Unit IV : Indirect Evidences of Organic Evolution

Evolution stated as descent with modifications which is accepted worldwide.

On the basis of the modern theory of organic evolution, life evolved from simple to more complex form (Complexity from simplicity).

Organic evolution is a series of partial or complete and irreversible transformation of the genetic composition of population, based upon interaction with environment.

Modern evolutionists like Lamarck, Darwin, Cuvir, Weismenn, Spencer, Huxley, etc supports Modern theory of organic evolution.

Evidences from Comparative Anatomy and Morphology:

Study of functional anatomy is called **Tectology**

The Comparative anatomy provide us good evidences for evolution

All the organs in animals are formed on the same basic plan, though they may be modified variously

The comparative relationship in the organisms in their anatomy shows that they have evolved from common ancestor and modifications are secondary development according to their needs

When we make a general survey of the animals for structural evidences of evolution, we found two types of characters 1. Common origin and 2. Adaptive feature

Homology

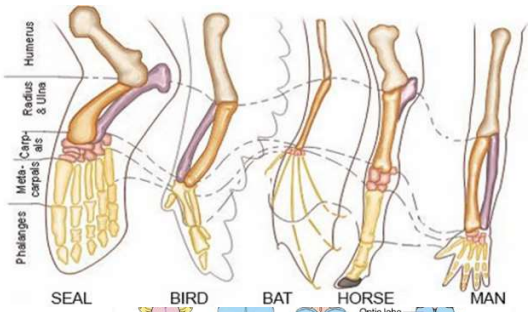
Homology is the similarity between various organs of different animals based on common origin or common ancestor

Homologous organs are those organs which are fundamentally the same in structure and have the same origin, may be modified to perform widely different function

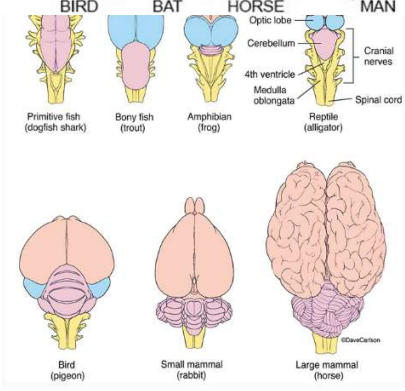
Homology is found in every organ system from fishes to mammals.

Homology of Vertebrate fore limbs

The fore limb of man and different vertebrates look so much different and perform different functions are homologous structure because all of them possess a pentadactyle plan and shows adaptation to different environmental conditions. Thus animal inherited homologous structure from ancestor



Homology in Brain structure



The brain of vertebrates ranging from fishes to mammals consist of similar series of parts i.e. olfactory lobes, cerebral hemispheres, optic lobes, cerebellum and medulla oblongata

As we progress through the series from fishes to mammals some lobes become more prominent than others like cerebral hemispheres which are smaller in fishes but highly developed in mammals due to adaptations and evolutionary changes.

Homology in Heart structure of Vertebrates

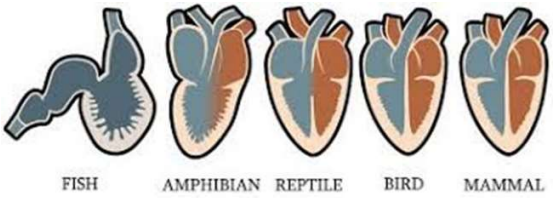
The basic plan of heart in all vertebrates are similar and perform the function of circulation of blood.

In all vertebrates heart basically divide into two parts, upper Auricle and lower Ventricle which further divide into right and left separated parts in amphibian to mammals

In fishes heart circulate only impure blood and divide into auricle and ventricle whereas amphibian heart circulate mixed blood and divide into three chamber .

In reptile, heart is partially or incomplete four chambered but in birds and mammals this is four chambered

This shows homology in heart structure



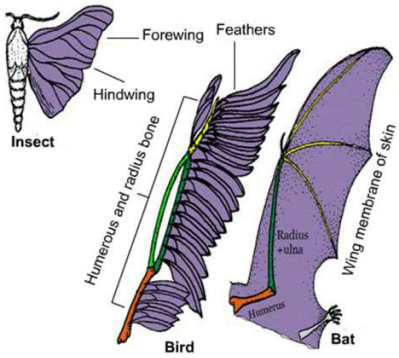
Analogy

The adaptive features which are unlike origin but are of similar functions are called **Analogy**

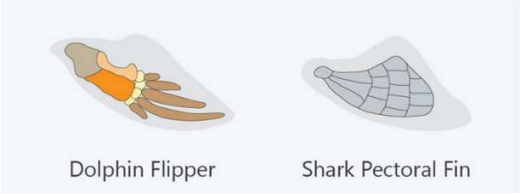
Those organs which are fundamentally unlike i.e. they have different origin but have the same function are called **Analogous Organs**

Wings of Butterfly and Birds

Perform similar function but basic structure and origin are different

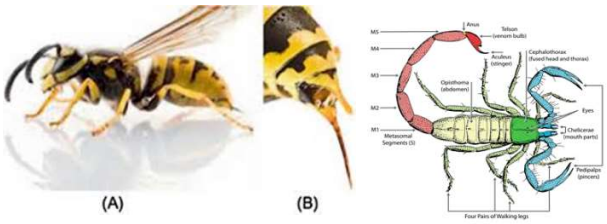


Fin of Fish and Flapper of aquatic mammals



These structure have similar appearance and function but their structure are different origin and therefore these are analogous organ

Sting of Honey bee and Scorpion



Sting of Honey bee and Scorpion perform similar function and similar in their structure, but their origin is different.

In Honey bee it is a modification of ovipositor while in Scorpion it is modification of last abdominal segment. Hence these are analogous

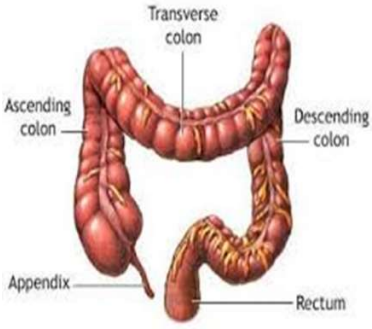
Vestigial Organ

The structure or organs which are functionless and reduced are called vestigial organs

The occurrence of vestigial organ suggest that these organs were well developed and functional in the ancestors but have become reduced to alternate development in the organism or change of environment

Examples of Vestigial organs

Vermiform appendix in Man:

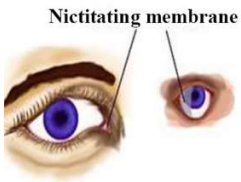


Appendix is a small structure without any known functions

It attached to the short section of the large intestine.

Some other mammals which live on course diet rich in cellulose, the appendix is functional

Nictitating membrane



A protective covering membrane is found in birds on the surface of eye to keep it moistened.

This membrane also found in reptile.

In human being it is functionless membrane called semilunar fold and present in inner angle of eye. This shows relationship of reptile, birds and mammals

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

Tail bones or Caudal vertebrae

Tail bone in human being

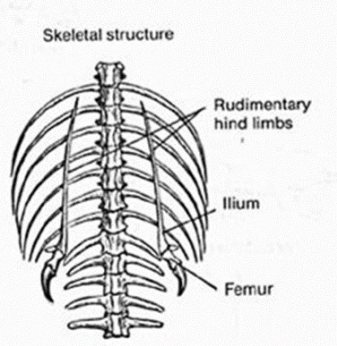
Majority of Mammals have well developed tails but it is absent in man

It is represented by caudal vertebrae (Coccyx) even present in man.

Vestigial hind limb in Python

In Python vestigial hind limb structure externally present on ventral sides.

Internally it shows structure of full formed limb, made of several bones i.e. ilium, femur, tibia, claw etc.

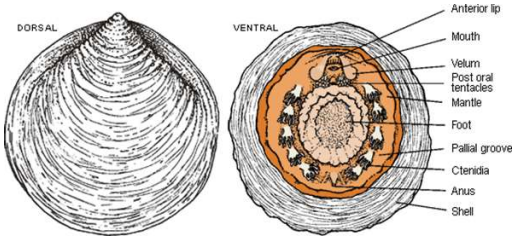


Connecting Link

The organisms living or extinct which possess characters intermediate between two different groups are called **connecting links.**

Following are some important examples of connecting links.

Neoplina - It is a connecting link between Annelida and Mollusca.



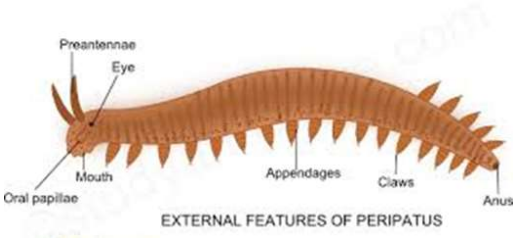
It resembles molluscs as it possesses a shell, a mantle and a large muscular foot.

Its annelid characters are presence of segmentally arranged gills, nephridia and muscles and a trochophore-like larval stage.

Peripatus- an arthropod, is a connecting link between annelida and arthropoda.

Its arthropod characters include haemocoel, tracheae as respiratory organs and tubular heart with ostia.

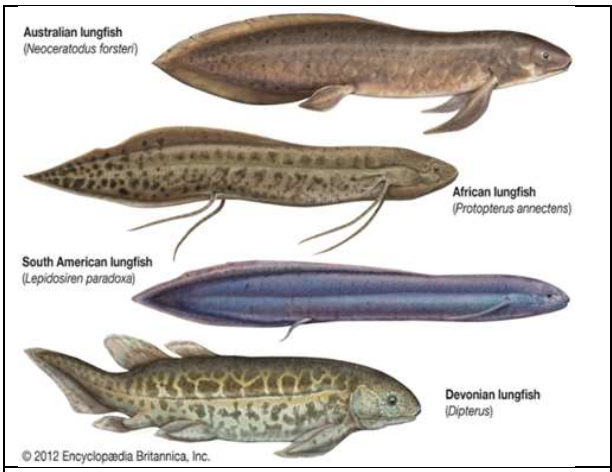
The annelid characters exhibited are the worm-like body, structure of the eyes, unjointed legs, presence of segmental nephridia, soft cuticle and continuous muscle layers in the body wall.



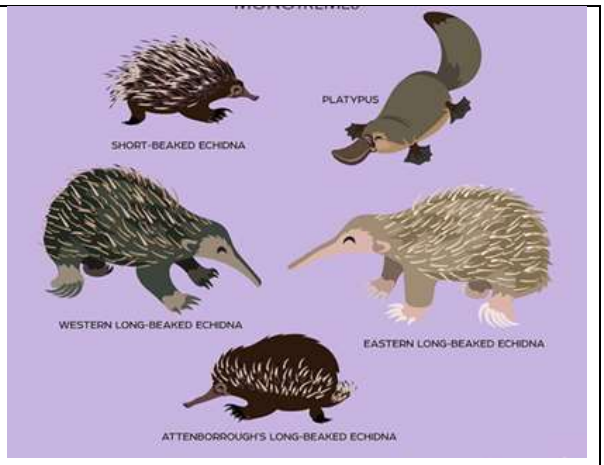
The lung fishes, e.g., Protopterus (African lung fish), Lepidosiren (South American lung fish) and Neoceratodus (Australian lung fish) may be considered the connecting links between the

fishes and amphibians. The lung fishes have all the characters of a typical fish, but they are capable of respiring through lungs and possess a three chambered heart.

Egg-laying mammals (e.g., Ornithorhychus. Duck-billed platypus and Tachyglossus or Echidna or Spiny ant eater) bear hair and mammary glands, but also possess some of the reptilian characters such as laying of eggs, presence of cloaca and some skeletal similarities. Thus they are connecting link between reptiles and mammals.



The lung fishes,



Egg-laying mammals

Atavism

It has been observed that some individuals are born with some abnormal features which are supposed to have been present in their ancestors, but have lost during the course of evolution.

The reappearance of certain ancestral characters which had either disappeared or were reduced are called **Atavism**

There are present some examples of atavism in human beings-

The power of moving pinna in some persons,

Greatly developed canine teeth,

Exceptionally long dense hairs,

Short tail in some babies

Thus the study of comparative anatomy reveals that all the animals in fact are related either closely or distantly to each other.