Organic Evolution

Evidences

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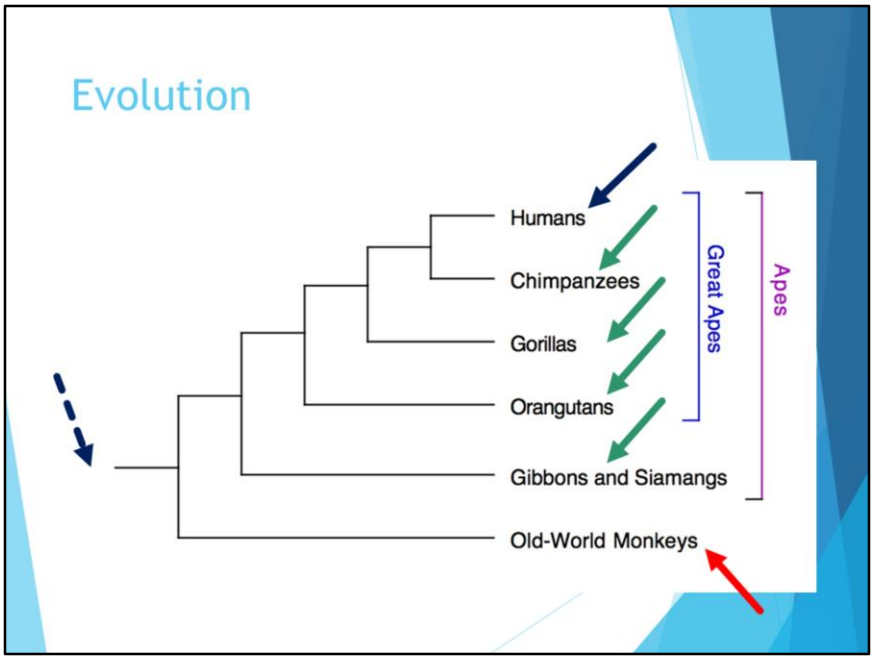
Lecture 3

Origin of Life vs. Organic Evolution

- Origin of Life
  - The first set of events in the origin of life in the remote past was the spontaneous generation of certain organic compounds which subsequently gave rise to the first living organisms
  - The origin of life was essentially the beginning of organic evolution
- Organic Evolution
  - The simplest living entities subsequently and gradually gave rise to other more complex living beings

Evolution

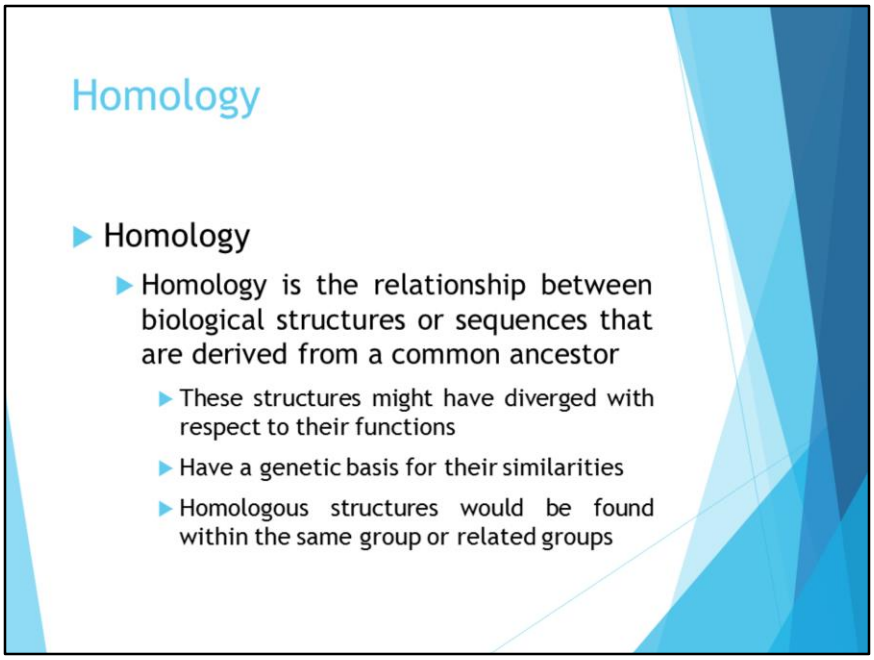
- Evolution may be described as derivation of new species of plants and animals from those existed in the past.
  - An **ancestor-descendant** relationship is an important concept in evolution.
- For instance
  - Evidence showed that man was not evolved from monkey, but that the man and the monkey had some common ancestor.
    - In course of time these diverged in two different directions.


Evolution
Humans
Chimpanzees
Gorillas
Orangutans
Gibbons and Siamangs
Old-World Monkeys
Great Apes
Apes

Evidences of Evolution

- Evidence from different disciplines
  - Comparative anatomy
  - Taxonomy
  - Embryology
  - Physiology and biochemistry
  - Palaeontology
  - Biogeography
  - Genetics
  - Molecular biology

Comparative anatomy, particularly in case of animals, has given the most extensive evidences to support the idea of organic evolution. A few examples in order to demonstrate this will be discussed here. These examples have been divided into several groups depending upon the kind of relationship involved in a particular example.



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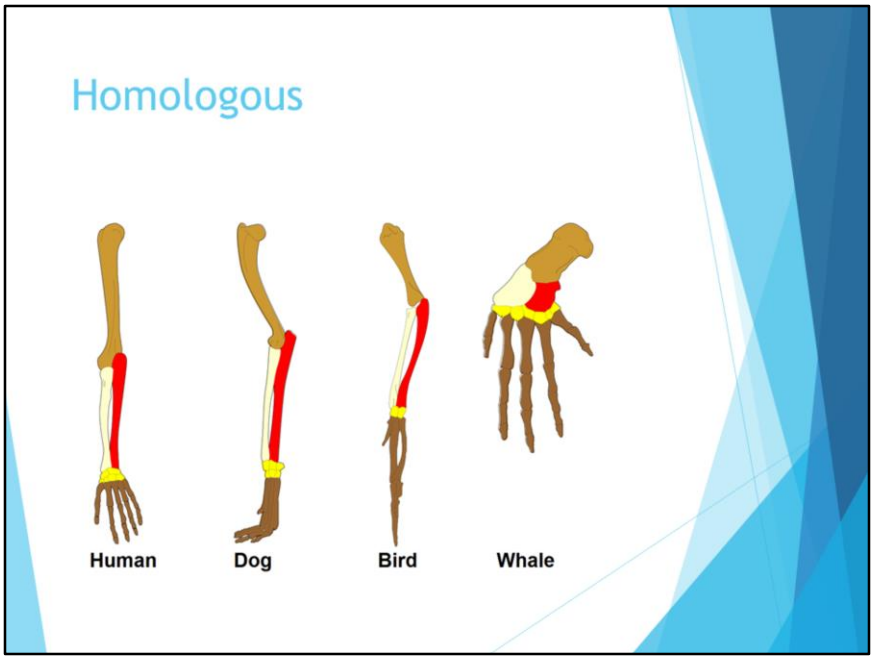
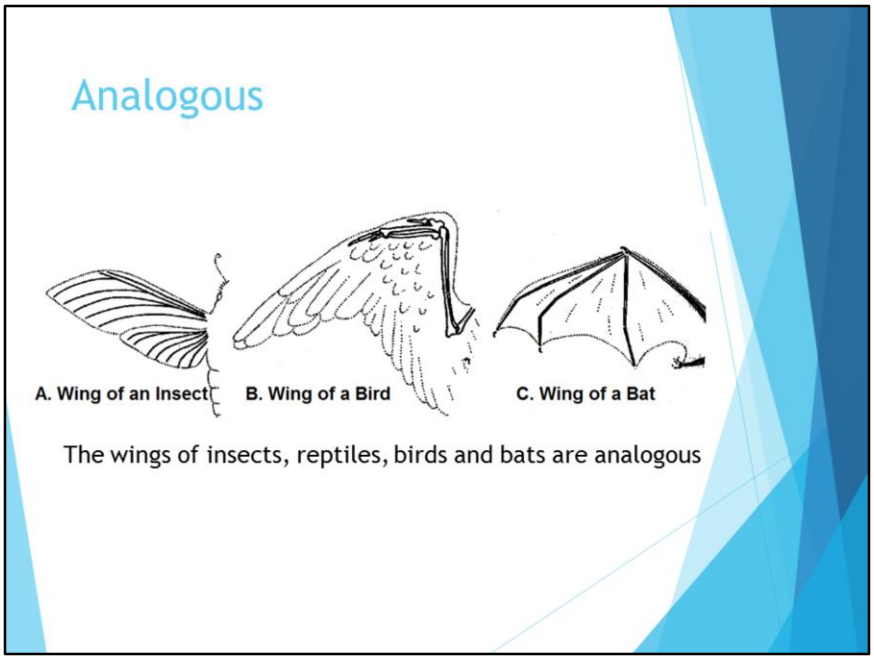


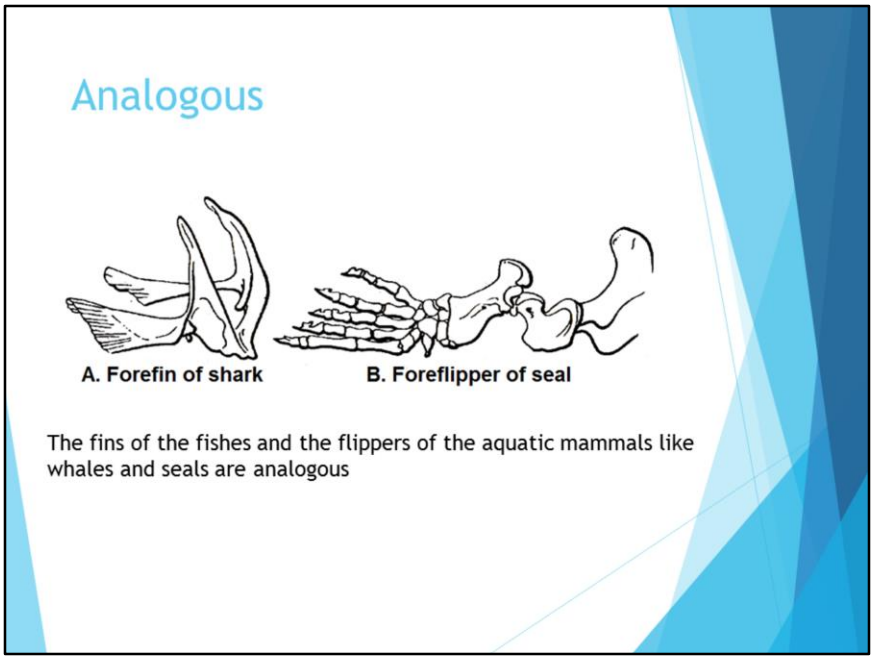
The principle of homology: The biological derivation relationship (shown by colors) of the various bones in the forelimbs of four vertebrates is known as homology and was one of Charles Darwin's arguments in favor of evolution.

Analogy

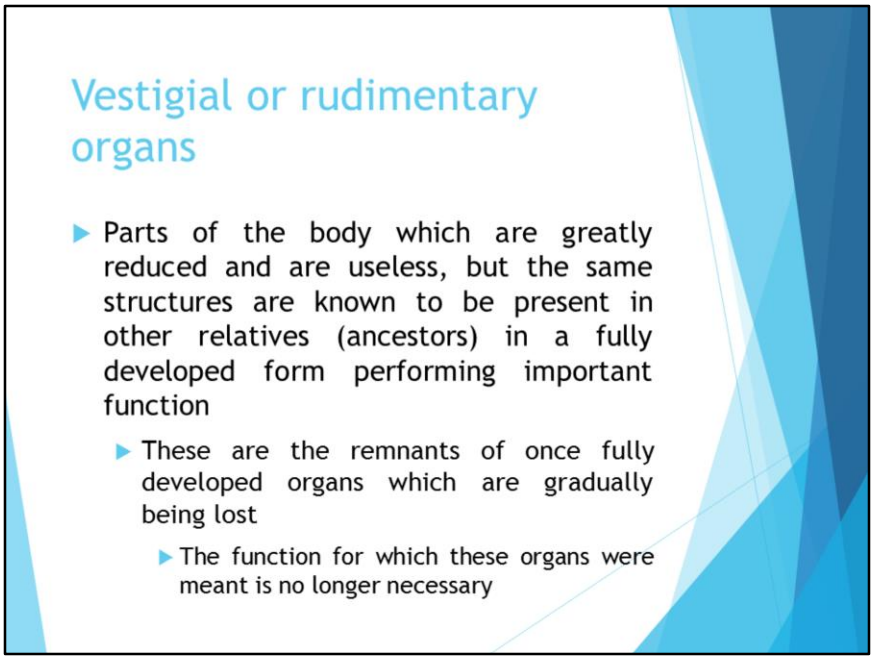
- Analogy
  - The relationship between structures, which though differ anatomically but would have superficial similarity due to similar functions
    - Such structures were originally created for different purposes and that their present function is secondarily achieved out of necessity
    - For example, the wings of a insect, a bird and a bat are analogous because they developed independently as adaptations to a common function—flying.



The wings of insects, reptiles, birds and bats are believed to have developed independently but are analogous, since they perform the same functions. While the wing of an insect is a membrane supported by veins, those of birds and bats are derived from forelimbs of a tetrapod. Although the wings of vertebrates are homologous in this respect, wings in general have atleast three different lines of descent and are thus analogous (Fig.)



A classicial example is furnished by the fins of the fishes and the flippers of the aquatic mammals like whales and seals. These structures found in animals distantly related serve the same function and are therefore analogous (Fig.). The skeletons of fins and flippers in the two cases respectively show that they are **not** homologous.

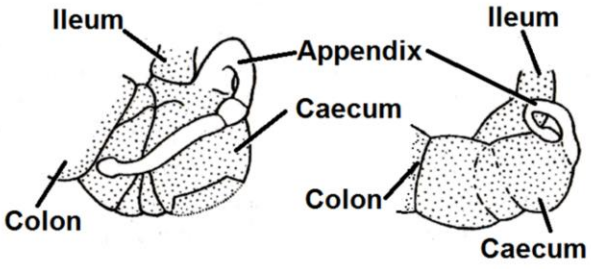


The presence of such structures can hardly be explained unless one assumes that these are the remnants of once fully developed organs which are gradually being lost, since the function for which these organs were meant is no longer necessary.

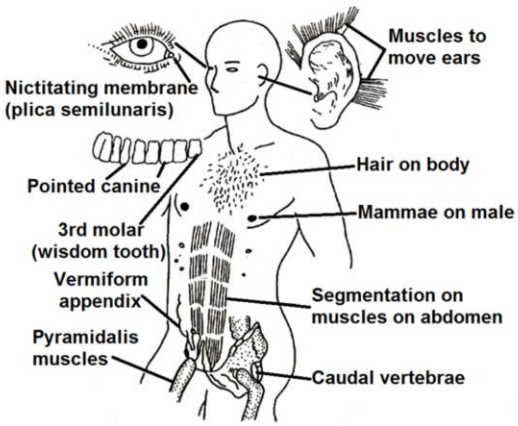
Vestigial Organs

- Vestigial organs in Human
  - Vermiform appendix in human
  - External ear in human
  - Caudal vertebrae in human
  - Skin fold in eye, wisdom teeth and body hairs in man
- Vestigial organs in other animals
  - Cave animals shows different degrees of degeneration of eye
  - Presence of vestigial pelvic girdle due to loss of hind limbs in snakes and whales
  - Vestigial wings in birds like Ostrich
  - Emu and Kiwi and the vestigial fibula of hind limbs in the form of splint bone in hoofed mammals like horse and deer

Vestigial Organs



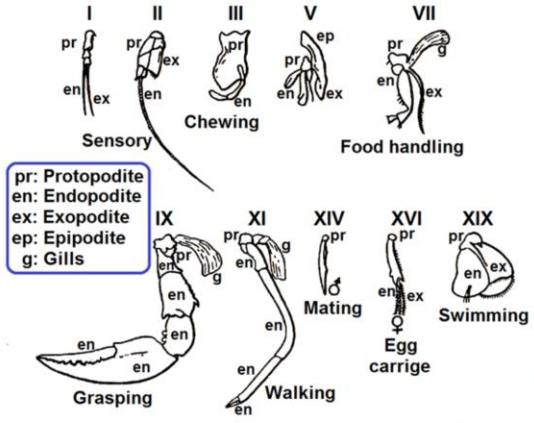
Vestigial Organs

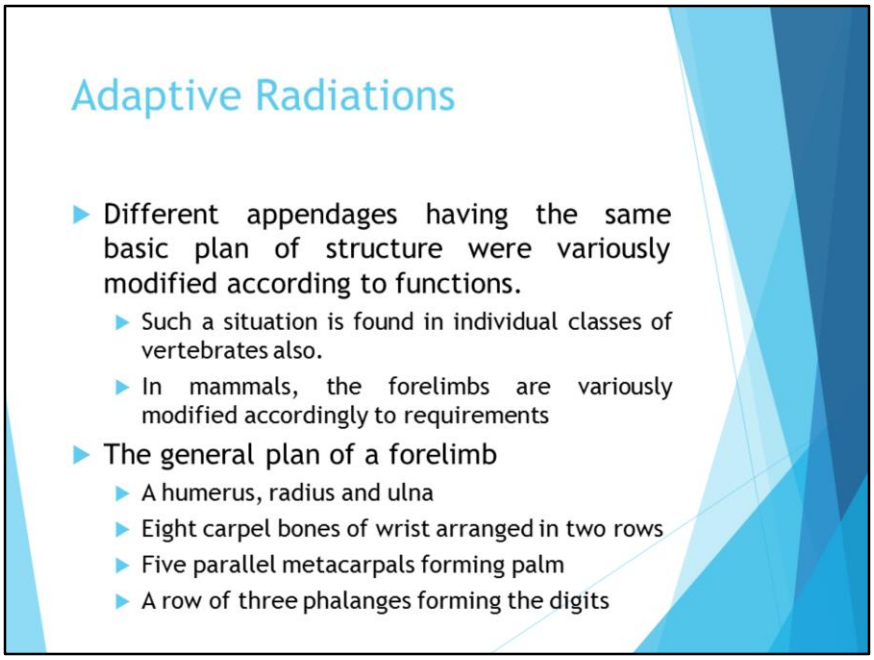


Serial Homology

- Serial homology is typical of all animals whose body structure is based on a series of serial segments
- Typical crustacean
  - There is one pair of appendages with each segment
  - Appendages in different segments are based on same structural plan
- The major examples of serial homology
  - Annelida
  - Arthropoda
  - Chordata

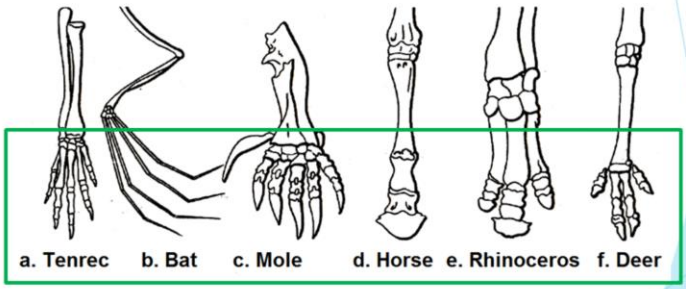
Serial Homology





It was realized that different appendages having the same basic plan of structure were variously modified according to functions. Such a situation is found in individual classes of vertebrates also. For instance, in mammals, the forelimbs are variously modified accordingly to requirements. The general plan of a forelimb consists of a humerus, radius and ulna, eight carpel bones of wrist arranged in two rows, five parallel metacarpals forming palm and a row of three phalanges forming the digits. These different structures are variously modified in different mammals according to functions they have to perform.

Adaptive Radiations

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