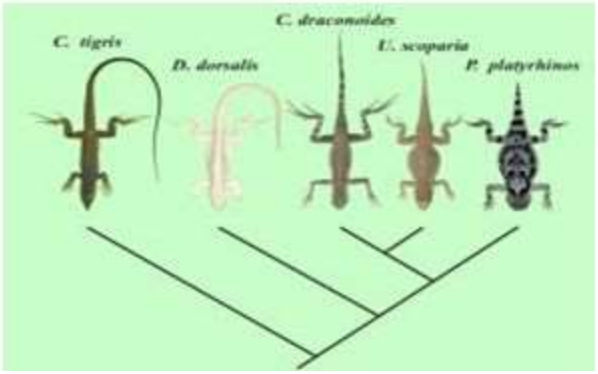
Evidences for evolution

Evidences of Evolution

1. Biogeography
2. Fossils
3. Taxonomy
4. Comparative Anatomy
5. Comparative Embryology
6. Molecular Biology

- To trace **phylogeny** (the evolutionary history of life) biologists use evidence from paleontology, molecular data, comparative anatomy, etc.
  - Tracing phylogeny is one of the main goals of **systematics**, (the study of biological diversity in an evolutionary context.)
    - Systematics includes taxonomy, which is the naming and classsification of species and groups of species.

As Darwin correctly predicted, "our classifications will come to be, as far as they can be so made, genealogies."



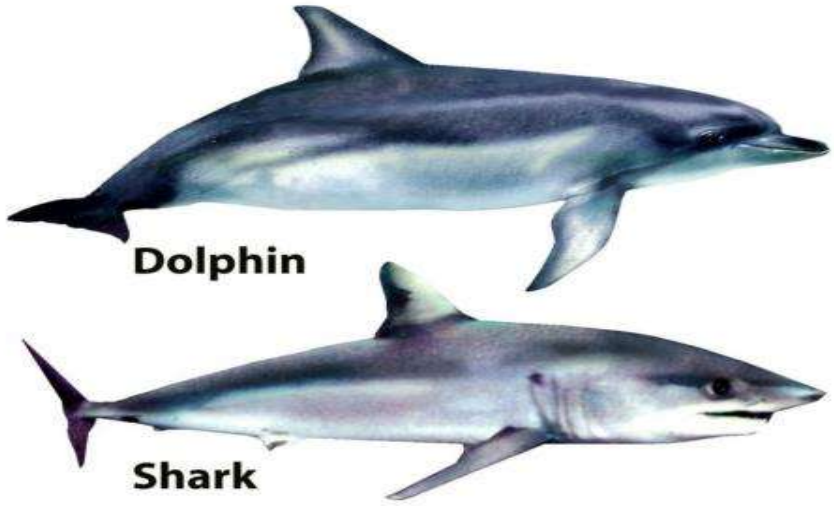
DOMAIN
Kingdom
Phylum
Class
Order
Family
Genus
Species
Subspecies

Do
Kasper /Katarina
Play
Classical
Or
Folk
Guitar
Songs?

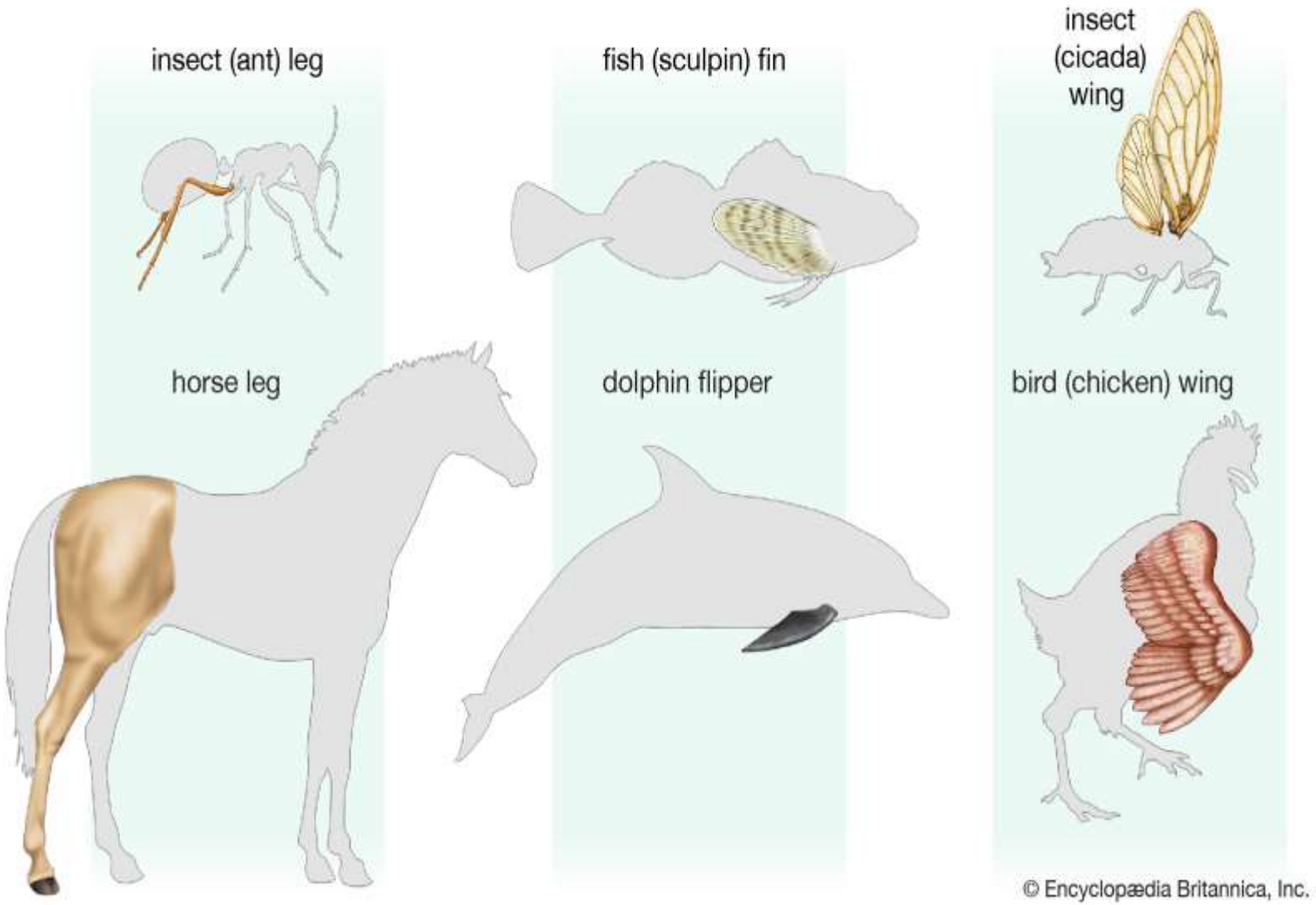
Evidence from comparative anatomy

Evidence supporting theory of evolution

- Analogous structures
  - Structures similar in form and function.
- Develop as a result of convergent evolution?



Comparison of analogous structures



Homology and analogy

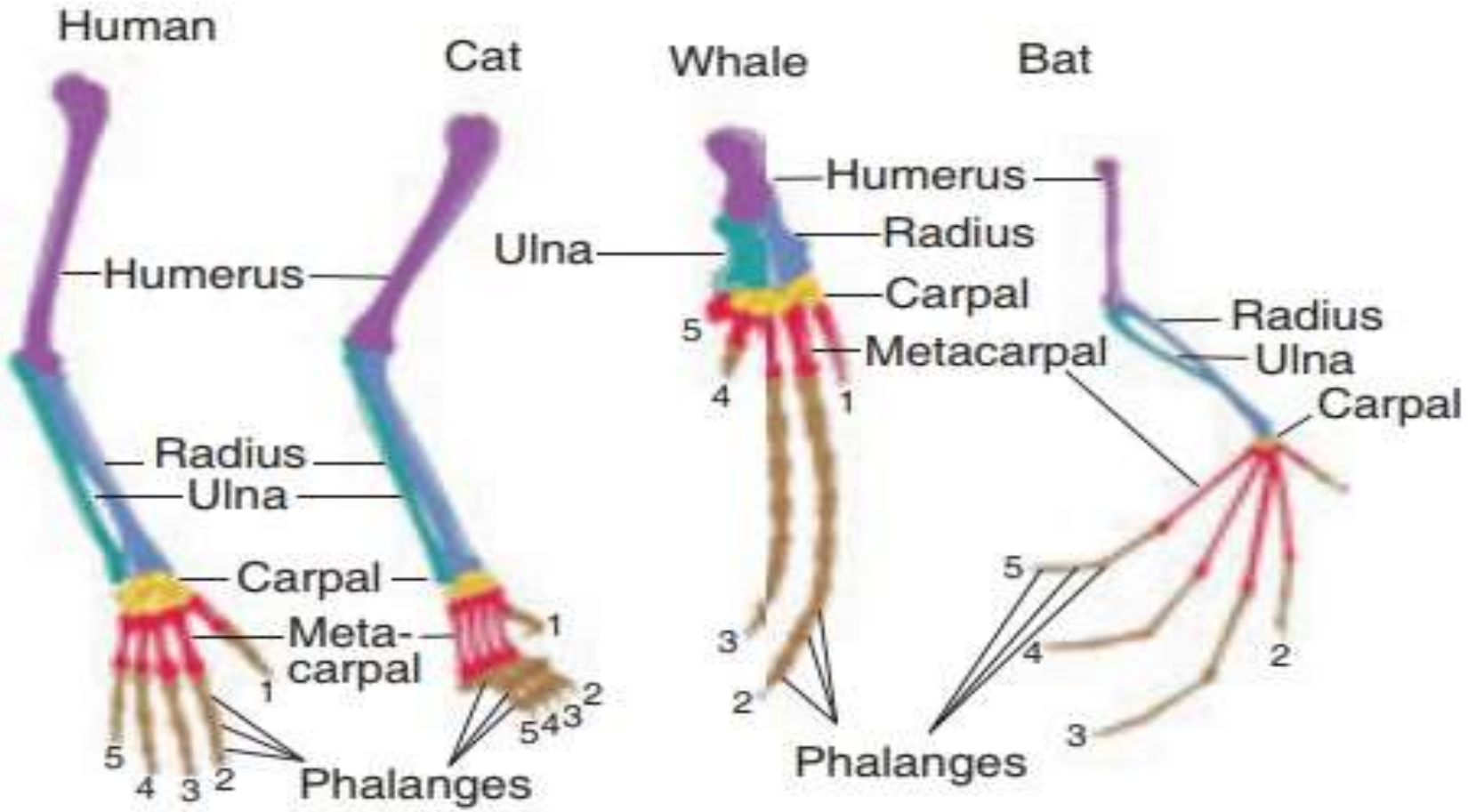


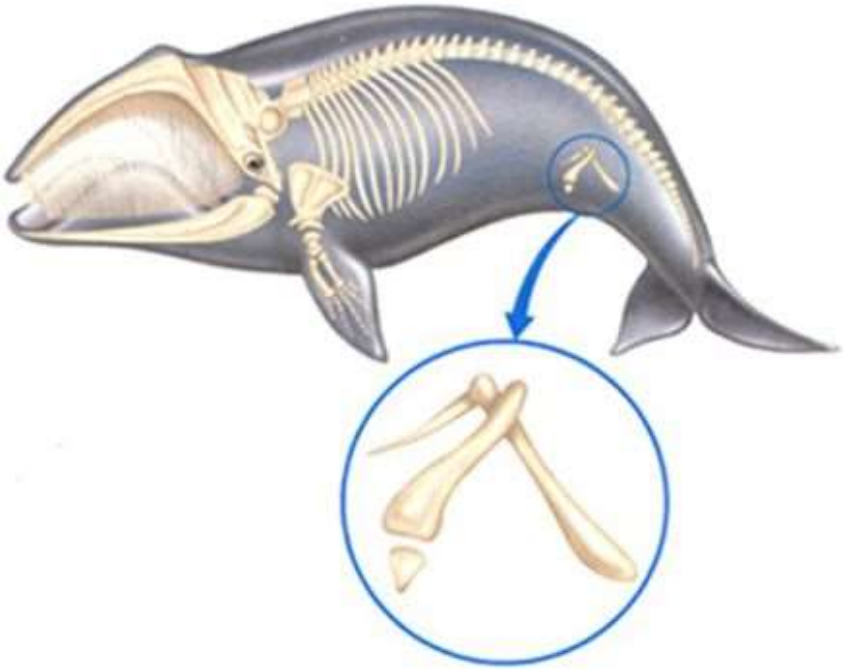
Figure 19.1 Forelimbs of vertebrates showing homologous structure

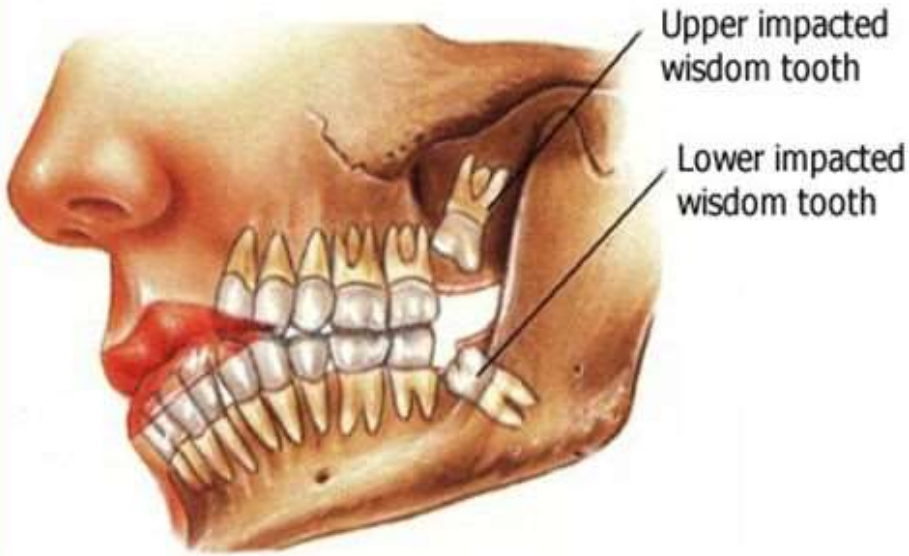
Vestigial Structures

- **Vestigial Structures**: characteristics found in existing species that have **no known function**
- Provide **evidence of common ancestry**
- As species evolve their structures change
  - Two things will happen
    - Species will adapt the organ/structure to a new use
      - penguin
    - The organ or structure will no longer have a use
      - Whale pelvis/snake feet.

4. Vestigial organs

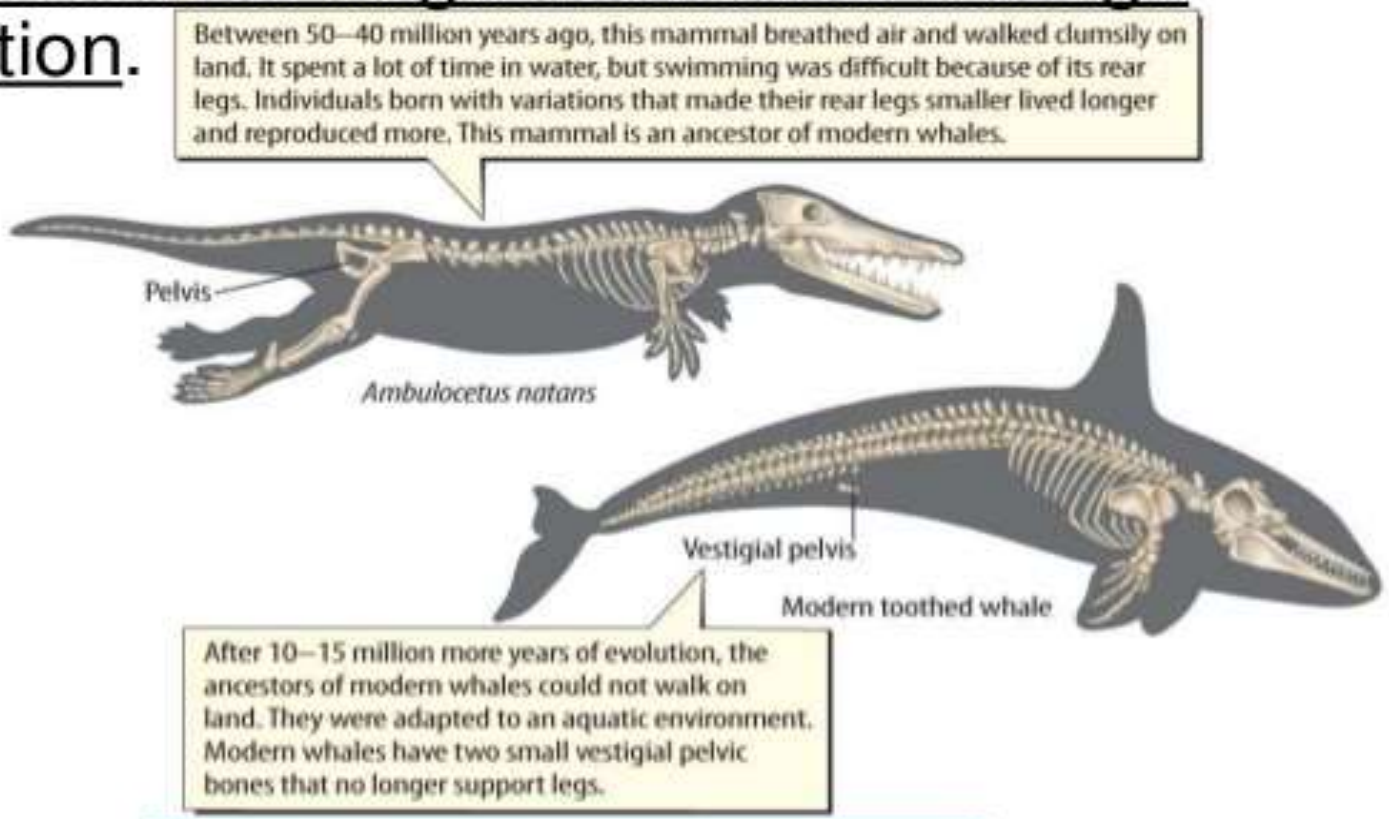
- remains of structures/organs that ONCE had an importance in organism's ancestors
  - Example: tailbones in humans, appendix, wings on ostrich, wisdom teeth in humans, nipples in male mammals, femur and pelvis in whales



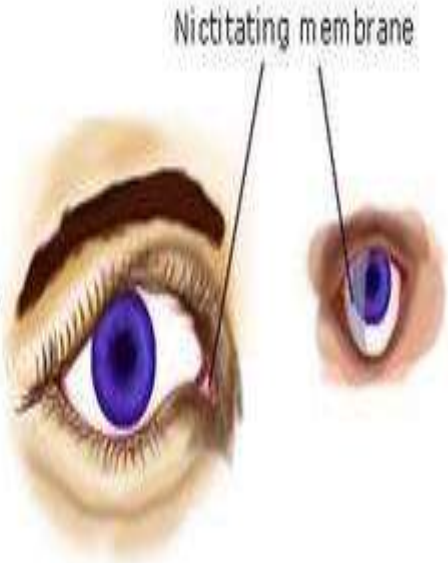


Comparative Anatomy

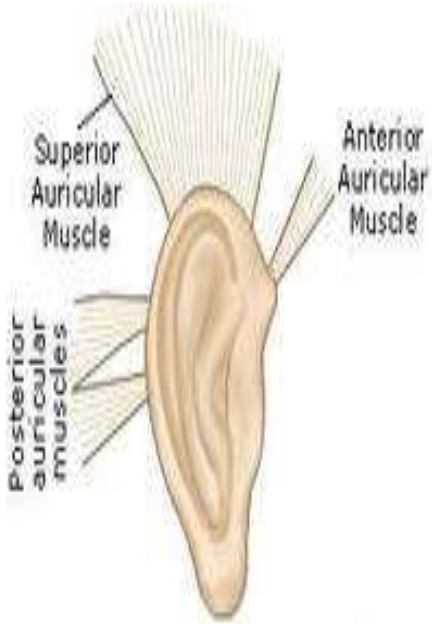
Vestigial structures are body parts that have lost their original function through evolution.



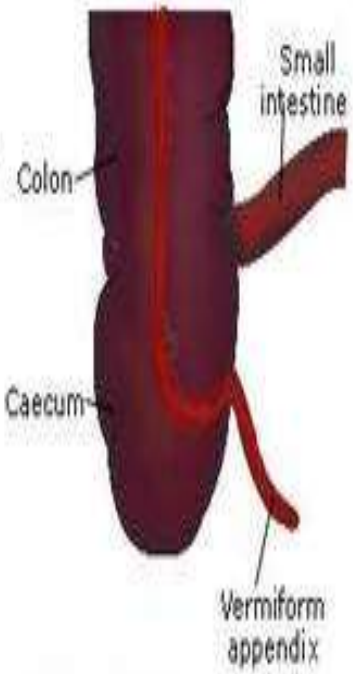
Tail bone in human being



Nictitating membrane in the eyes of man(Left) and ape(Right)



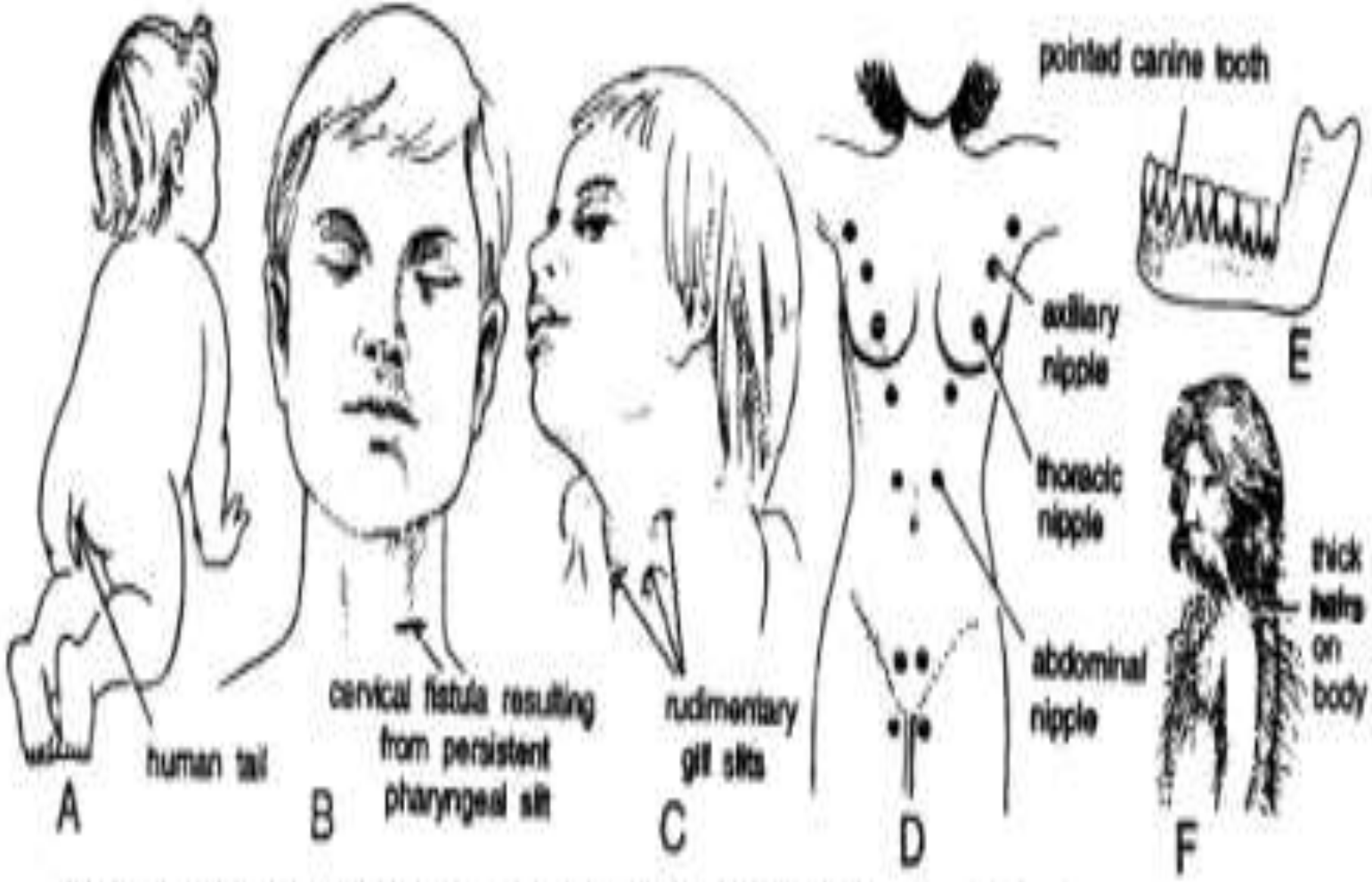
Vestigial auricular muscles of the pinna in men



Vestigial caecum and vermiform appendix in man

4)ATAVISM OR REVERSION

- Definition: It involves the reappearance or refunctioning of those organs which are either completely lost, or are present as vestigial organs.
- Such characters indicate the ancestral history
- Example: Birth of a human baby with a small tail, development of power of moving pinna in some person
- Significance: It support organic evolution that living organism have ability to develop even lost or non-functional structures.



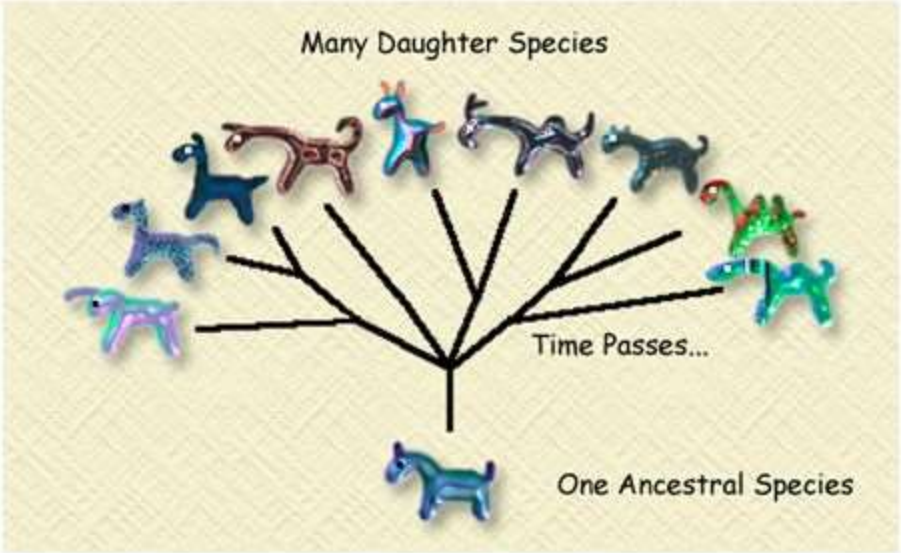
Some human atavistic characters. A—Human baby with tail, B, C—Cervical fistula or rudimentary gill-slits, D—Additional nipples, E—Pointed canine tooth, F—Thick hair on body.

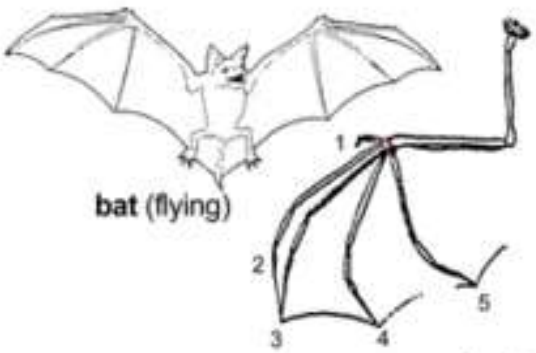
Adaptive Radiation

1. Type of divergent evolution

2. One species or group evolved through natural selection into many diverse forms

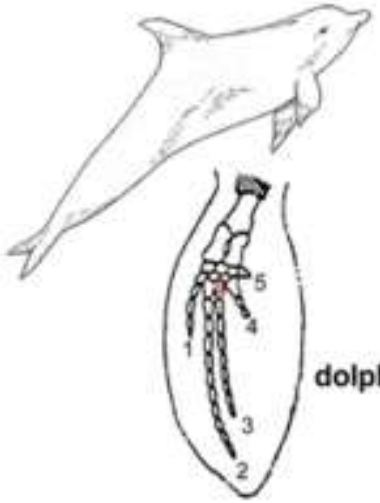
3. Examples:
   - Darwin's finches
   - Mammals after dinosaur extinctions

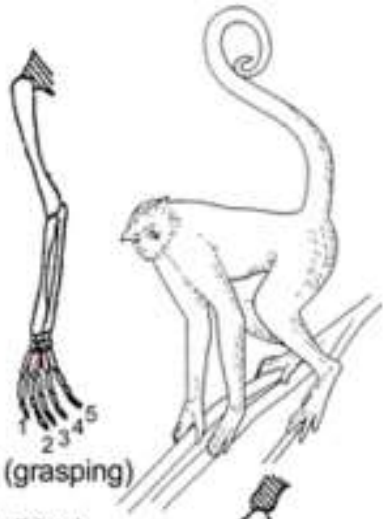


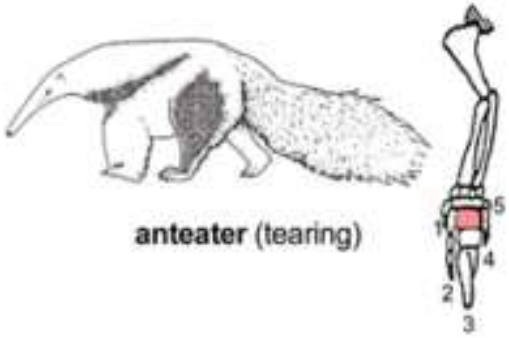


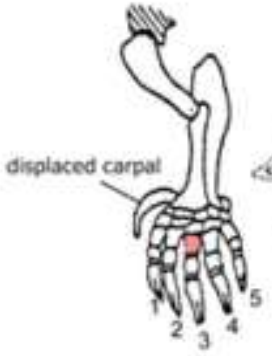
The **pentadactyl limb** as the 'ancestral' terrestrial vertebrates limb plan, subsequently adapted by modification for different uses/habitats.

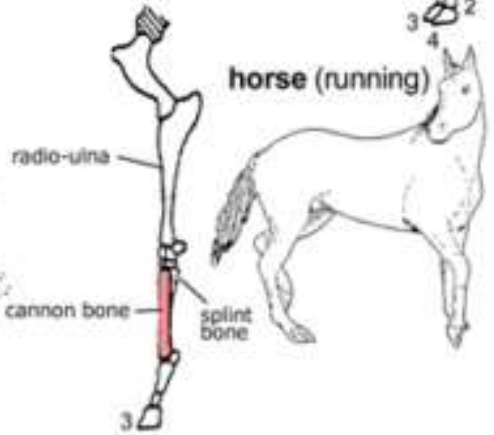
lay-out of a 'five-fingered' (pentadactyl) limb











forelimb		hindlimb
upper arm → humerus		femur ← thigh
forearm → radius + ulna		tibia + fibula ← lower leg
wrist → carpals		tarsals ← ankle
hand/foot → metacarpals + phalanges		metatarsals + phalanges ← foot

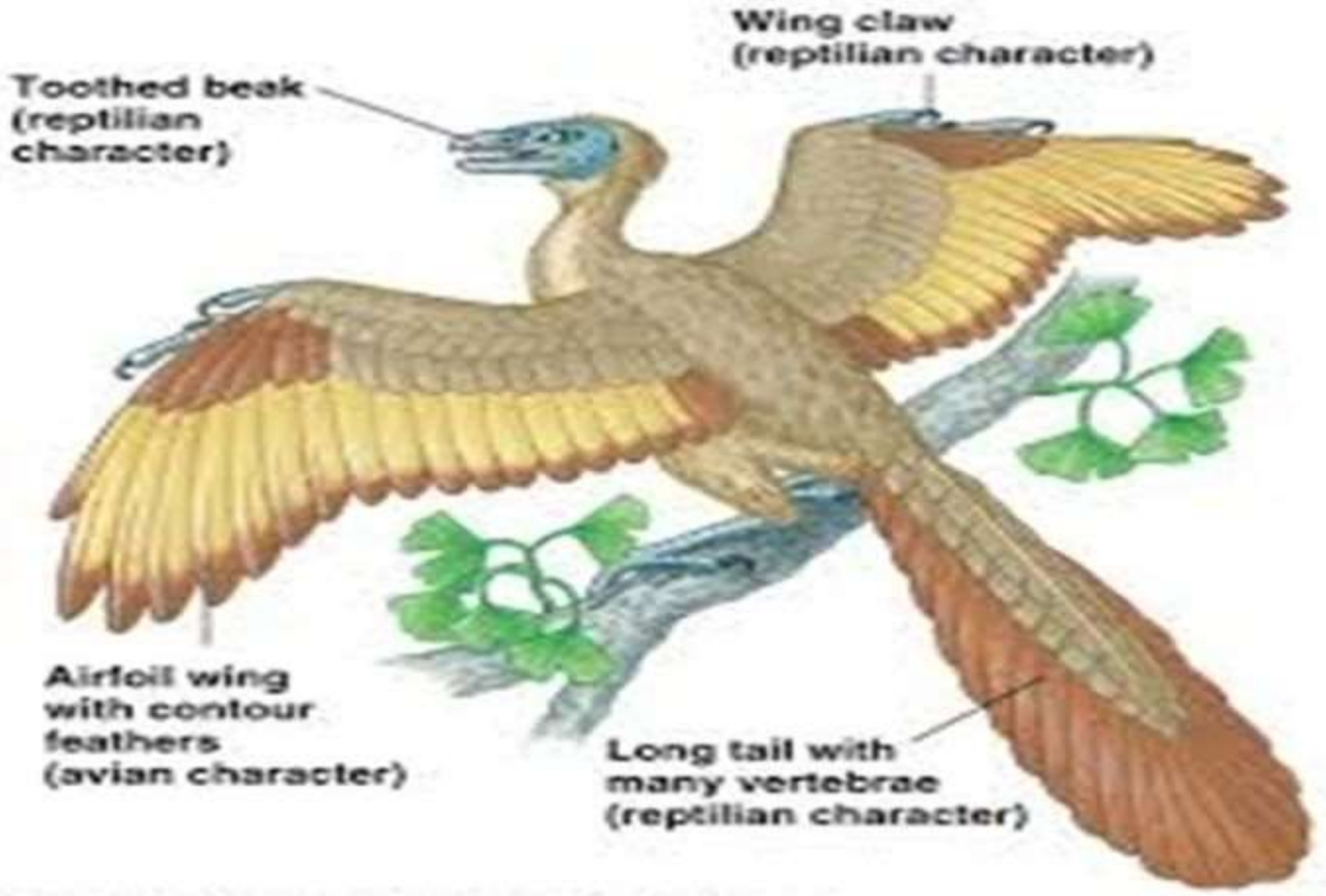
Evidence from connecting links

Evidences from evolutionary link

organism	Connecting link
virus	Living & non living
euglena	Plants & animals.
Peripatus	Annelida & arthropoda
Neopilina	Annelida & mollusca
Dipnoi (lung fish)	Pisces & amphibia
Archaeopteryx	Reptiles & aves
Prototherа	Reptiles and mammals

A. Palaeontological evidences

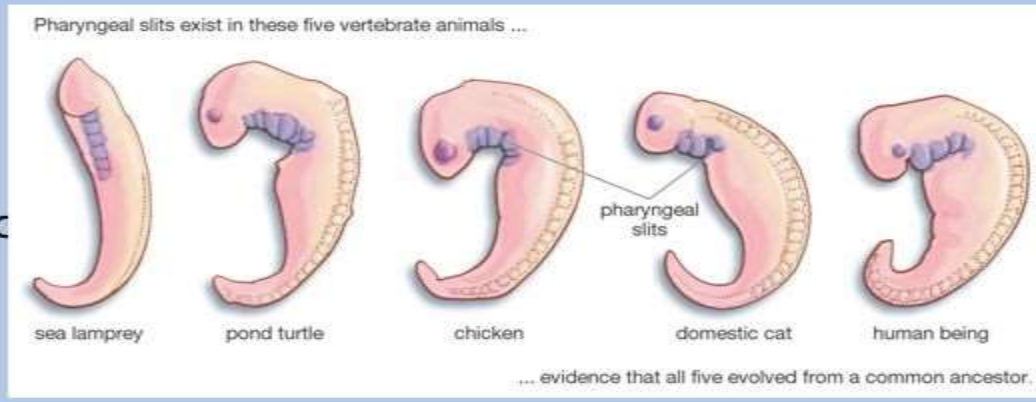
Palaeontology deals with study of fossils. Fossils are described as true witnesses or documents of evolution. Fossil record provide the connecting link between two groups of organisms. e.g. ***Archaeopteryx*** is a connecting link between reptiles and birds.

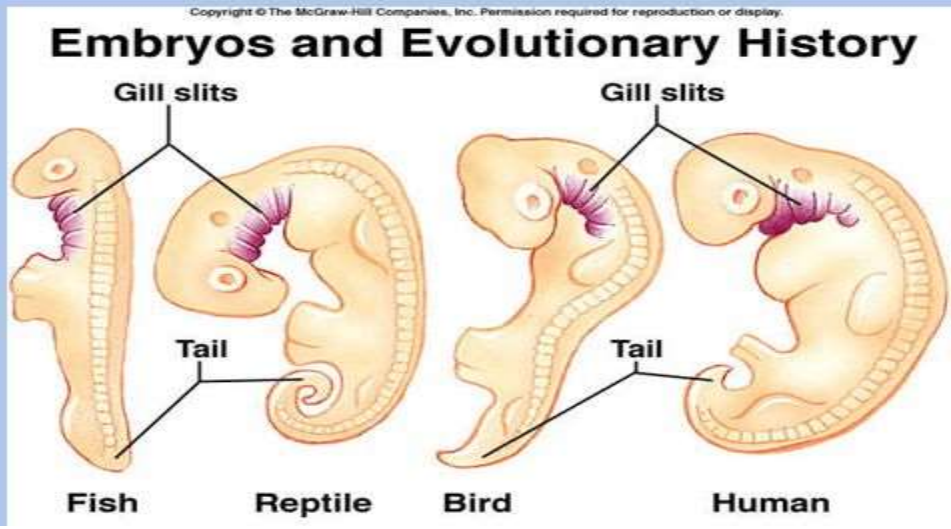


Evidence from embryology

Embryology

- Embryology is a new metho of examining evidence of evolution
  - Embryo = first 9 weeks of vertebrate development
- Embryonic structures of different species show significant similarities
- By studying the same patterns of early development across many different animals, we can find evolutionary links between animals





Evidence from molecular record

Molecular record

- Comparing DNA & protein structure
  - compare common genes
    - cytochrome C (respiration)
    - hemoglobin (gas exchange)
  - Closely related species have sequences that are more similar than distantly related species