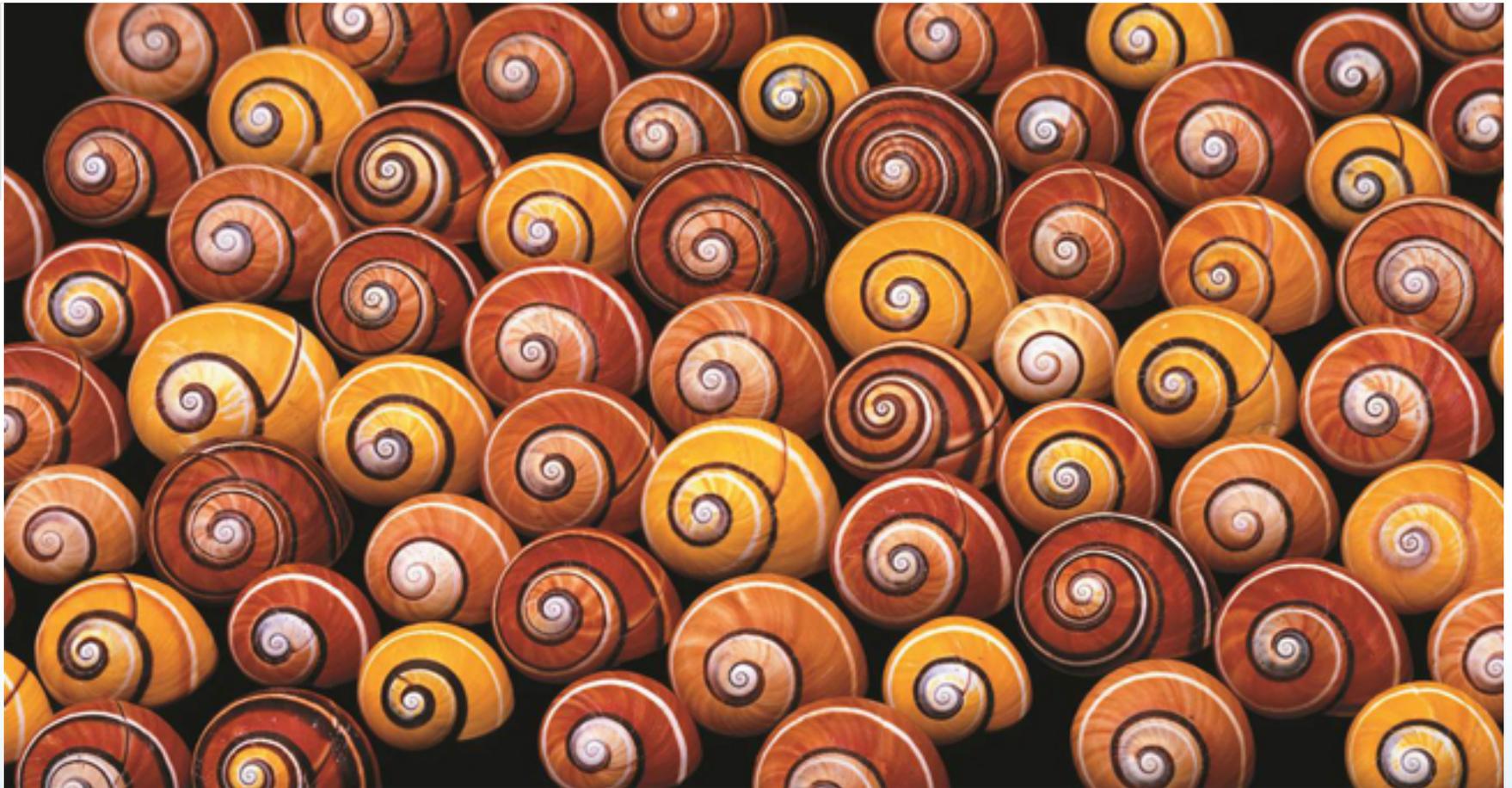




# Evidence of Evolution

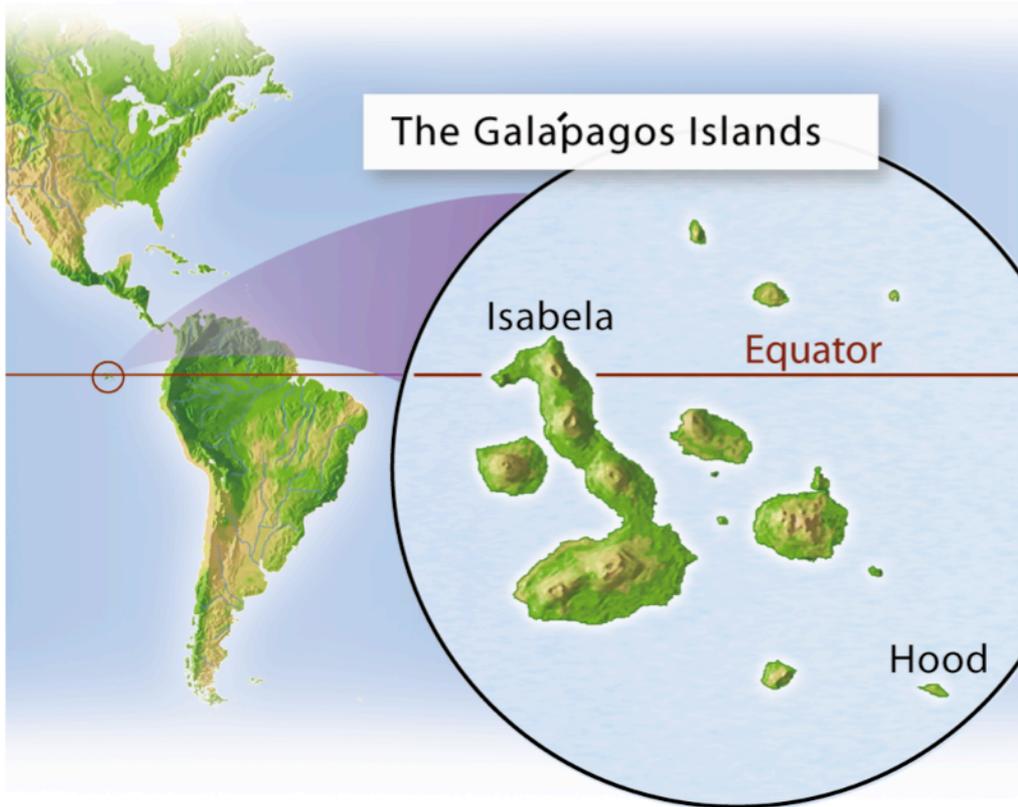




# Learning Objectives

- Explain how geologic distribution of species relates to their evolutionary history.
- Explain how fossils and the fossil record document the descent of modern species from ancient ancestors.
- Describe what homologous structures and embryology suggest about the process of evolutionary change.
- Explain how molecular evidence can be used to trace the process of evolution.
- Explain the results of the Grants' investigation of adaptation in Galápagos finches.

# Biogeography

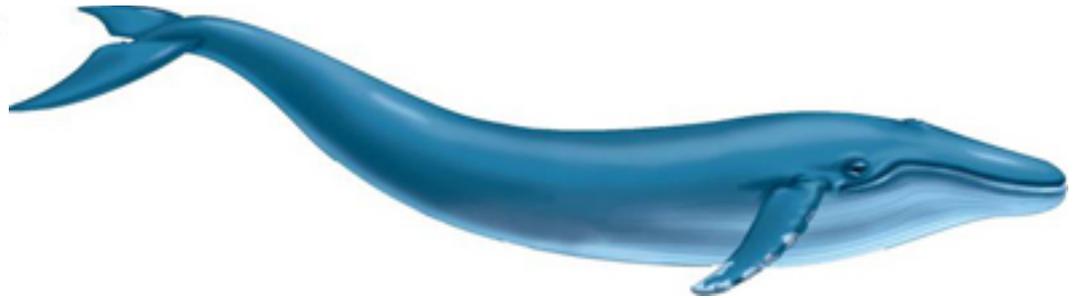


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# The Age of Earth and Fossils

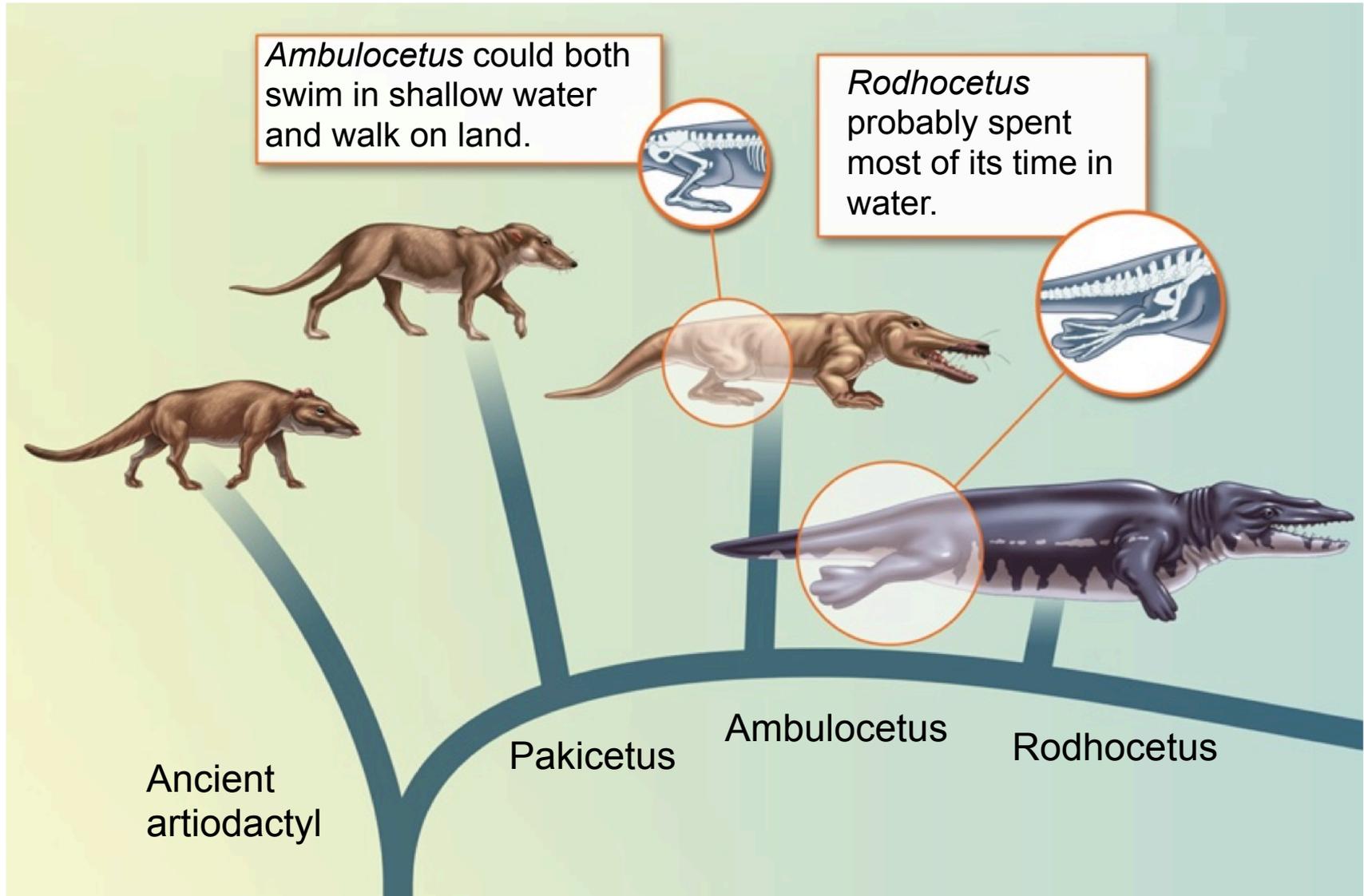


Ancient artiodactyl

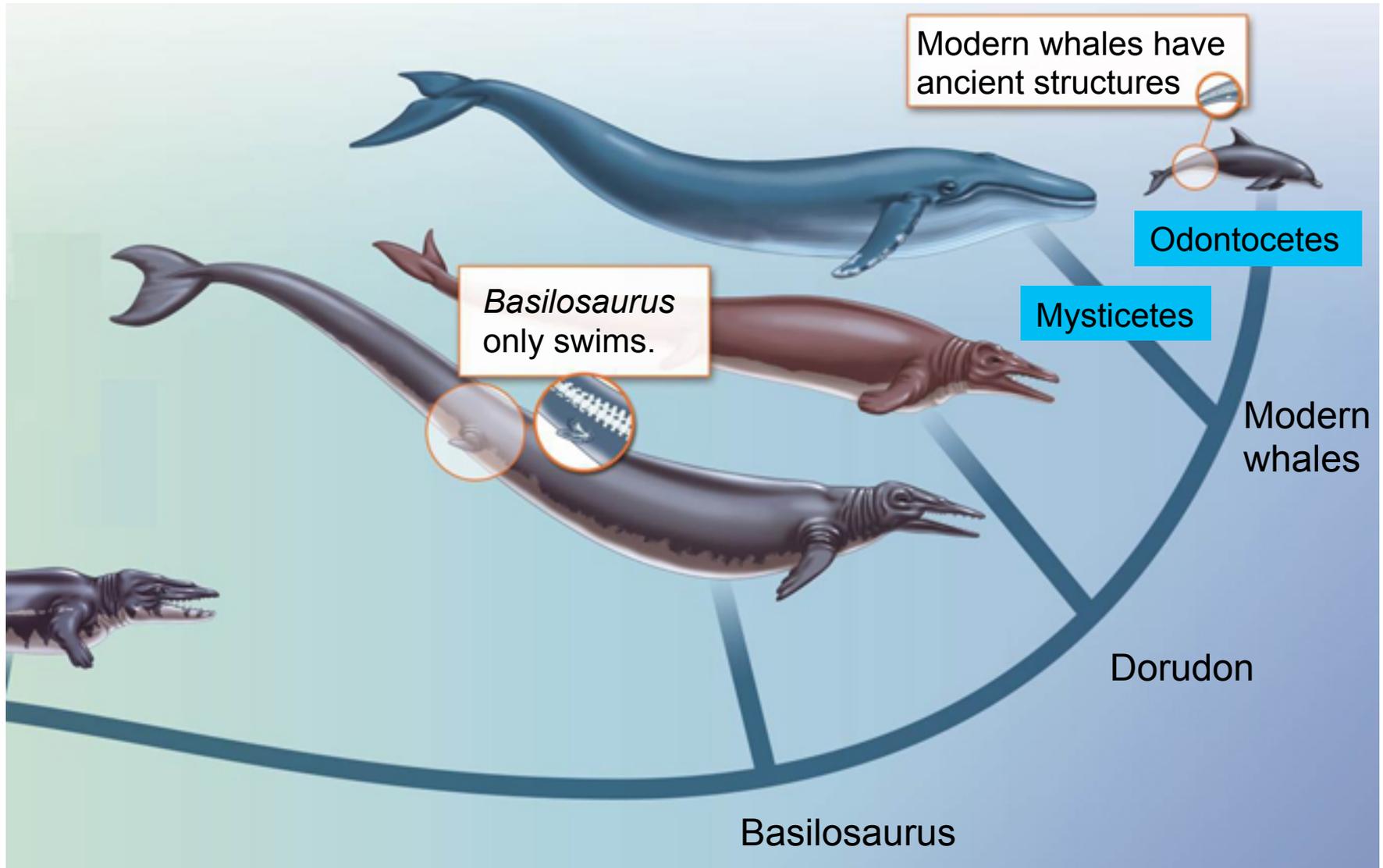


Modern whale

# Ancestors of Whales



# Evolution of Whales



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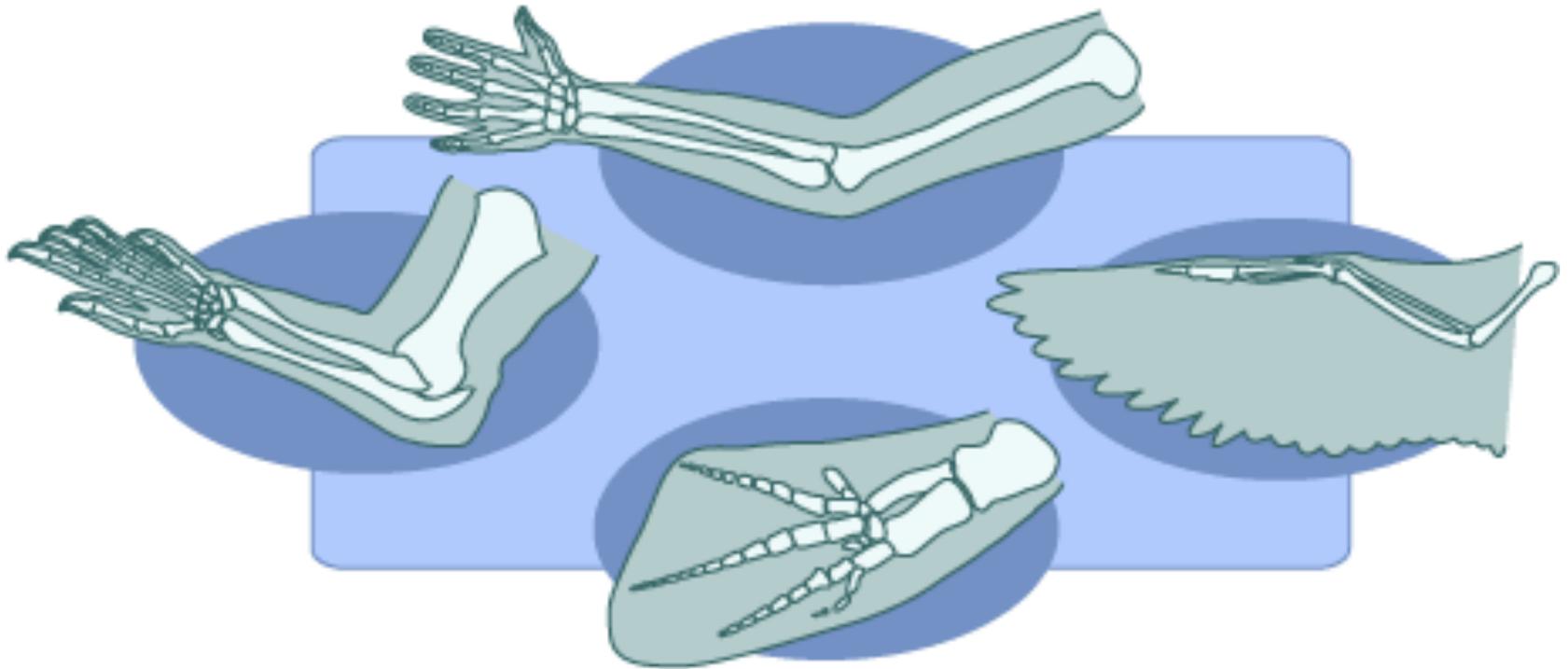
# Gaps in the Fossil Record



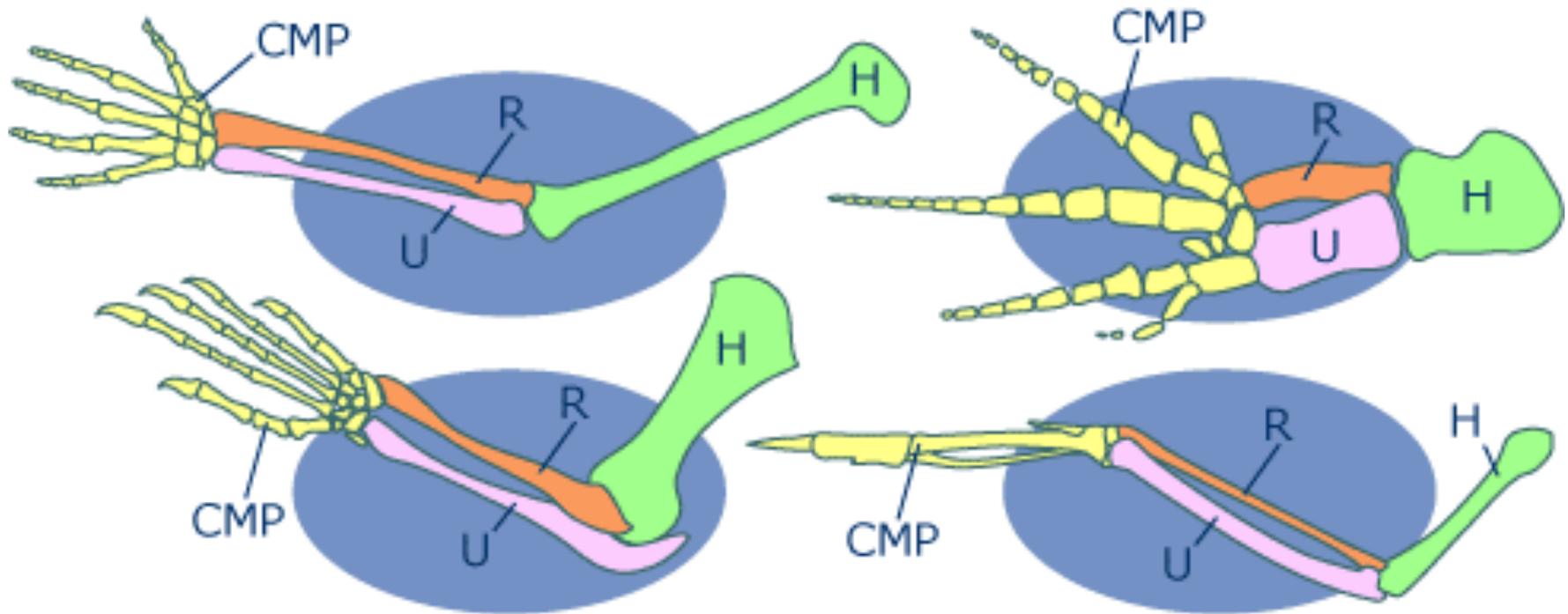
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# Homologous Structures

## Homologous Tetrapod Limbs



# Homologous structures



**H** = Humerus

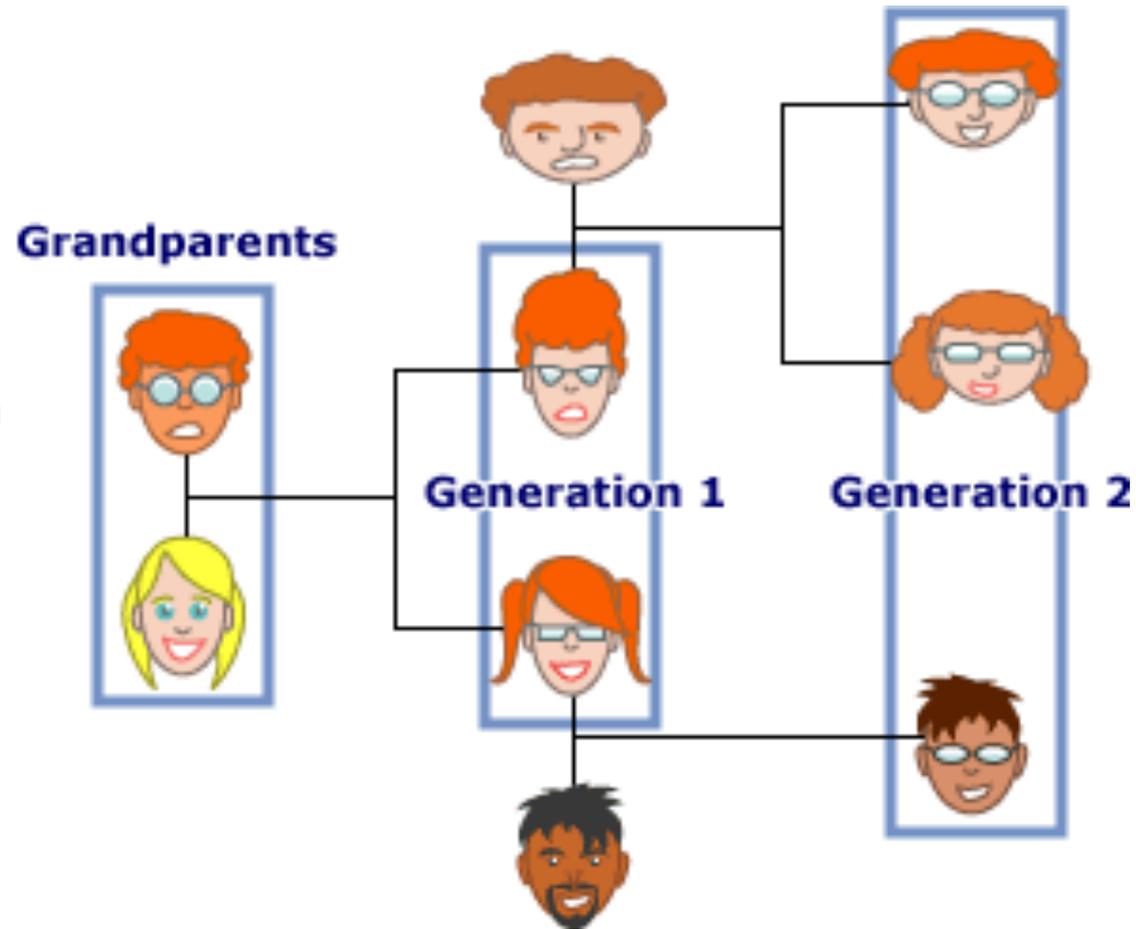
**U** = Ulna

**R** = Radius

**CMP** = Carpals, Metacarpals  
and Phalanges

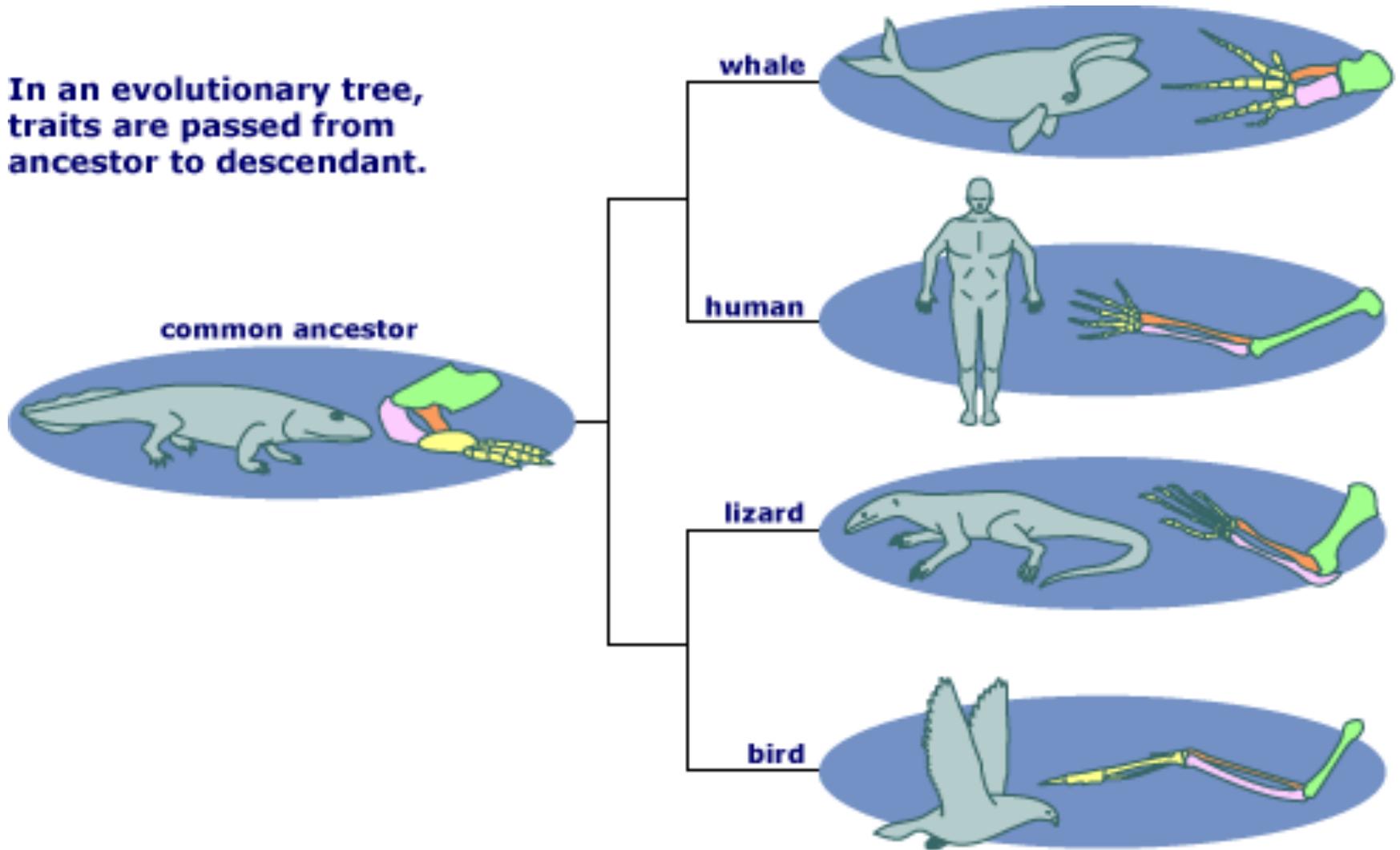
# Just as traits are inherited...

**In a family tree, traits such as hair color and poor eyesight are passed from generation to generation.**



# Homologies are inherited

In an evolutionary tree, traits are passed from ancestor to descendant.



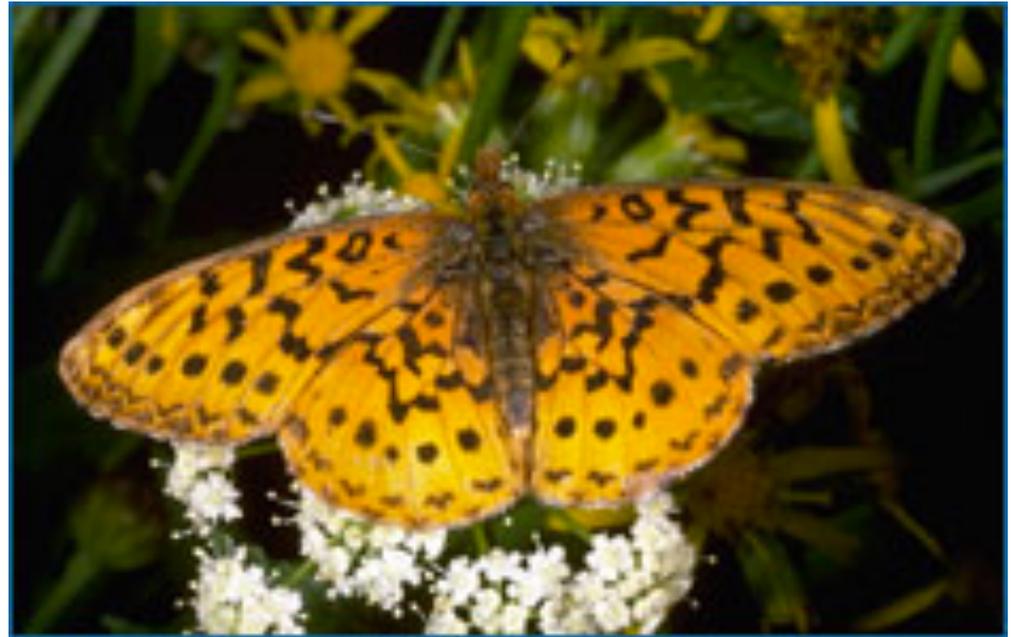
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**Oak (l) and Ginkgo (r) are both descendants of an ancient plant with leaves**



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**Dragon fly (l) and moth (r) are both descendants of an ancient flying insect.**



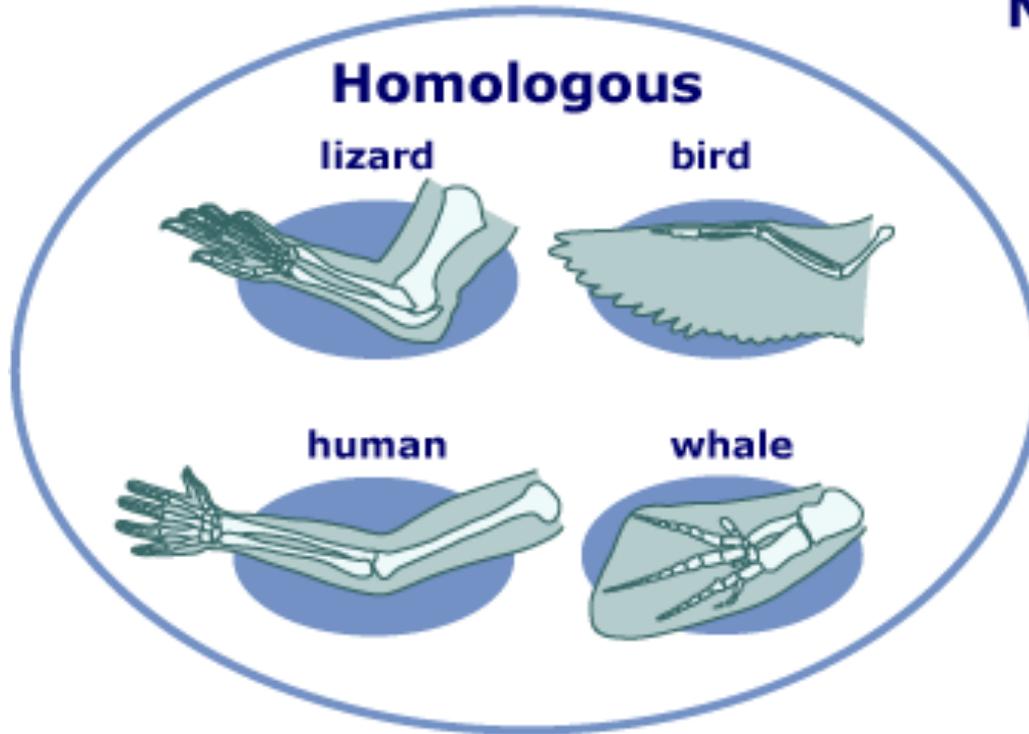
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# Not all homologies are obvious

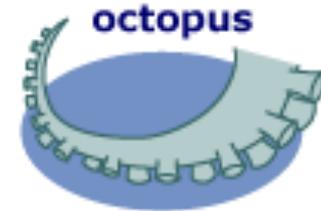


The beaver uses its teeth for chewing through tree trunks, and the elephant uses its tusks for a number of tasks including digging, peeling bark from trees, and fighting. But if you examine these two structures closely, you will see that each is a modification of the basic incisor tooth structure. Over time, evolution adapted each of these animals' incisors to perform different functions. They are homologous structures, inherited from a common ancestor with incisor teeth.

# Not all similarity is **HOMOLOGY**



## Not homologous



These structures perform similar functions but are not related through common ancestry.... Such structures are called **ANALOGOUS**.

---

# Analogous



- skeleton made of cartilage
- use gills to get oxygen from the water
- don't nurse their young
- don't have hair
- do have hair



- skeleton made of bone
- go to the surface and breathe atmospheric air in through their blowholes
- do nurse their young
- do have hair — they are born with hair around their "noses"

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# Vestigial Structures

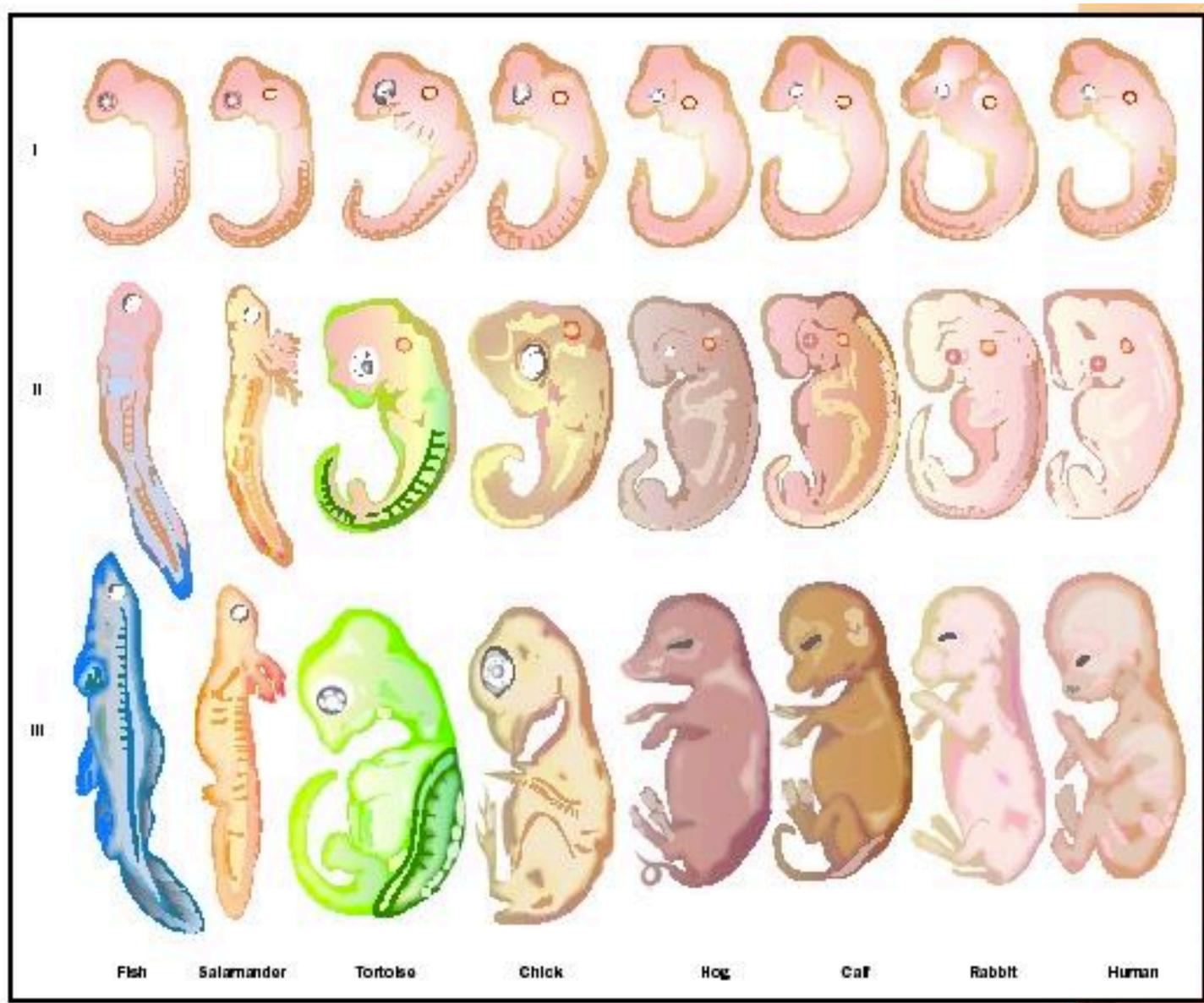


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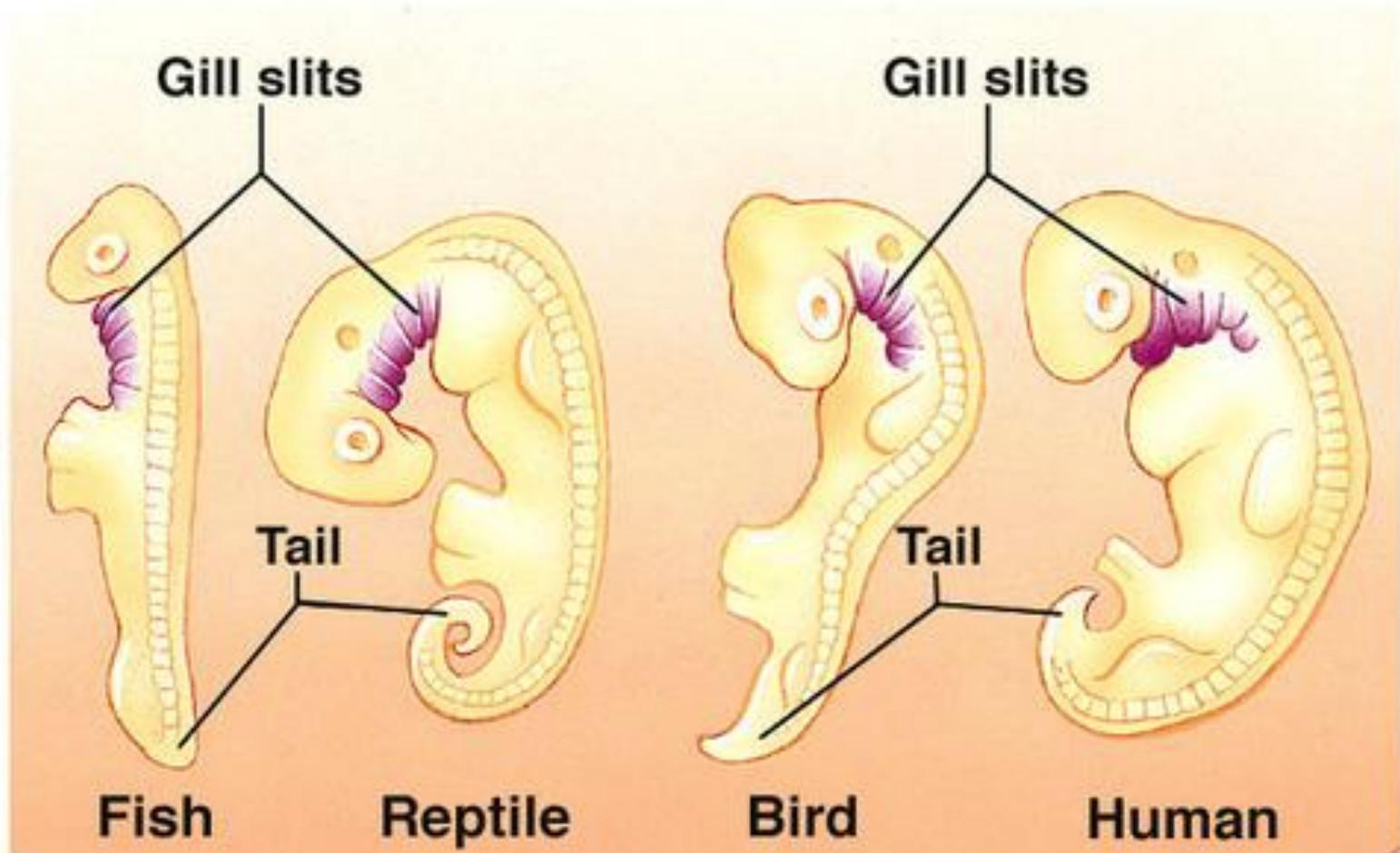
# Development



# Embryology: DNA dictates development



# Embryos and Evolutionary History

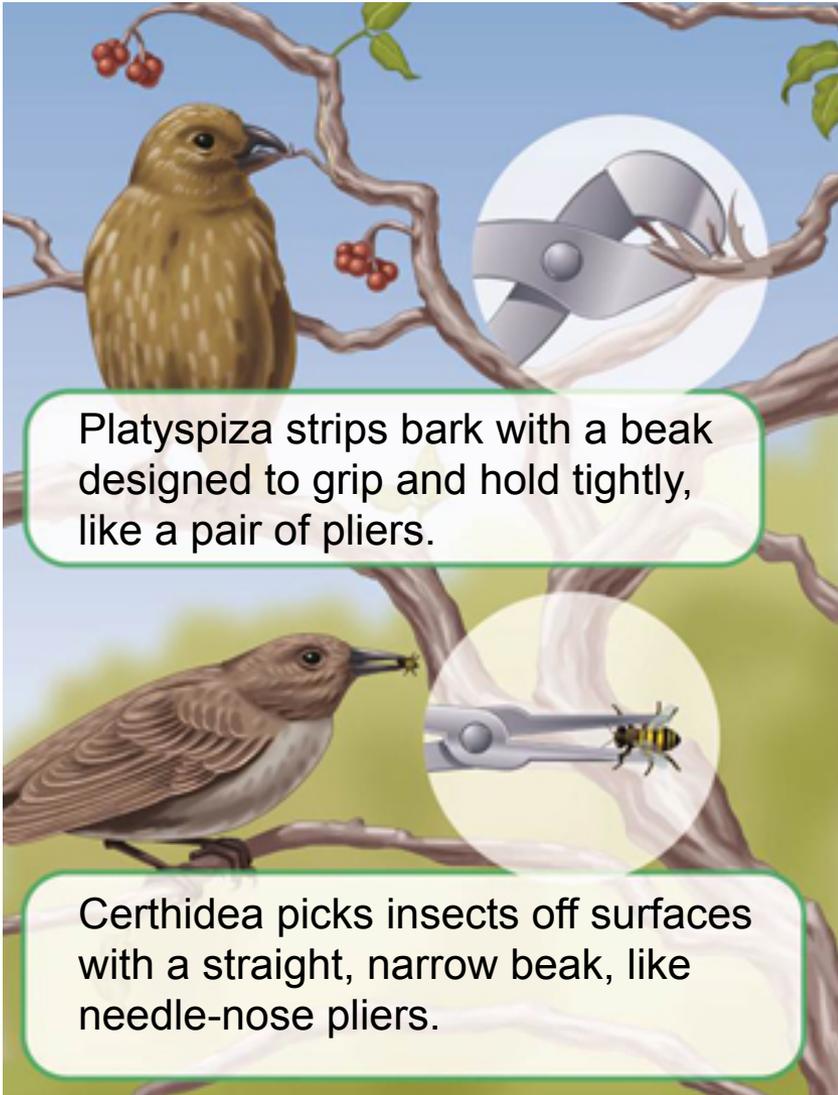


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# Genetics and Molecular Biology

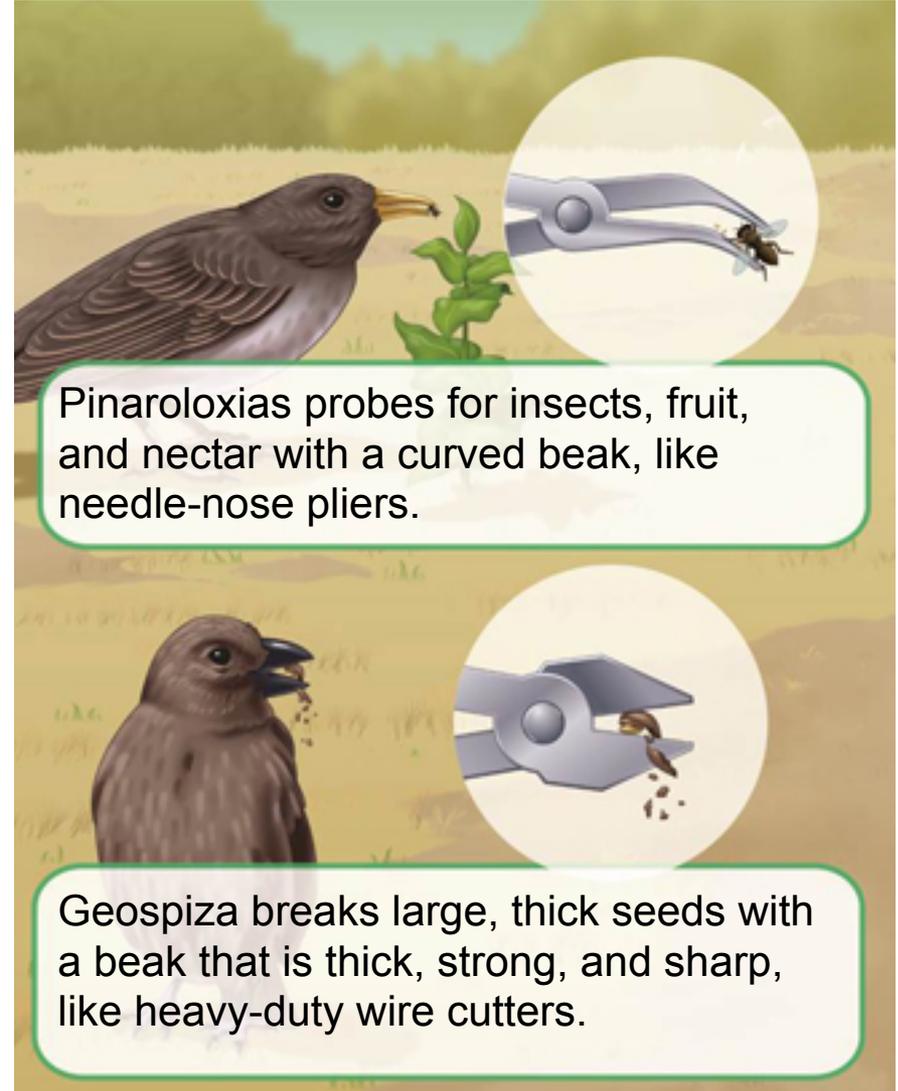


# Testing Natural Selection



Platyspiza strips bark with a beak designed to grip and hold tightly, like a pair of pliers.

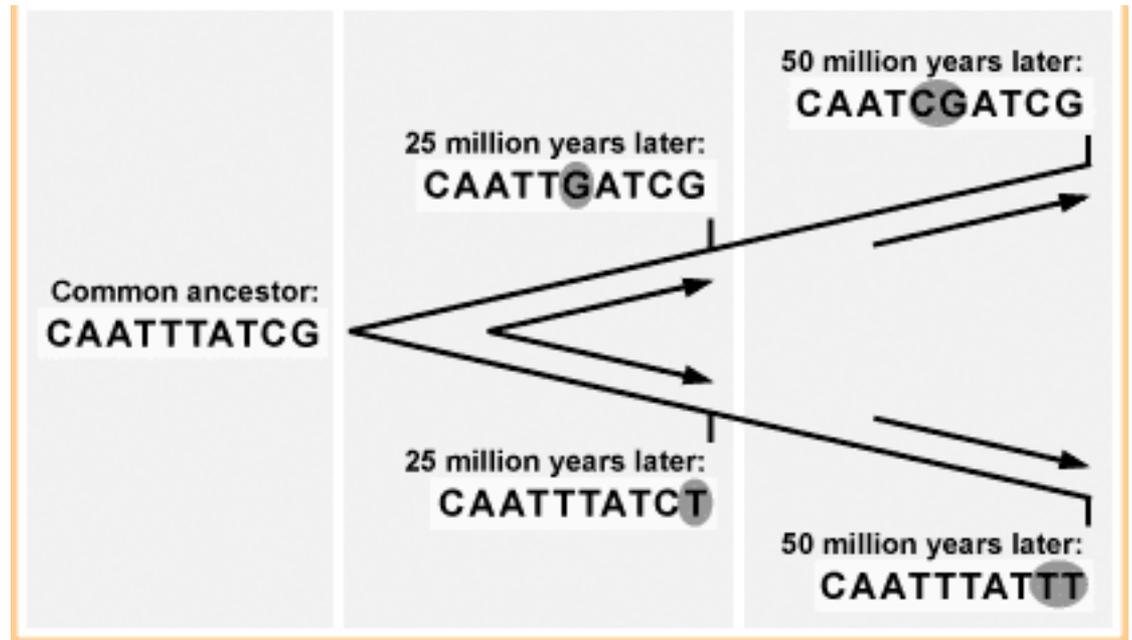
Certhidea picks insects off surfaces with a straight, narrow beak, like needle-nose pliers.



Pinaroloxias probes for insects, fruit, and nectar with a curved beak, like needle-nose pliers.

Geospiza breaks large, thick seeds with a beak that is thick, strong, and sharp, like heavy-duty wire cutters.

# Genes as molecular clocks



More closely related species share more **HOMOLOGY** in their genes (more similarity in sequence).

# Student Worksheet Answers

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_



## Evidence of Evolution

**Identify** A concept map helps you organize concepts, using visual relationships and linking words. Create a concept map, similar to the one shown here, identifying all the pieces of evidence that support evolutionary theory.

