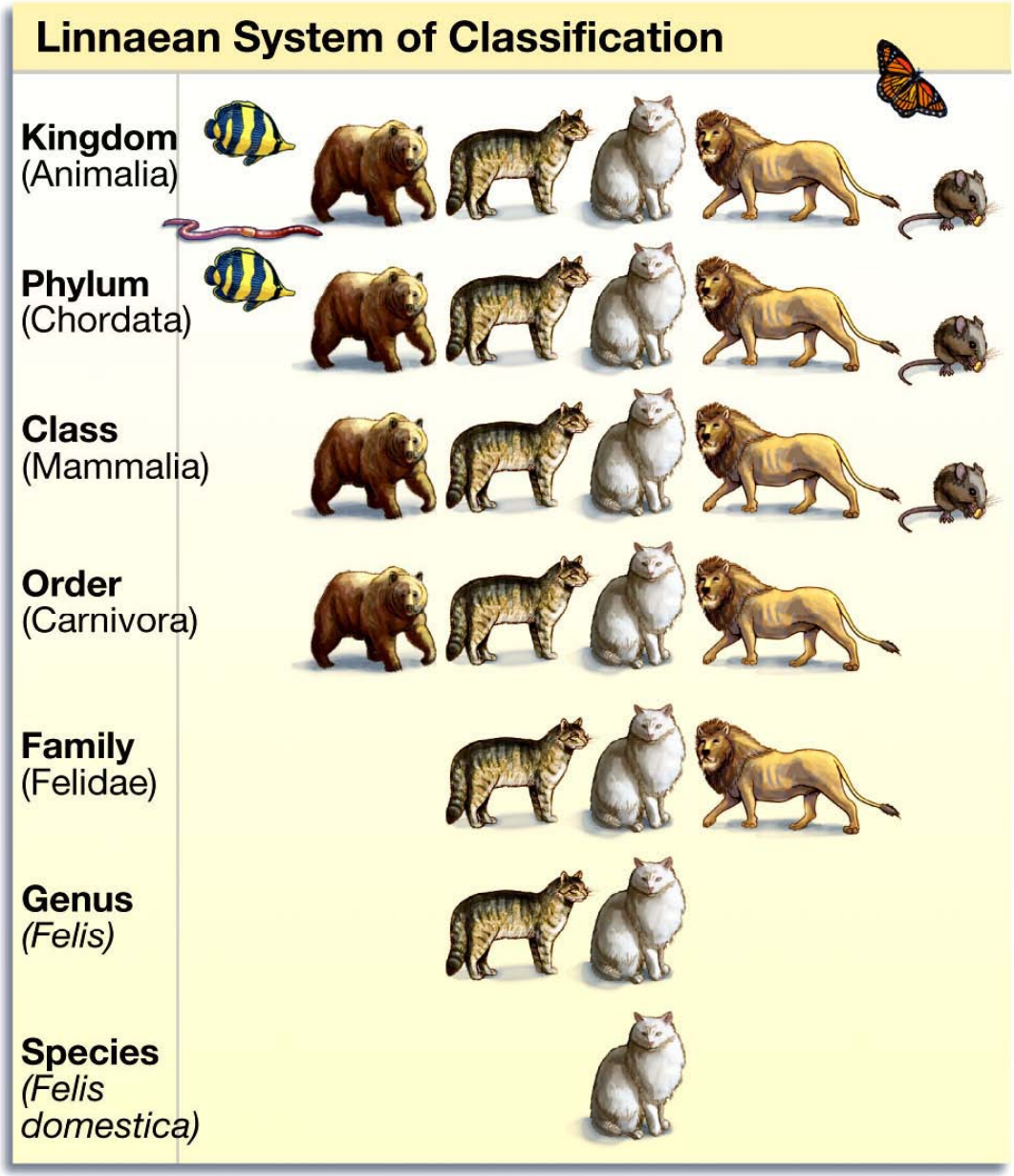
Two things needed for speciation

- New environment
- Specialization of food or some other resource.

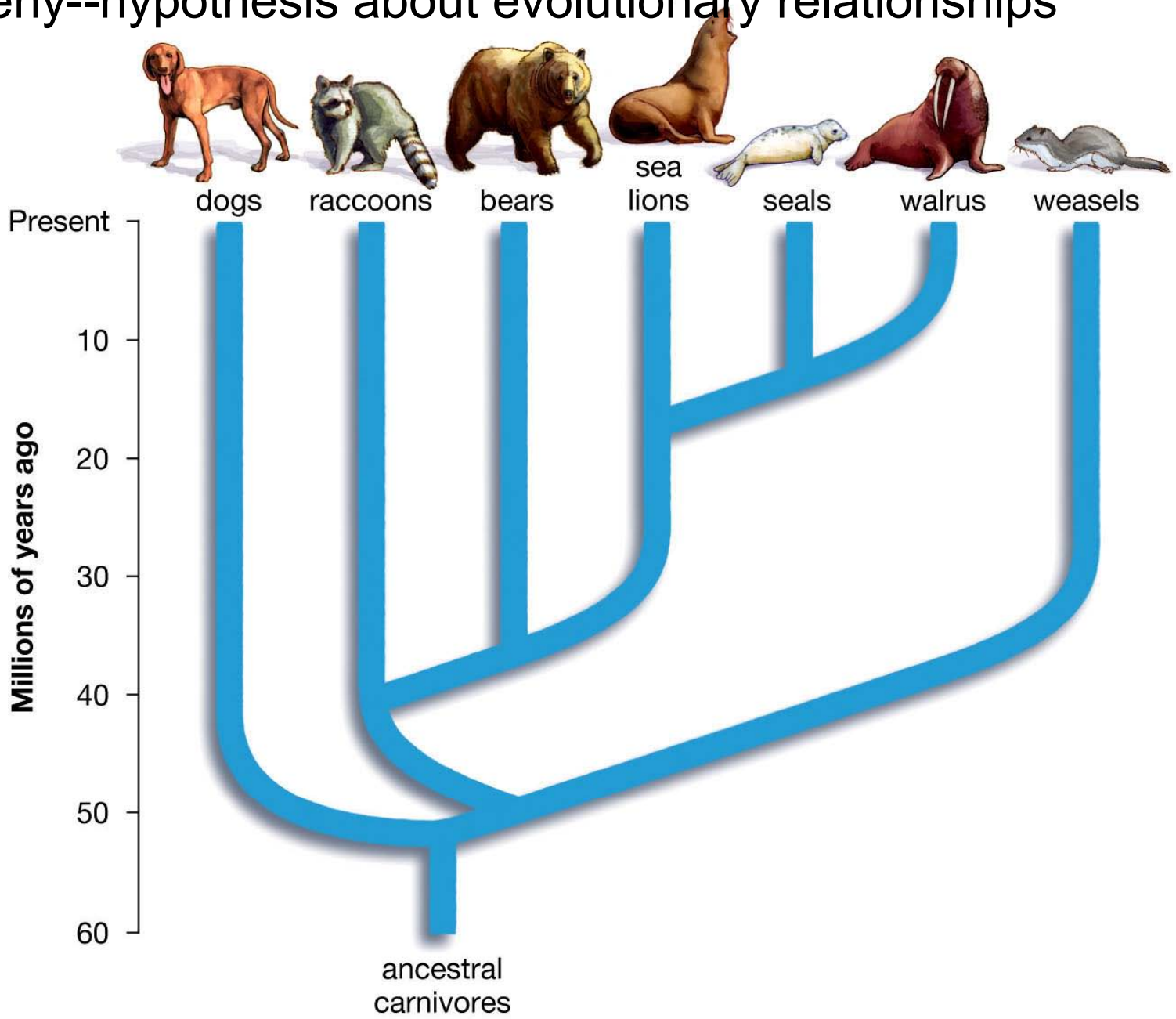




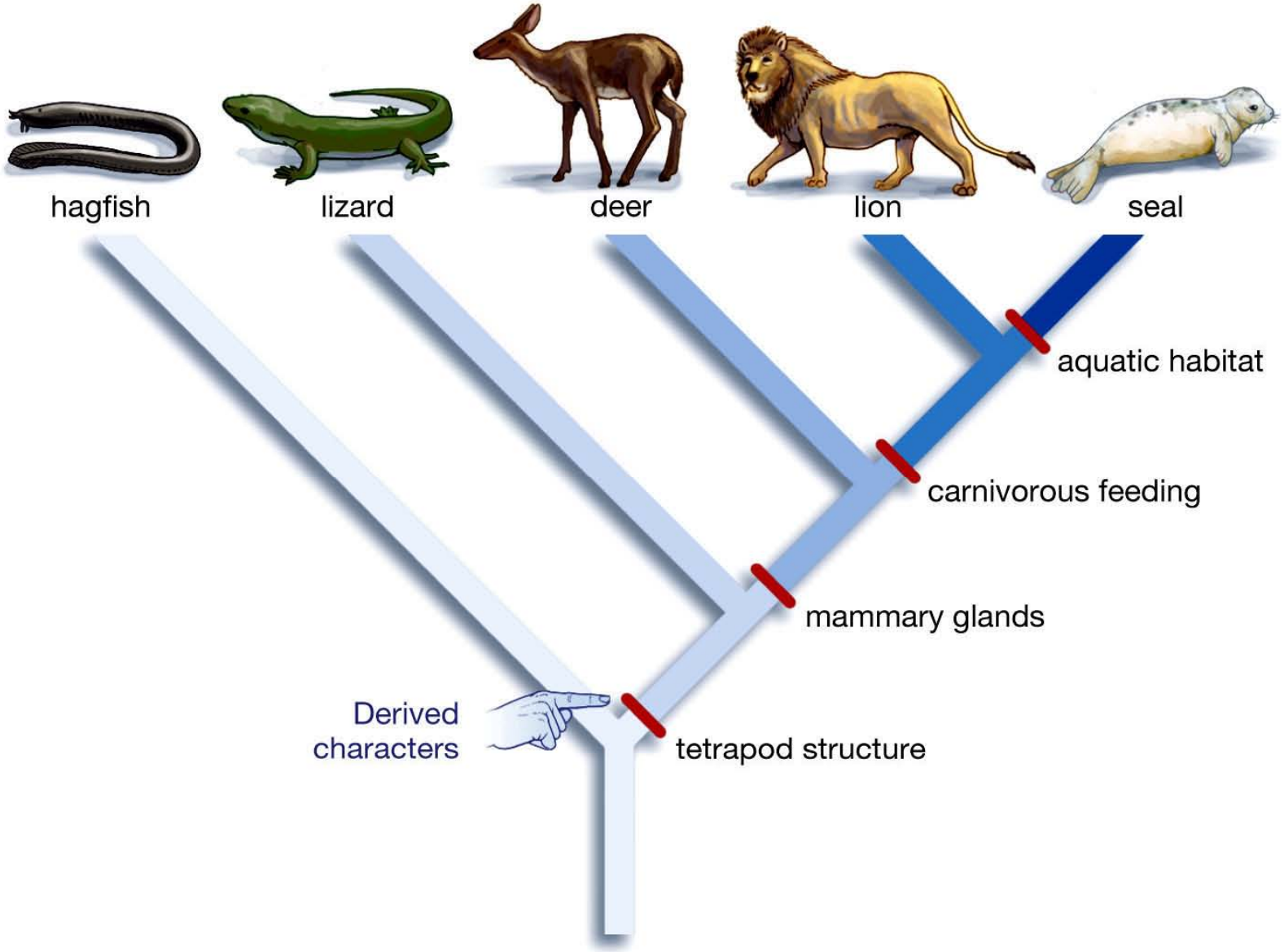
systematics



Phylogeny--hypothesis about evolutionary relationships

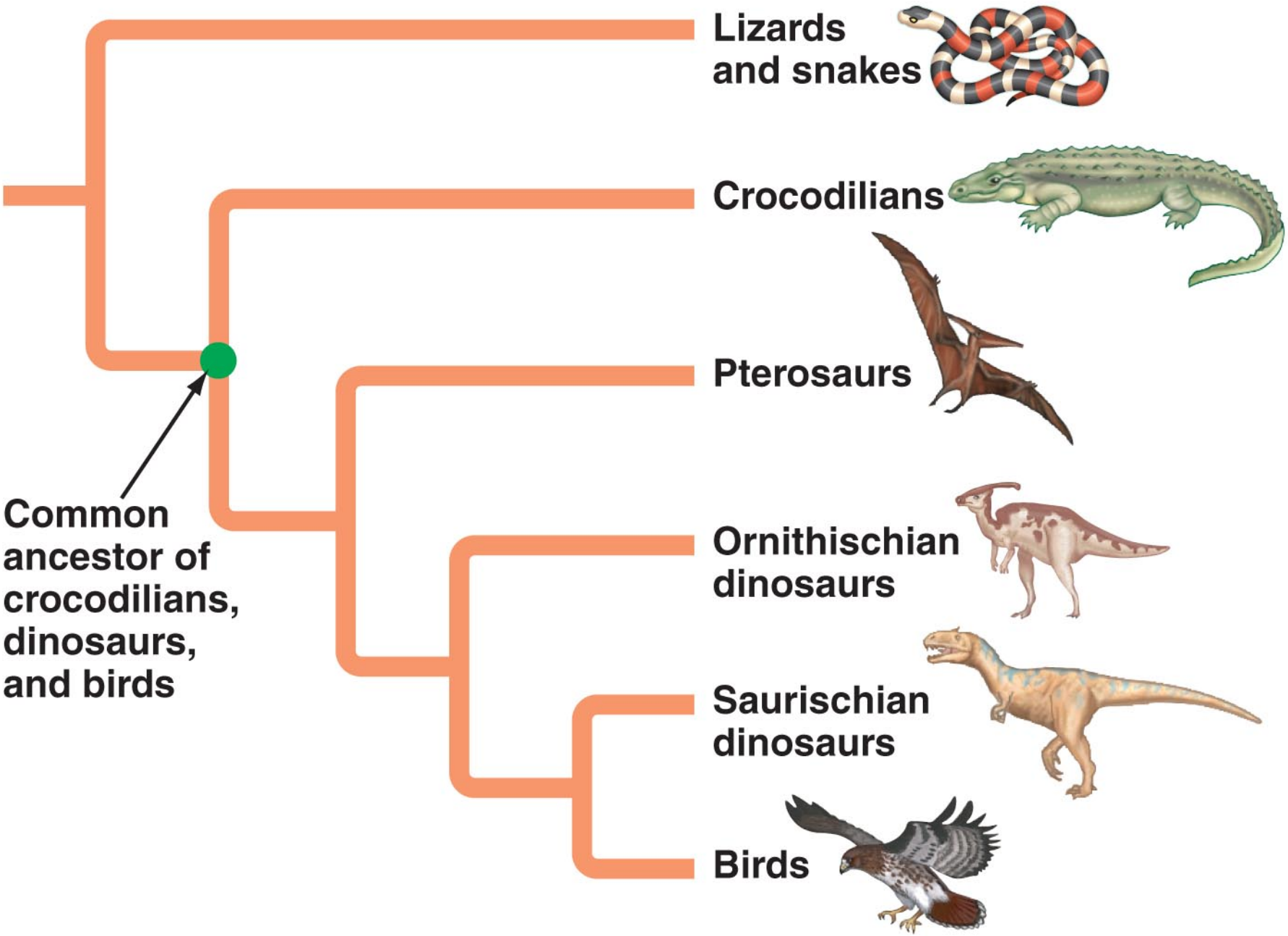


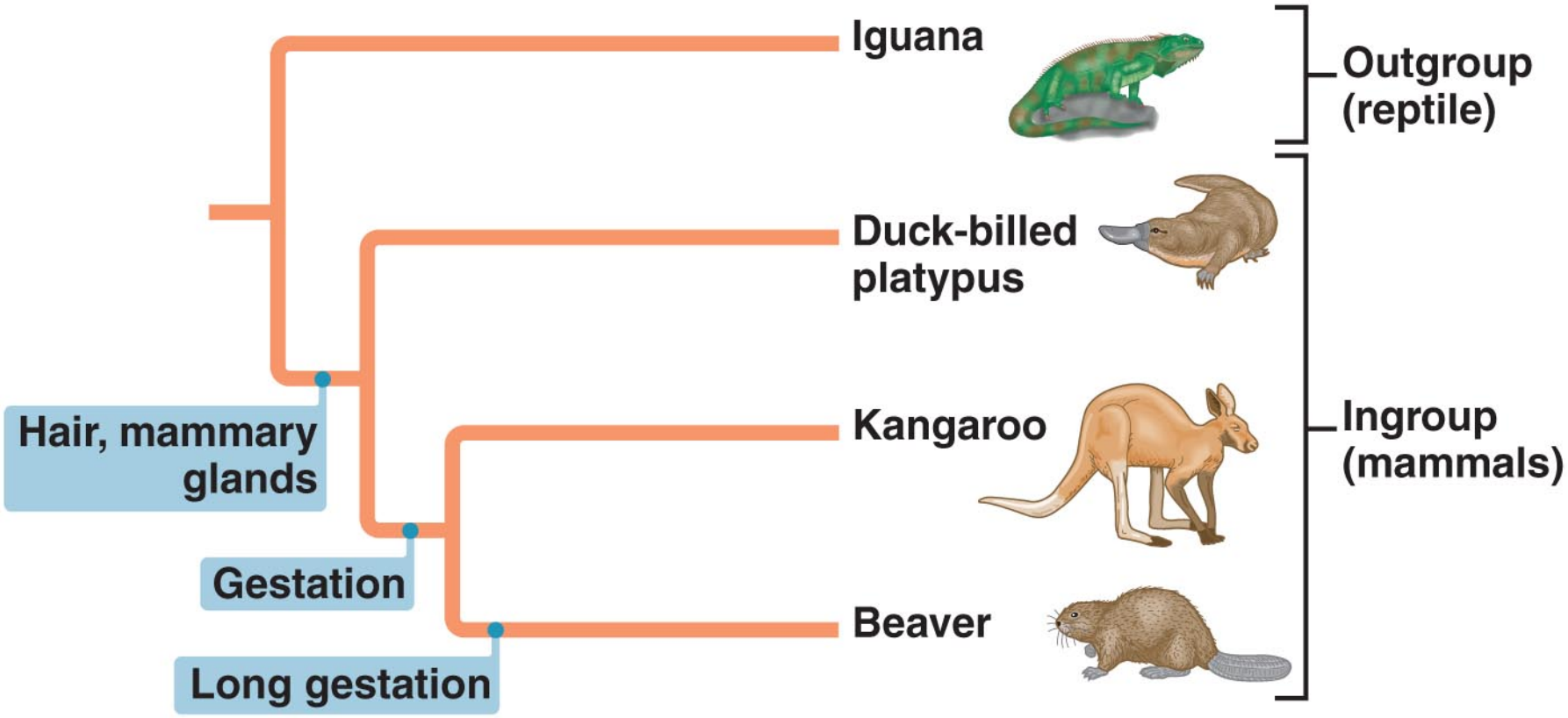
Cladogram-- notice no time line



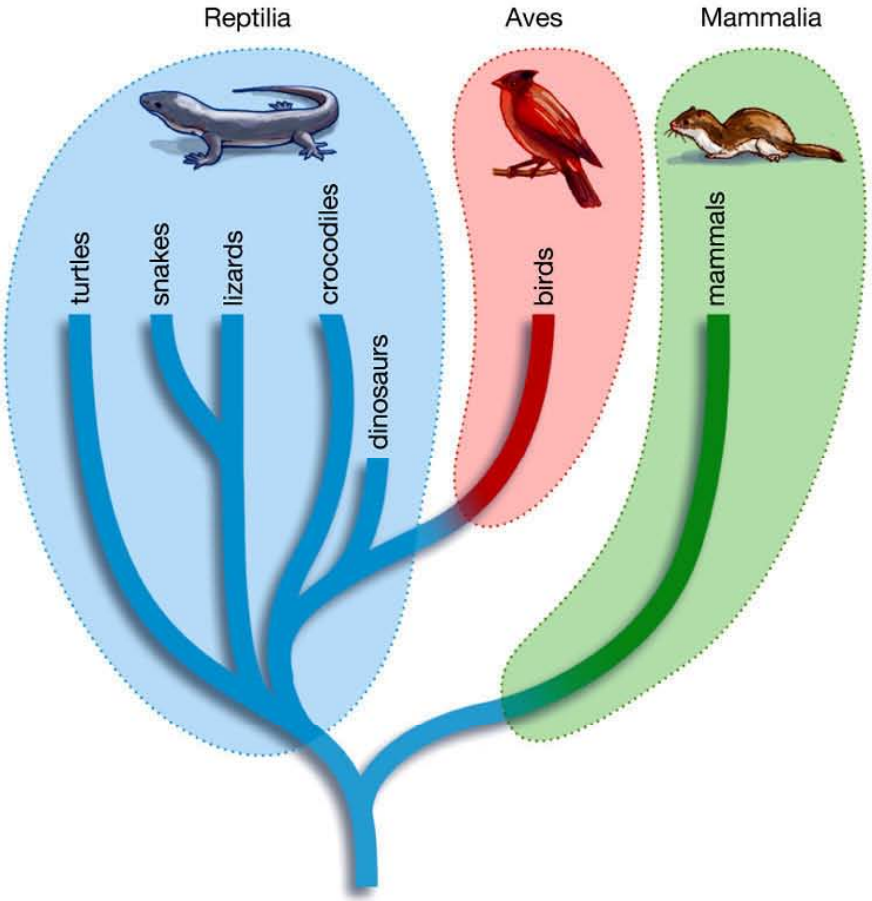
Cladograms show

- Ancestral characteristics: charcheristics that existed in an ancestor and is common to all of the species that have evolved from that ancestral species. (out-group)
- Derived characteristics: it is a characteristic that is unique to the taxa that descended from the common ancestor.





(a) Classical view of relationships among tetrapods



(b) Cladistic view of relationships among tetrapods