Sources of Evidence for Evolution

SBI3U

MS.DE SOUSA

Evidence for Evolution

When Darwin was developing the ***Theory of Evolution by Natural Selection***, a variety of scientists contributed to his theory by providing a variety of sources.

The theory of evolution by natural selection was proven by the following methods:

1)Fossil Record

2)Biogeography

3)Anatomy

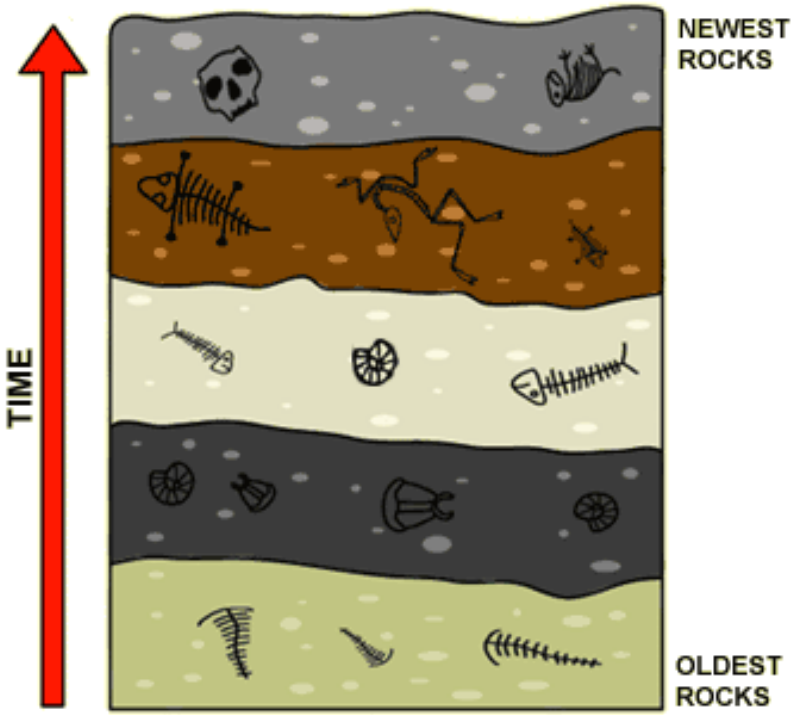
4)Embryology

5)DNA

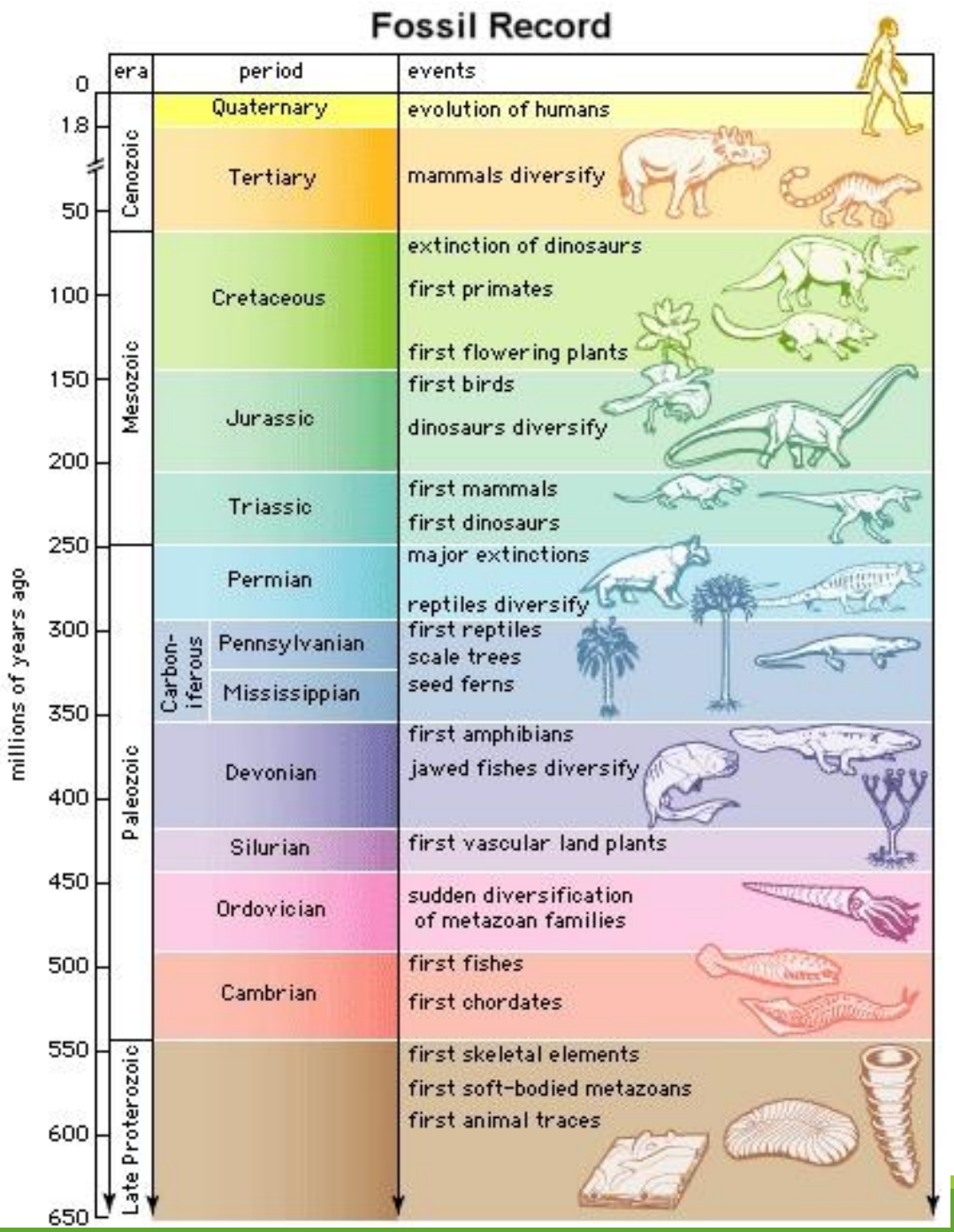
1) Fossil Record

Fossils are found within the layers of sedimentary rock. Specific fossils are found within each strata (each represents a different time period)/

*Fossil groups are **unique to each stratum. Paleontologists** use this to determine dates*



This illustration represents the appearance f the fossil record during the 4.6 billion years of the earth's history.



1) Fossil Record

Evidence from Fossil Record:

1. Fossils within the ***younger layers*** are most similar to species alive today.
2. Fossils appear in ***chronological order*** within the sedimentary layers.
3. Not all organisms appear in the fossil record at the same time.
   (depending on when the fossils appear in the layers, it may indicate which organism have evolved first)

1) Fossil Record

Fish were found to be in the deepest sedimentary layers. Amphibians, reptiles and mammals, seemed to have appeared later in the sedimentary layers.

Fish

Amphibian

Fossils can also be used to trace the evolution of a certain type of species.

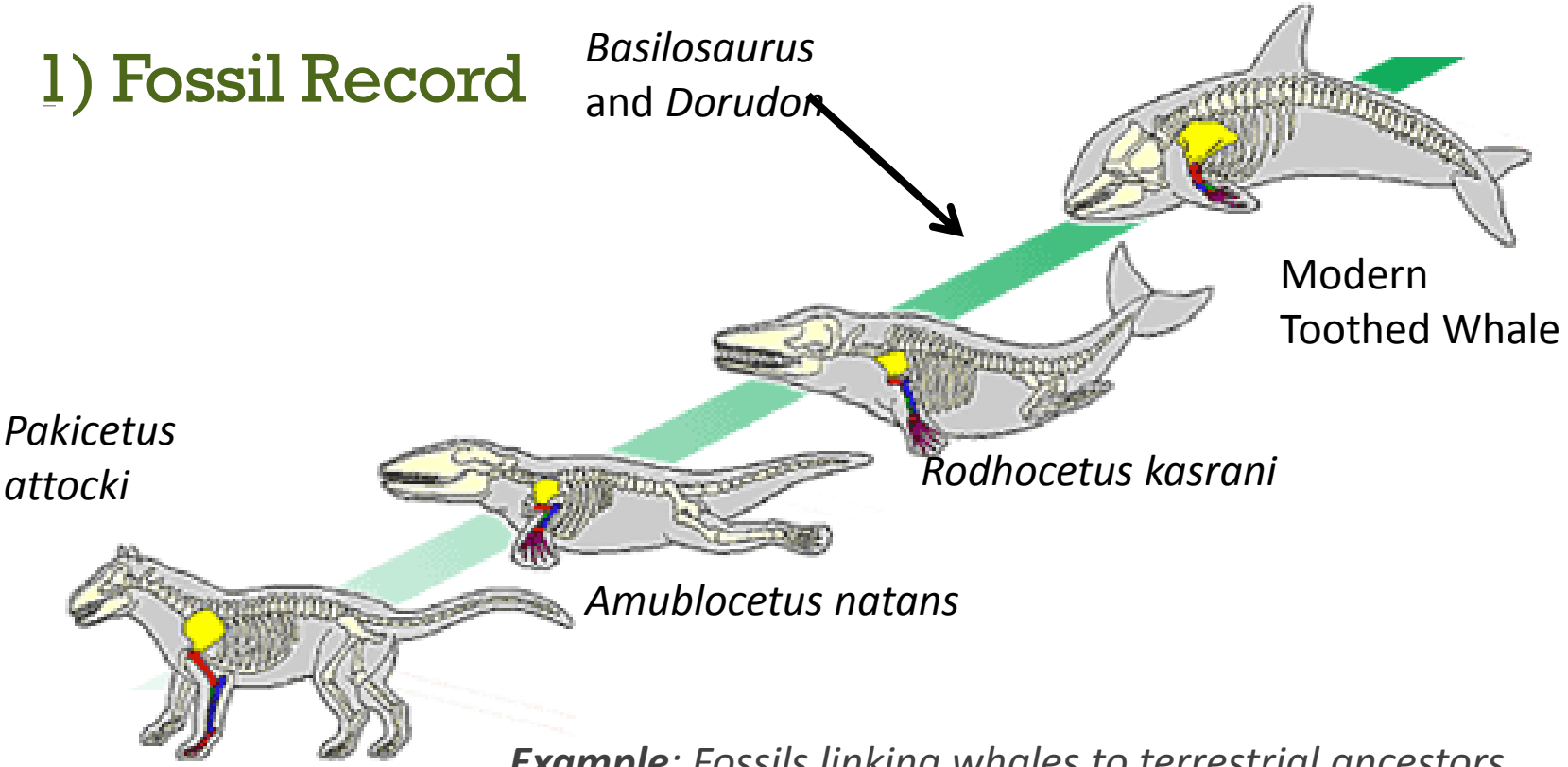
1) Fossil Record

Table 15.1 Camel Evolution

Age	Paleocene 65 million years ago	Eocene 54 million years ago	Oligocene 33 million years ago	Miocene 23 million years ago	Present
Organism					
Skull and teeth					
Limb bones					

***Transitional Fossils*:**

1) Fossil Record



***Example**: Fossils linking whales to terrestrial ancestors.*

The Basilosaurus and Dorudon were ancient whales that were aquatic but had tiny hind limbs.

1) Fossil Record

Vestigial Structures: reduced forms of structures that were functional in an organism's ancestors

Examples:

- *pelvic bone in baleen whales*
- *human appendix*
- *male breast tissue and nipples*
- *wisdom teeth*
- *wings on ostriches*

2) Biogeography

Study of the past and present geographical distribution of species.

Recall: Darwin's theories were based on geography

- Hypothesizes that species evolve in one location and spread to new locations

2) Biogeography

Geographically **close environments** are populated by **related species**.

Example: *Cacti are only native to the deserts of North, Central and South America.*

These are not found in other deserts in the world.

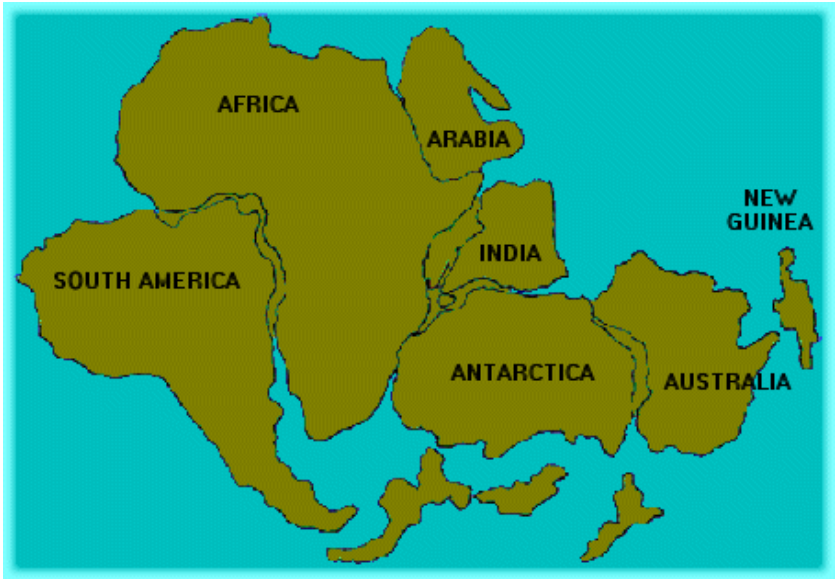
2) Biogeography

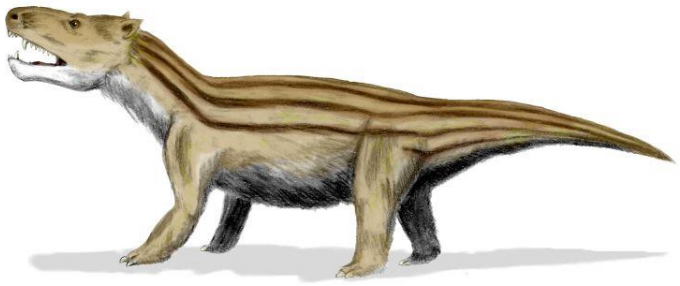
Animals on an **island** resemble animals on the **closest continent**.

Example: Lizards on the Canary islands are similar to lizards found in west Africa.

2) Biogeography

Fossils of the **same species** can be found on the **coastline of neighbouring continents**.

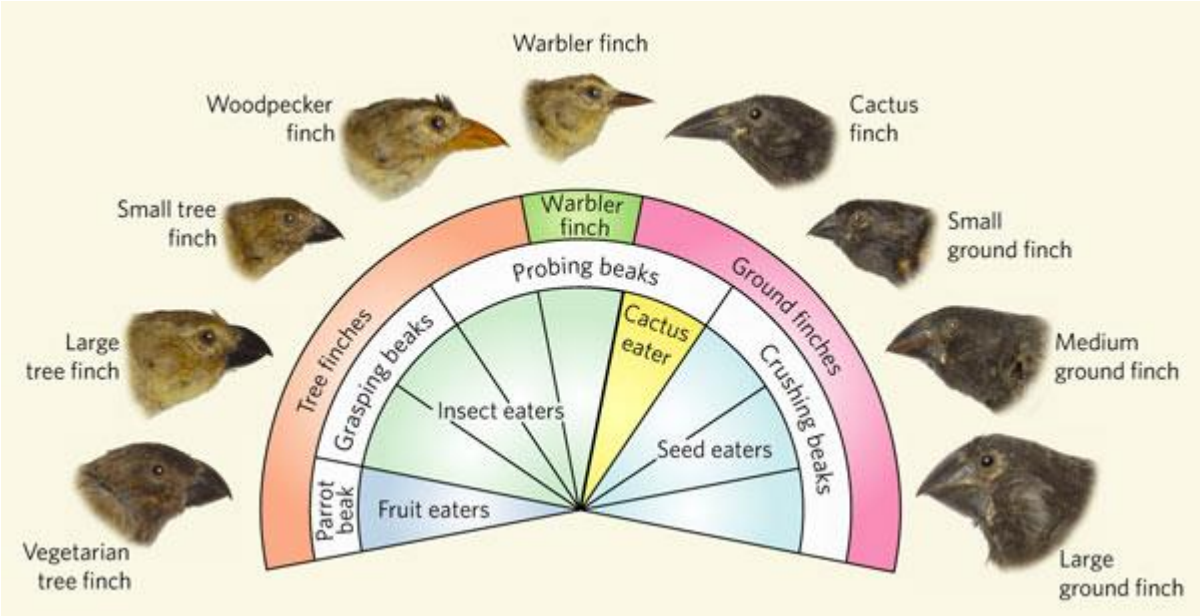




Example: Fossils of Cynognathus have been found in Africa and South America

2) Biogeography

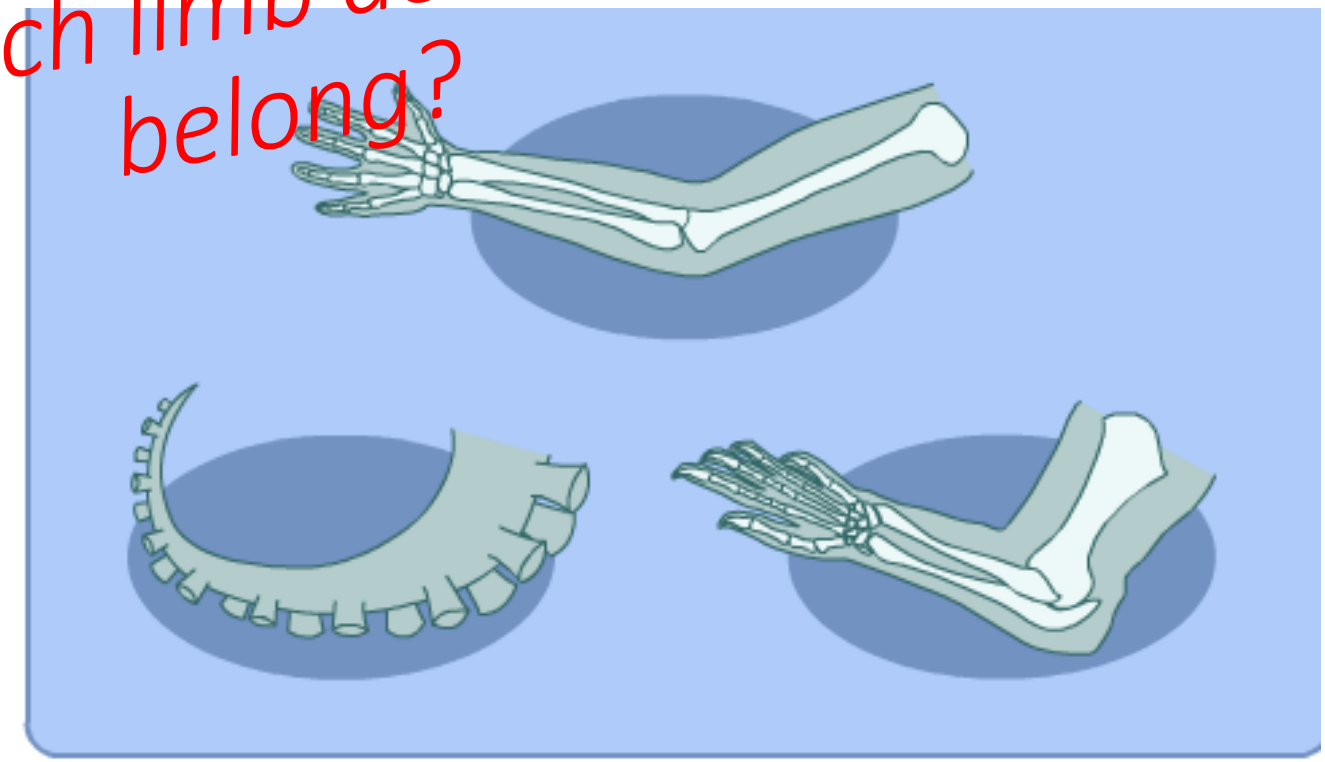
Closely related species are never found in exactly the same location or habitat.



Example: Darwin's finches varied slightly from island to island in the Galapagos.

3) Evidence from Anatomy

Which limb does not belong?



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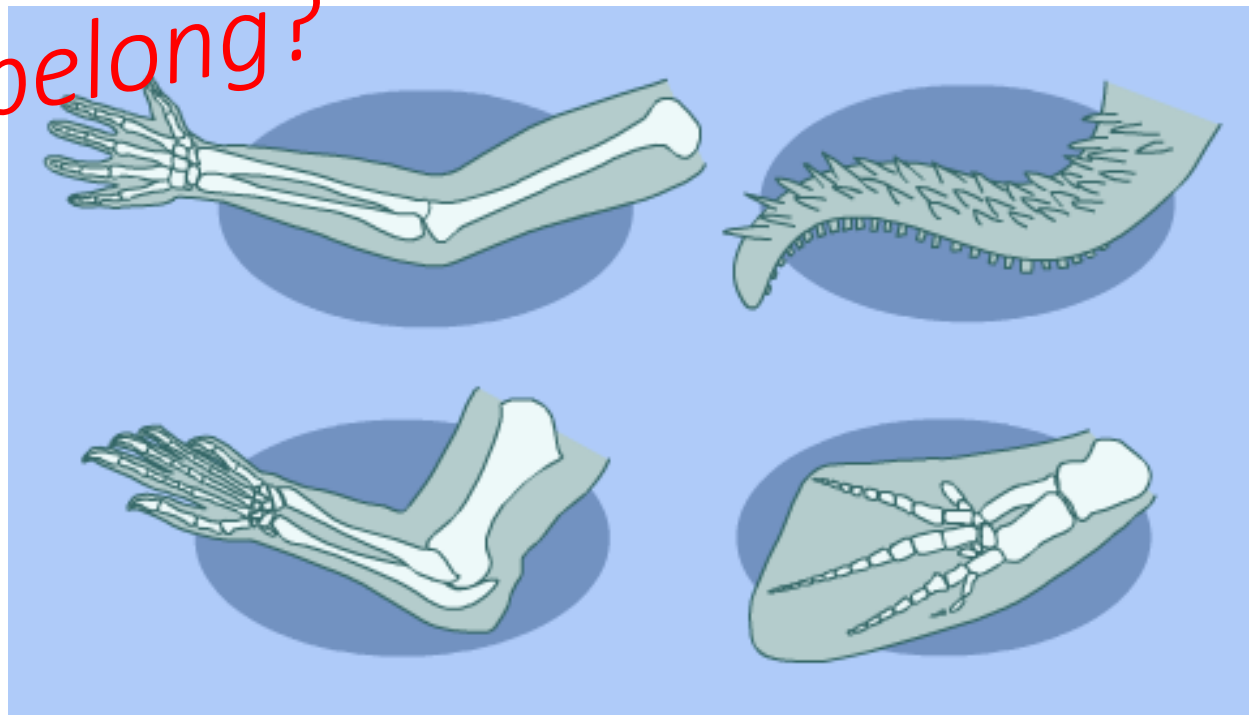

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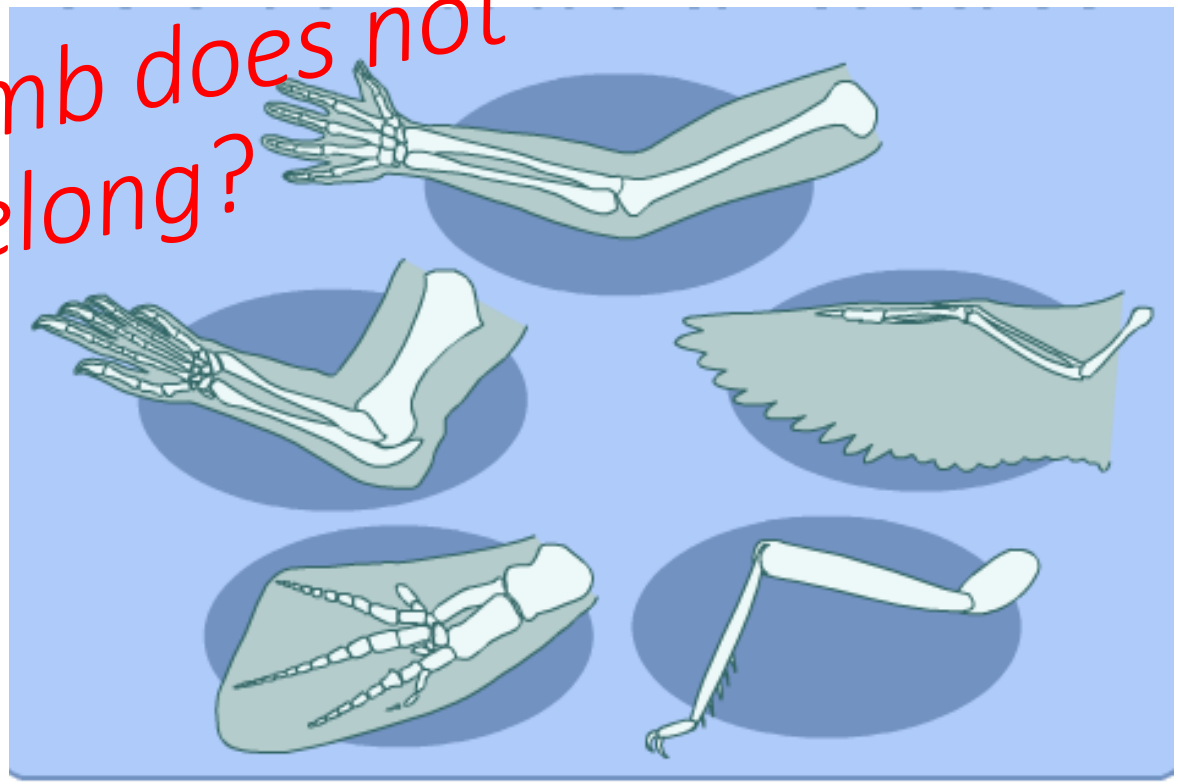
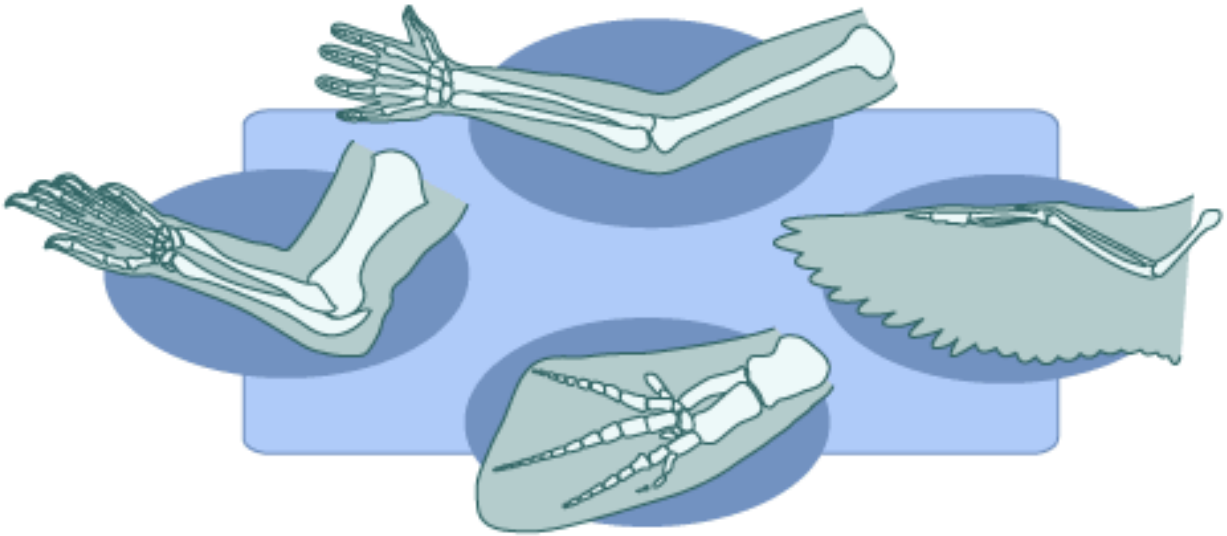
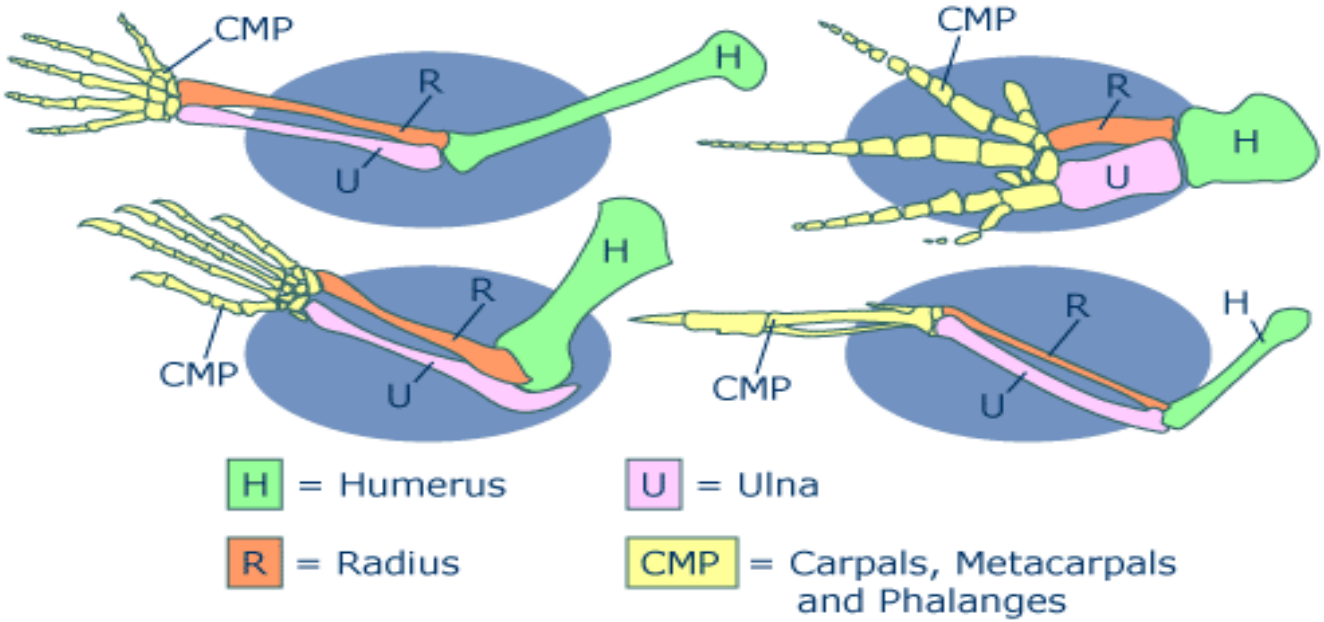


Homologous Tetrapod Limbs

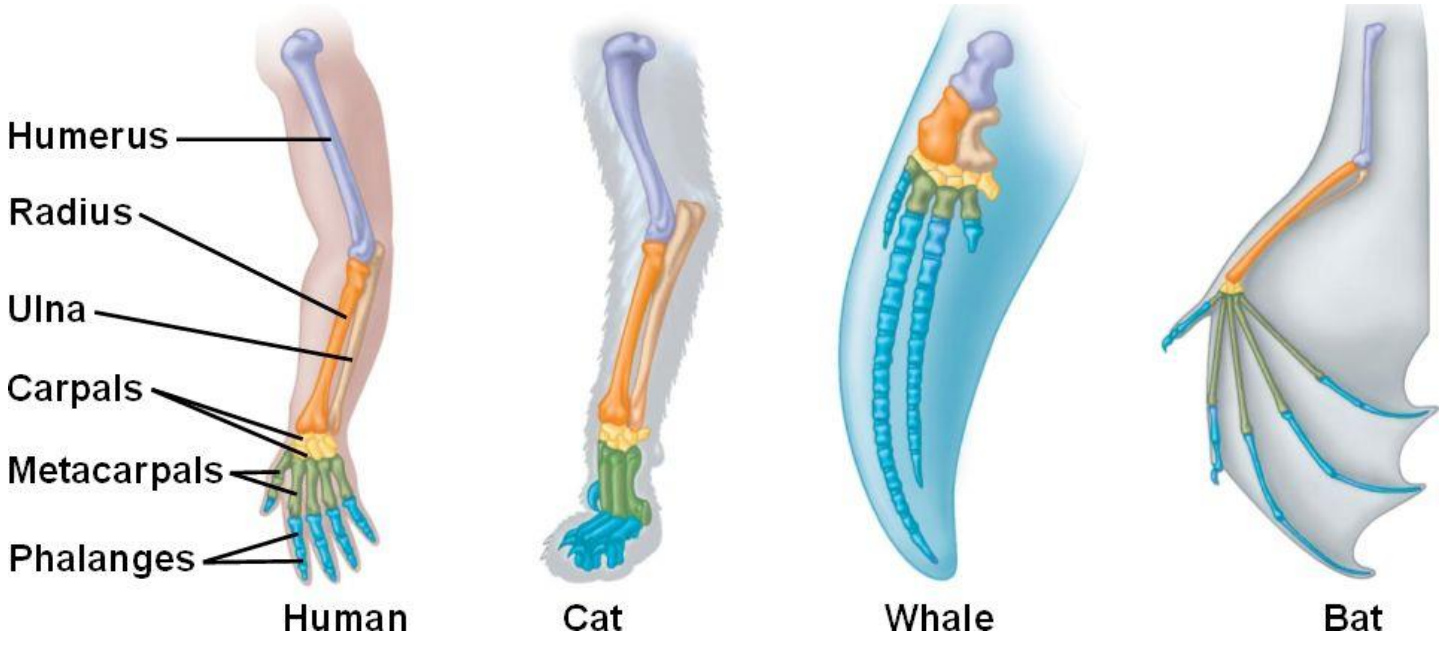


All of these organisms have a similar bone structure. These were inherited from a common ancestor



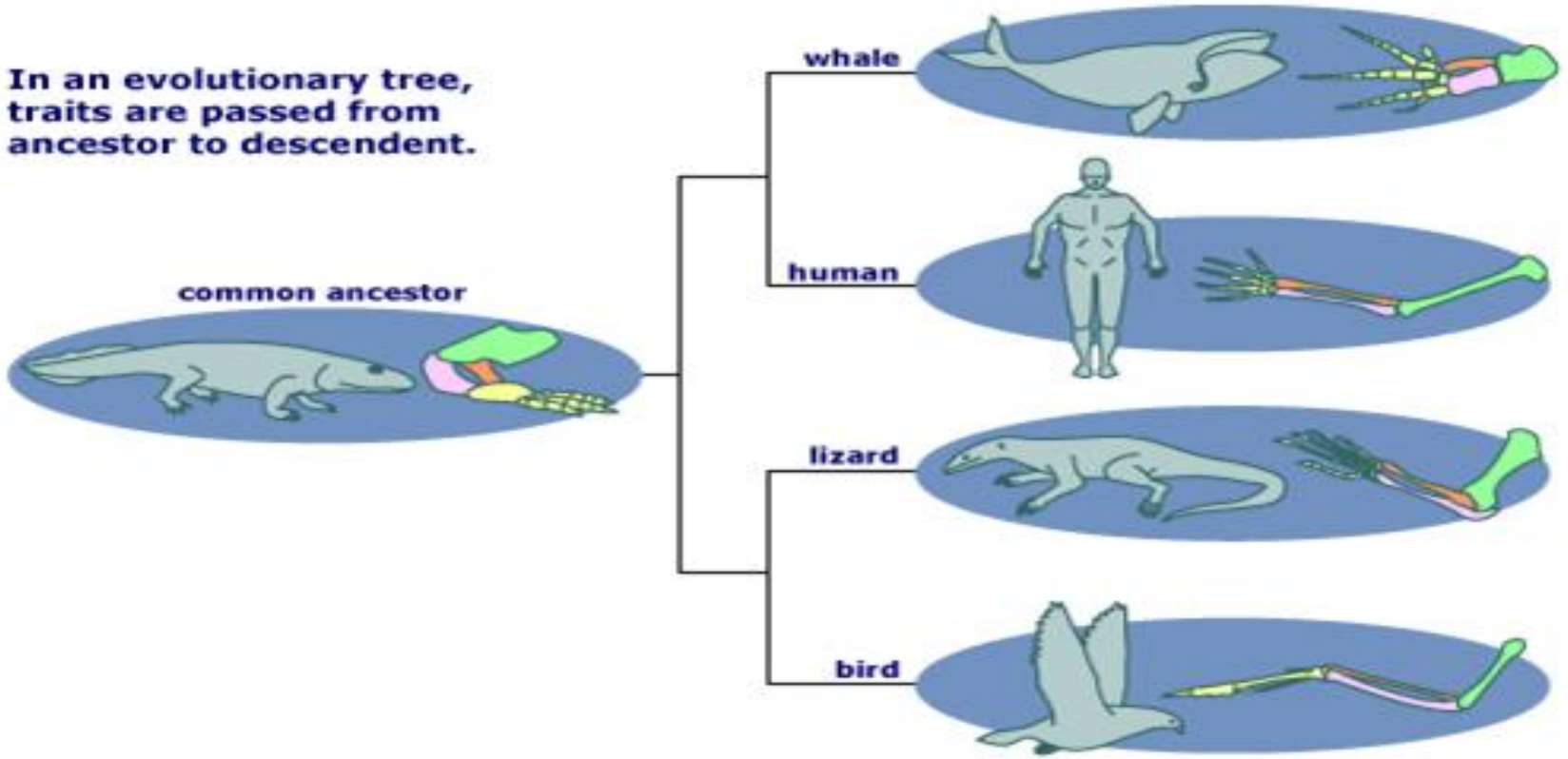
3) Evidence from Anatomy

Homologous Structures:



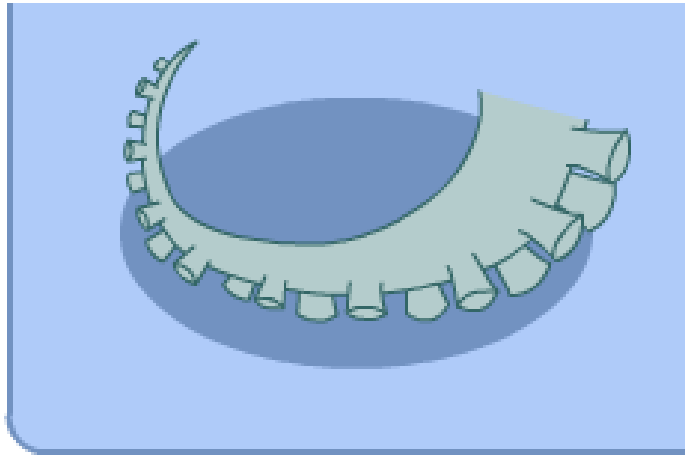
3) Evidence from Anatomy - Homologous

Example: The first tetrapod had a humerus attached to the radius and ulna. All of the descendents inherited this tetrapod limb.



3) Evidence from Anatomy - Homologous

The Octopus does not have a similar bone structure to the tetrapod because it has evolved independently.



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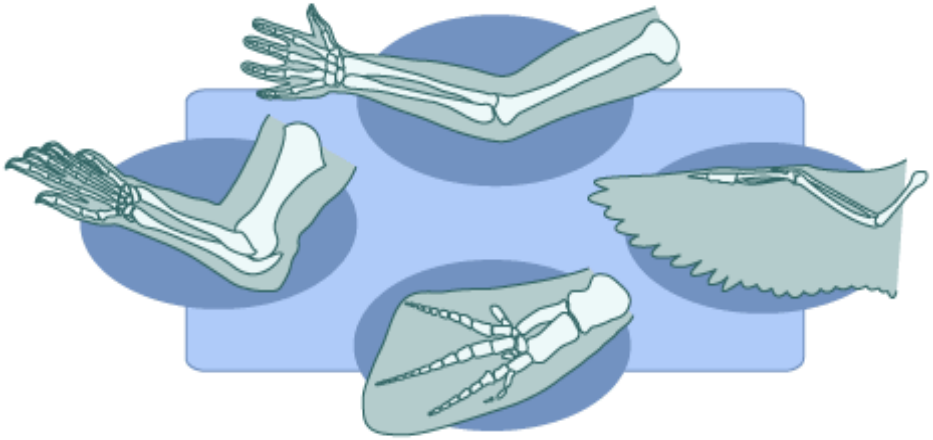


E.g: Homologous Structures

Dragonfly

Butterfly

Example: Tusks are a modification of the basic incisor tooth structure.

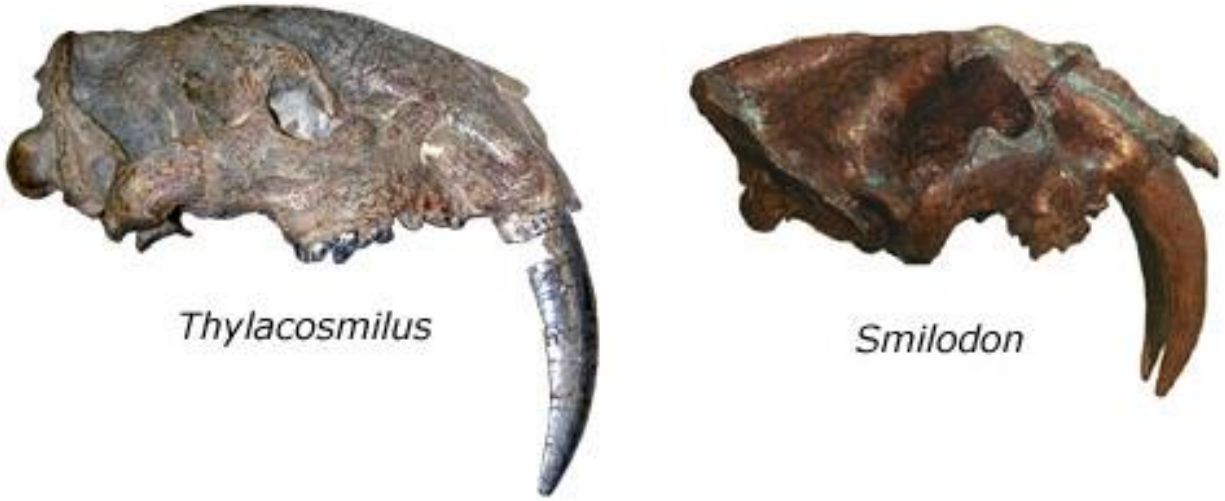
Evolution has adapted these structures to perform different functions.

3) Evidence from Anatomy

Analogous Structures:

Elvis impersonators have similarities, but these similarities are not inherited.

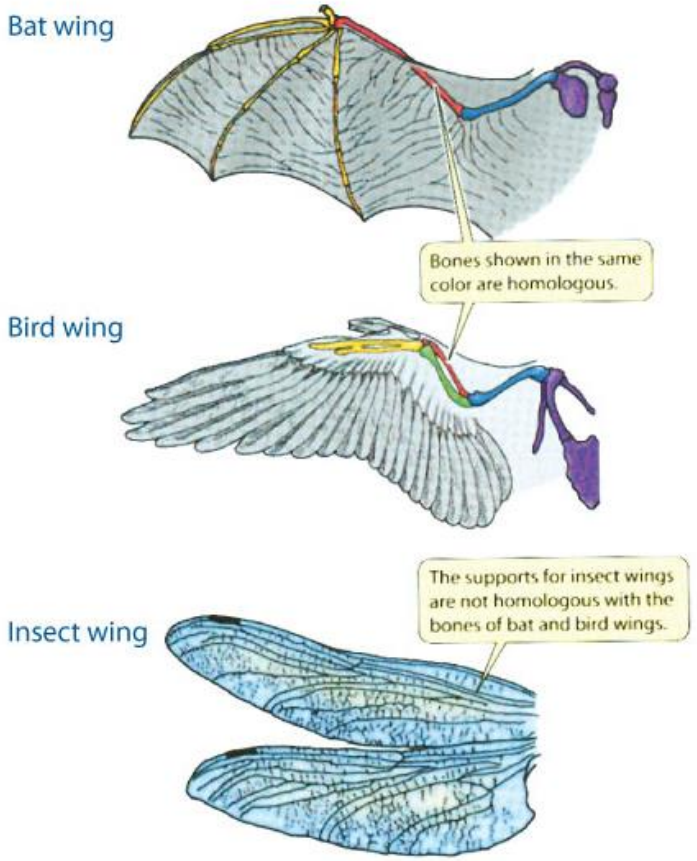
3) Evidence from Anatomy – Analogous



Example: Both skulls have saberteeth, but they were inherited from different ancestors.

3) Evidence from Anatomy – Analogous

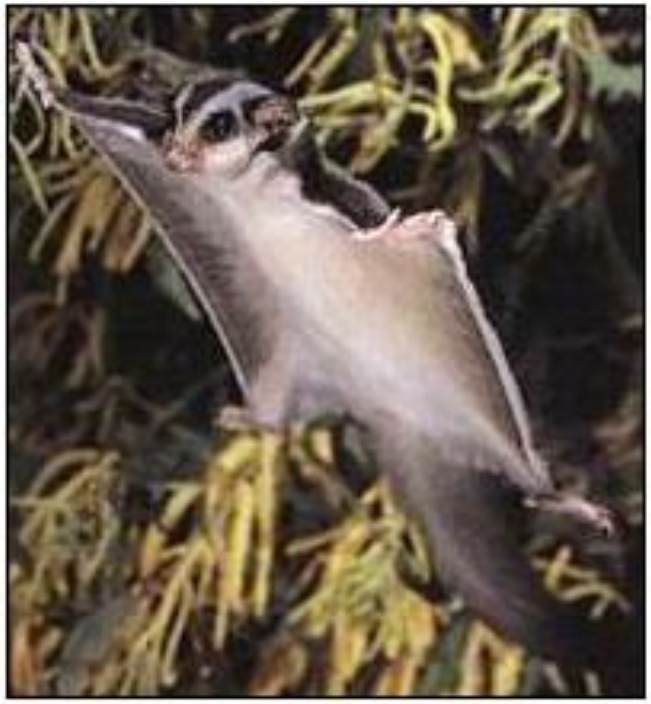
Example: Insects, Birds, and Bats all have wings used for flight (function) but insects do not come from a common ancestor because there are no bones.



**Note: the textbook describes bird and bat wings as analogous, this is NOT true.

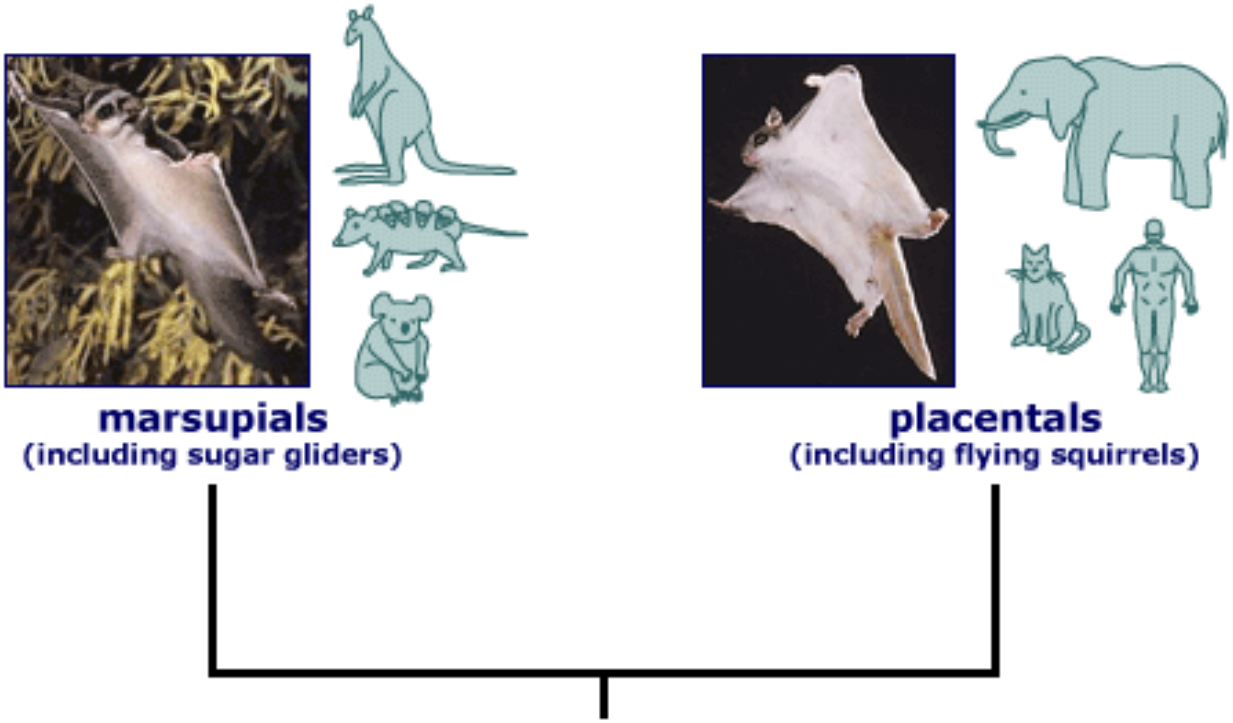
Homologous or Analogous Structure?

Flying squirrel



Sugar glider

Homologous or Analogous Structure?



Both types of squirrels have evolved from different lineages

Homologous or Analogous Structure?

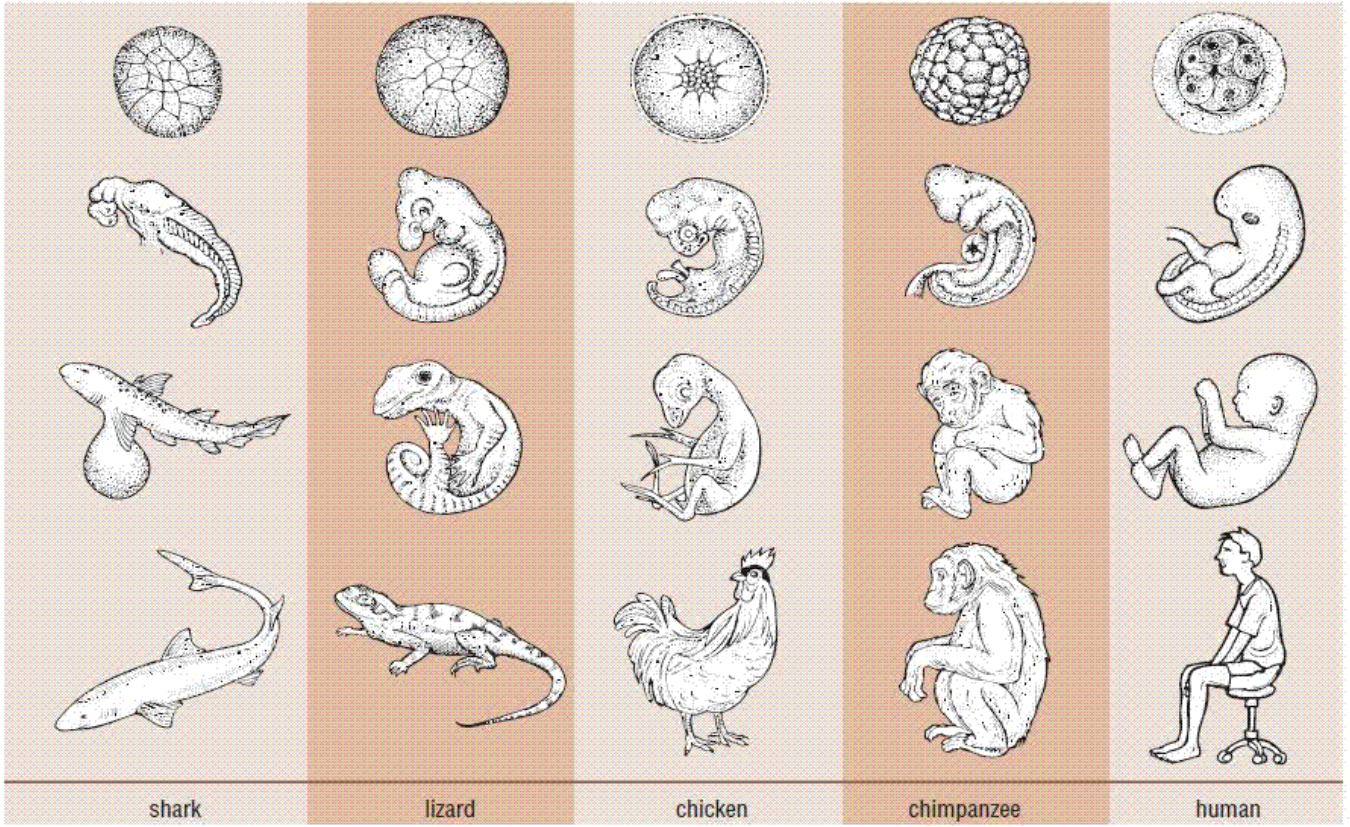
Sisters

Elvis Fans

3) Evidence from Embryology

Embryology:

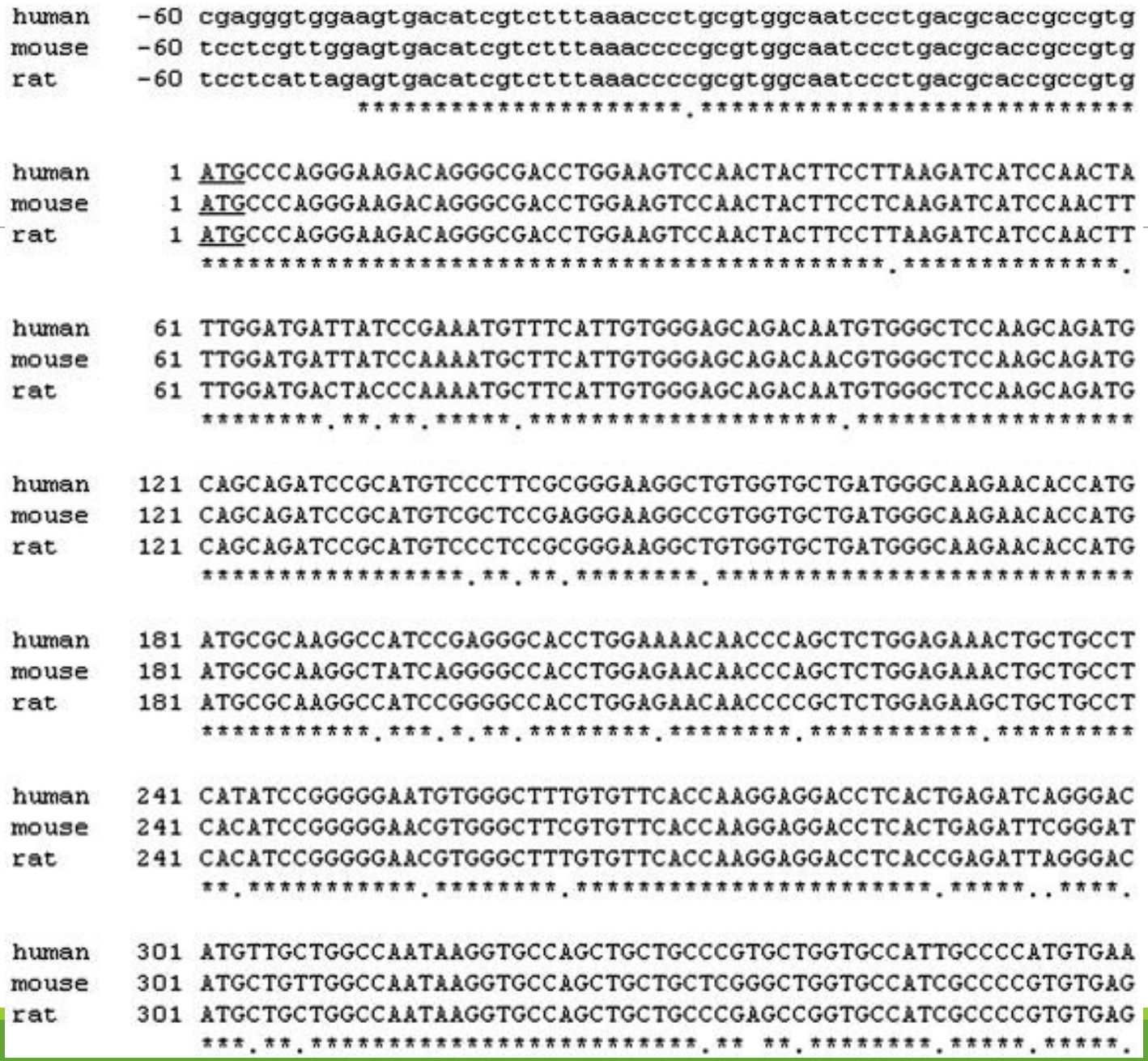
All vertebrate ***embryos*** *are similar in their* ***stages of development****.*



3) Evidence from DNA

By **comparing** organisms' genetic sequences, scientists can determine their **level of similarity.**

Two organisms with **similar patterns of DNA**, suggests that they **inherited** this information from a **common ancestor**.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mouse -60 tcctcgttggagtgacatcgtctttaaaccccgcgtggcaatccctgacgcaccgccgtg
rat -60 tcctcattagagtgacatcgtctttaaaccccgcgtggcaatccctgacgcaccgccgtg
human 1 ATGCCCAGGGAAGACAGGGCGACCTGGAAGTCCAACTACTTCCTTAAGATCATCCAACTA
mouse 1 ATGCCCAGGGAAGACAGGGCGACCTGGAAGTCCAACTACTTCCTCAAGATCATCCAACTT
rat 1 ATGCCCAGGGAAGACAGGGCGACCTGGAAGTCCAACTACTTCCTTAAGATCATCCAACTT
human 61 TTGGATGATTATCCGAAATGTTTCATTGTGGGAGCAGACAATGTGGGCTCCAAGCAGATG
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Homework

Textbook: p. 340 # 3, 5, 7, 8 & 10