NOTES 6.3

Chapter 6 - The Environment and Changes Over Time
Lesson 3 - Biological Evidence of Evolution

Evidence for Evolution

Modern-day organisms can provide clues about evolution.

By comparing organisms, scientists can infer how closely related the organisms are in an evolutionary sense.

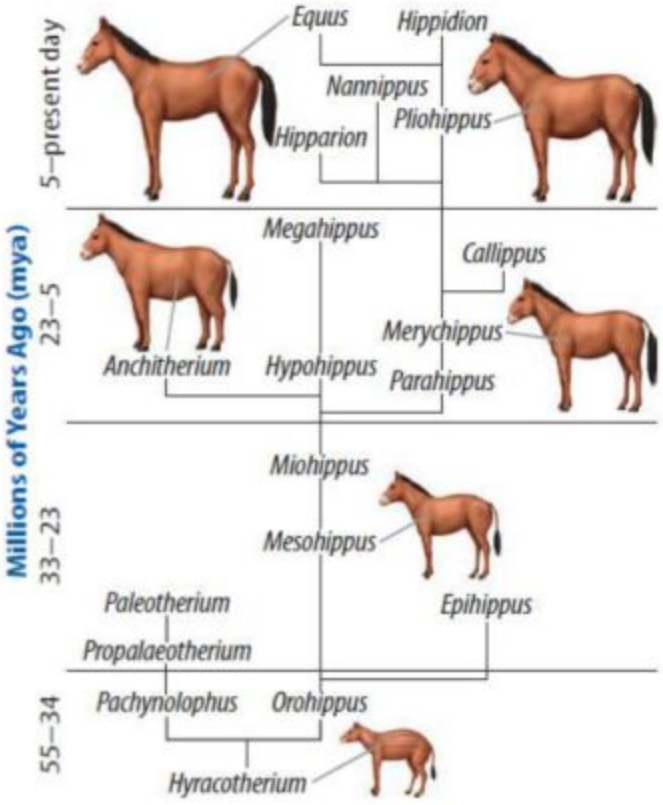
Scientists compare similarities in – body structures, development before birth, and DNA sequences to determine the evolutionary relationships among organisms.

Q: Which animals, from the following list, would you group together based on their similarities?

horse	mouse
rabbit	chipmunk
squirrel	deer
donkey	zebra

A:

Group 1	Group 2
horse	mouse
donkey	rabbit
zebra	squirrel
deer	chipmunk



Comparative Anatomy

Q: What is comparative anatomy?
A: the study of similarities and differences among structures of living species

An organism's body structure is its basic body plan, such as how its bones are arranged.

Ex. fishes, amphibians, reptiles, birds, and mammals all have a similar body structure – an internal skeleton with a backbone

This is why scientists classify all 5 groups of animals together as vertebrates.

Presumably, these groups all inherited these similarities in structure from an early vertebrate ancestor that they shared, also known as **homologous structures**.

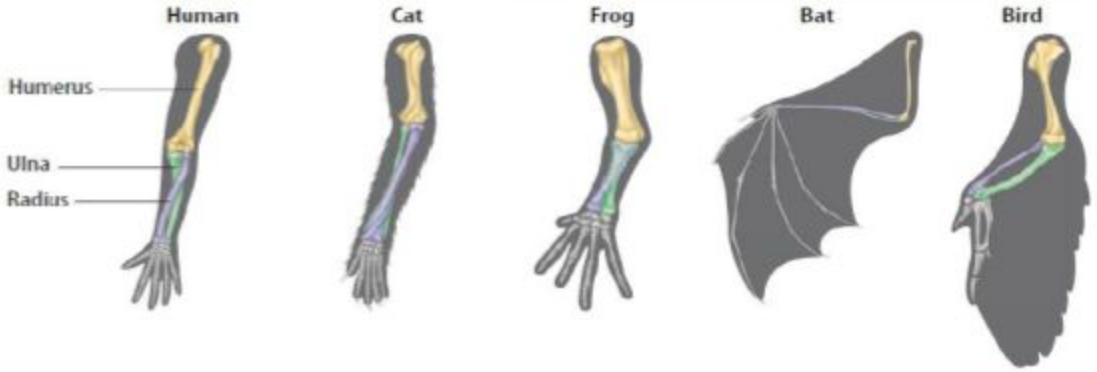
Q: What are homologous structures?
A: similar structures that related species have inherited from a common ancestor

Sometimes scientists find fossil evidence that supports the evidence provided by homologous structures.

Ex. fossils show that the ancestors of today's whales had legs and walked on land known as creodonts

This supports other evidence that whales and humans share a **common ancestor**

Homologous Structures



Q: Based on the diagram, do you think that humans share a common ancestor with cats, frogs, bats, and birds?

A: yes, because the bones are similar

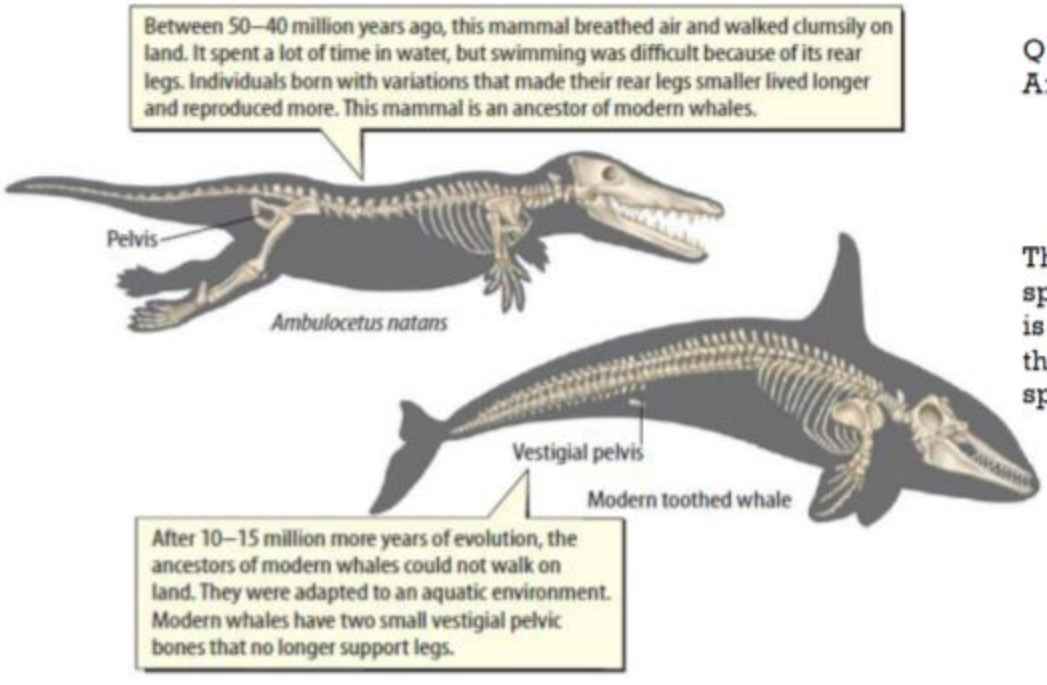
Q: What similarities in structure do the above limbs share?

A: the bones are connected the same way

Analogous Structures

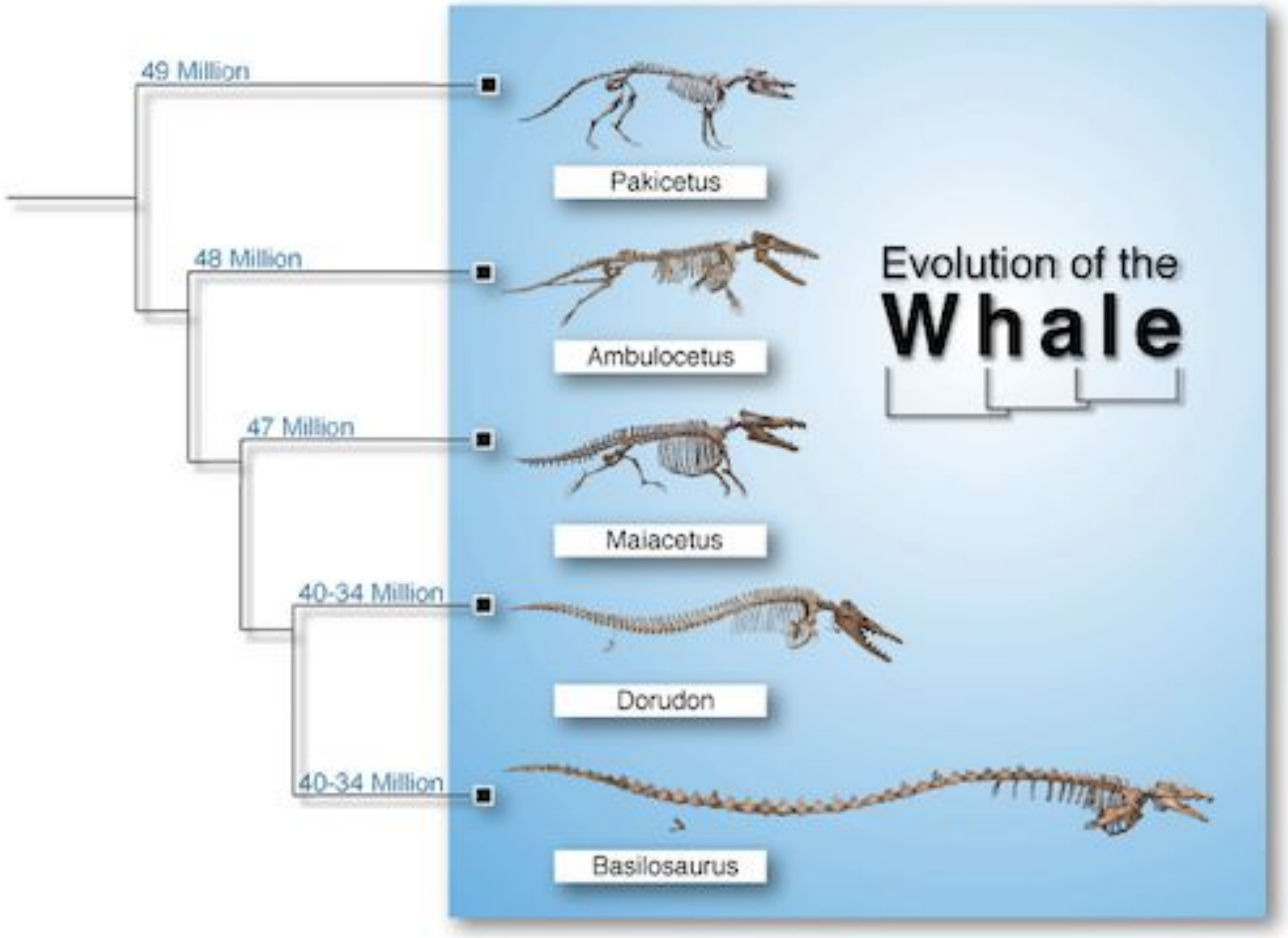
Q: What are analogous structures?
A: body parts that perform a similar function but differ in structure

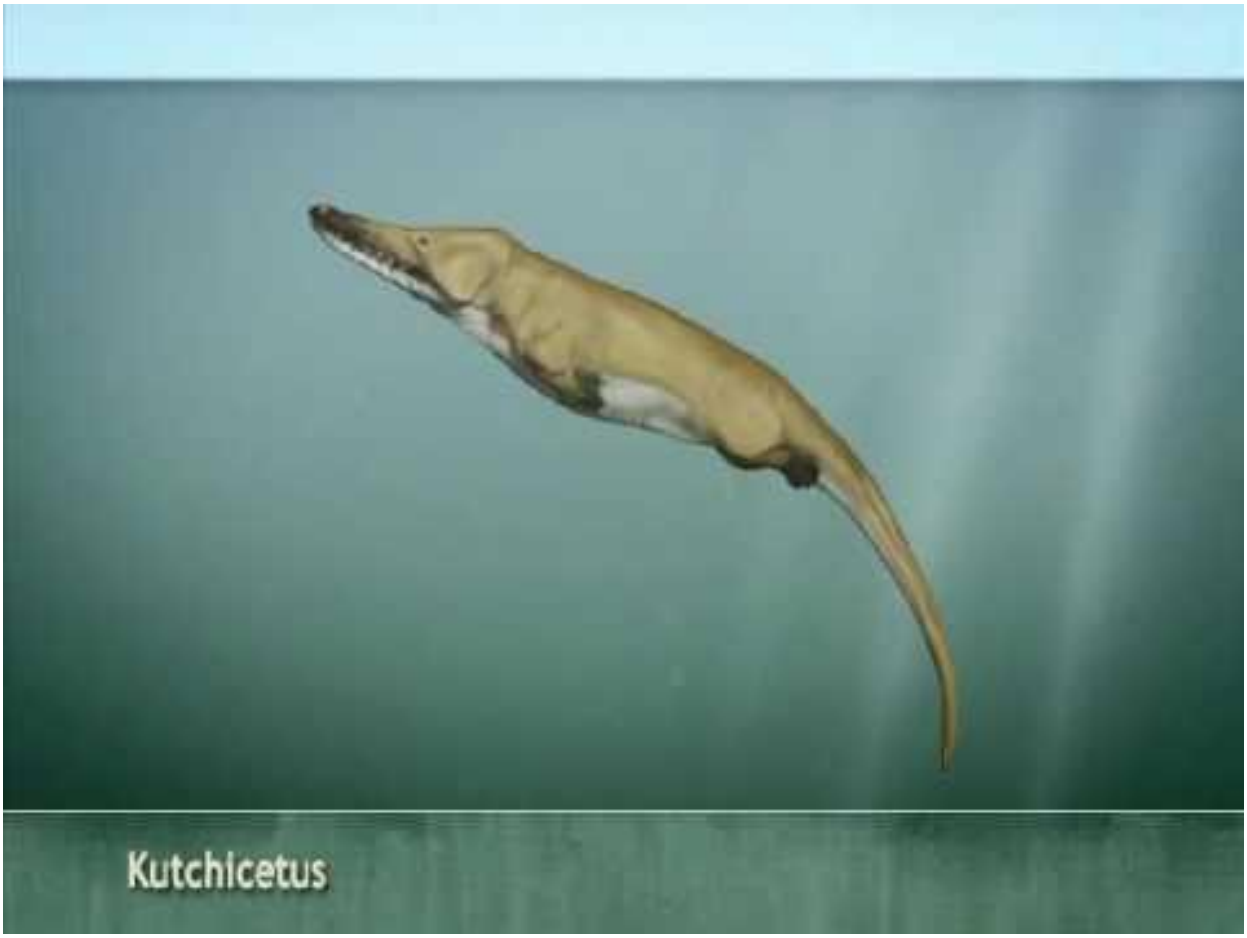
Vestigial Structures



Q: What are vestigial structures?
A: body parts that have lost their original function through evolution

The best explanation is that the species with a vestigial structure is related to an ancestral species that used the structure for a specific purpose.


49 Million
Pakicetus
48 Million
Ambulocetus
Evolution of the
Whale
47 Million
Maiacetus
40-34 Million
Dorudon
40-34 Million
Basilosaurus

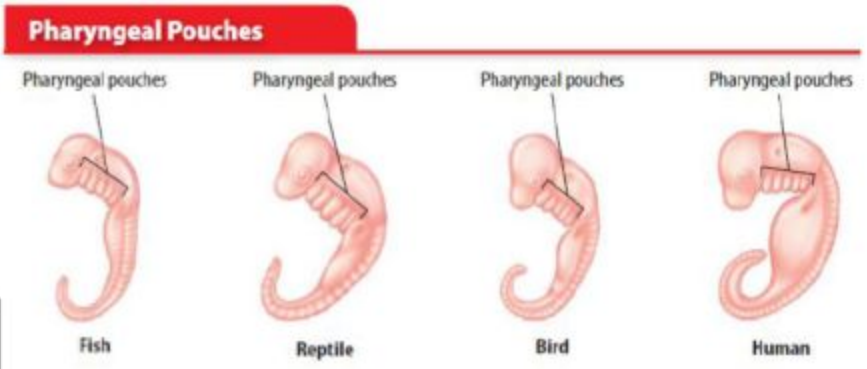

Kutchicetus

Similarities in Early Development

Scientists can also make inferences about evolutionary relationships by comparing the early development of different organisms.

These similarities suggest that these 4 vertebrate species are related and share a

common ancestor

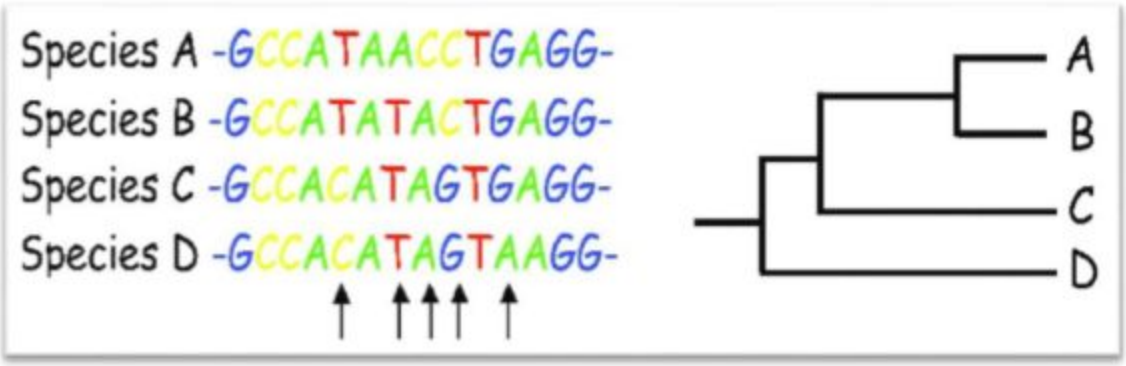


Similarities in DNA

Scientists infer that **species** with similar **body structures** and **development patterns** inherited many of the same **genes** from a common ancestor.

Recall that genes are made of DNA and by comparing, scientists can infer how closely related the species are by comparing –

- ☑ the sequence of nitrogen bases in the DNA of different species
- ☑ the order of amino acids in a protein



The more similar the sequences, the more closely related the species are. Recall also that the DNA bases along a gene specify what type of protein will be produced.

Recently, scientists have developed techniques that allow them to **extract** or remove, **DNA** from **fossils**. The DNA from fossils has provided new evidence about evolution.

Big Brain Knowledge

Q1: What can scientists learn from fossil DNA that they could not learn by studying the physical structure of fossils?

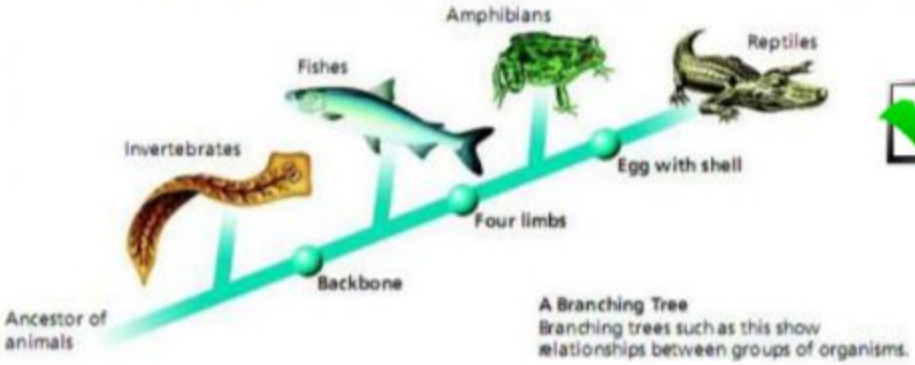
A1: **if they are truly biologically related**

Q2: Will the ability to extract DNA from fossils mean that scientists will no longer have to compare living species in order to reconstruct evolutionary relationships?

A2: **no, because you still need to see it**

Scientists use such combined evidence to construct **branching trees**

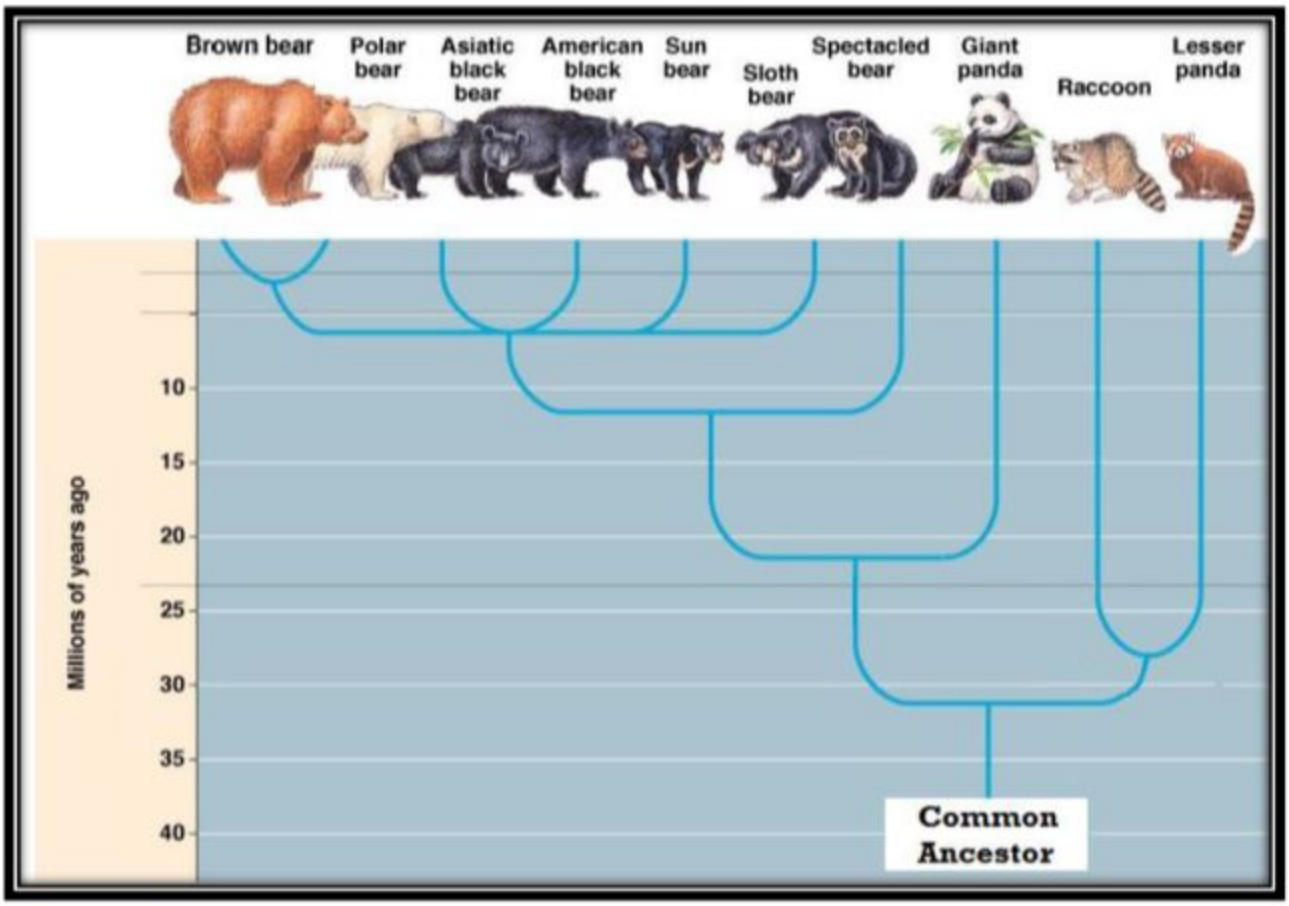
Q: What is a branching tree?
A: a diagram that shows how scientists think different groups of organisms are related



A Branching Tree
Branching trees such as this show relationships between groups of organisms.

Q: Are reptiles more closely related to fishes or to invertebrates?

A: **fish**



QI: Are lesser pandas more closely related to raccoons or to bears?

A1: **raccoons**

Q2: When did giant pandas and all bears evolve from their common ancestor?

A2: **22 mya**

Q3: When did all of these animals evolve from their common ancestor?

A3: **31-32 mya**

Q4: Which are more closely related, raccoons and lesser pandas, or giant pandas & all of the bears?

A4: **giant pandas & bears**

Q5: Who are the MOST related?

A5: **brown bear & polar bear**

Q6: Who are the LEAST related?

A6: **brown bear & lesser panda**