

TOPIC 5.1: EVIDENCE FOR EVOLUTION

Fossil Record

A fossil is the preserved remain or trace of a past organism

- The totality of all fossils is called the fossil record

Law of Fossil Succession

The fossil record shows that changes have occurred in organisms and these changes have occurred in a consistent sequence of development (the law of fossil succession)

- **Example:** Ferns always appear before flowering plants

Transitional Fossils

Transitional fossils represent intermediary forms within the evolution of a genus and demonstrate species connections

- **Example:** The archaeopteryx links the evolution of birds (wings and feathers) to dinosaurs (jaws and claws)

Selective Breeding

Selective breeding involves the mating of animals with desired characteristics (it is a form of artificial selection)

As human intervention drives selection, changes will occur over fewer generations as phenotype extremes are promoted

Examples of selective breeding include:

- Draft horses (power) versus racing horses (speed)
- Large variation in types of dog breeds

Molecular Evidence

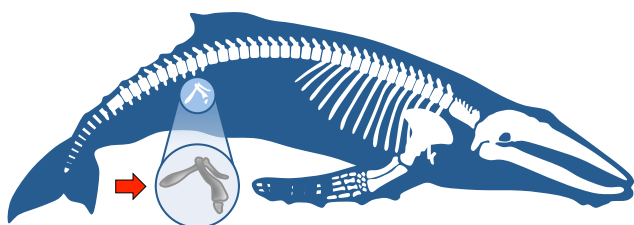
Closely related species share a greater degree of similarity in their DNA and protein sequences (due to common ancestry)

If a particular gene has a stable mutation rate, the time of evolutionary divergence can be estimated ('molecular clock')

Vestigial Structures

Some species show the presence of functionless or reduced remnants of organs that were once present in ancestors

- **E.g.** Whales have a *pelvic bone* (ancestors were terrestrial)



Comparative Anatomy

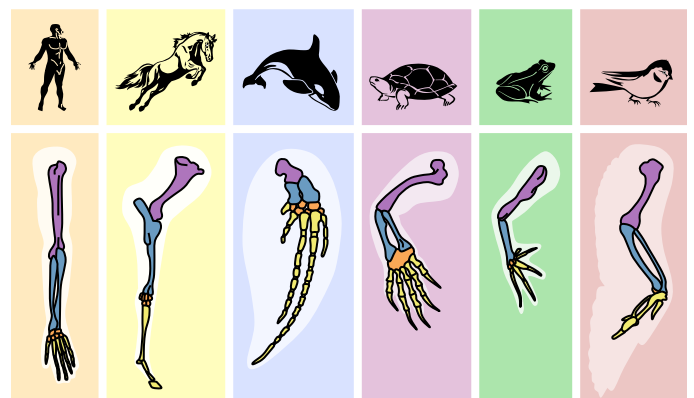
Homologous structures are anatomical features that share a common basic structure despite having distinct functions

The rapid diversification of an anatomical feature is a result of adaptive radiation (organisms adapt to different niches)

- Closely related species demonstrate greater homology

The pentadactyl limb is a prime example of a homologous structure (different appendages, yet same bone structure)

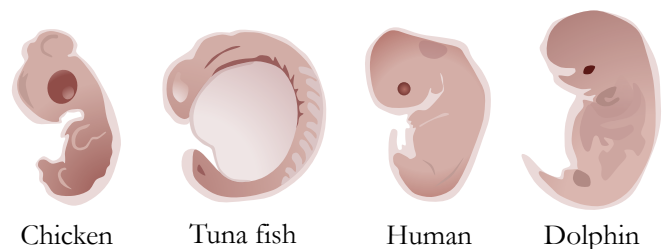
Homologous Structures – Pentadactyl Limb



Comparative Embryology

Comparing embryonic development in animals demonstrates similarities that suggest a common evolutionary pathway

- All terrestrial animals have non-functioning gill slits
- Many vertebrates have a primitive tail in early stages



Biogeography

Biogeography is the distribution of species across an area

- Related species will usually be found in close proximity
- **E.g.** Monotremes are exclusive to Australia/New Guinea

Exceptions may be explained via continental drift

- **E.g.** The ratites (flightless birds) are globally distributed over continents that were once part of a single land mass (Gondwanaland)

