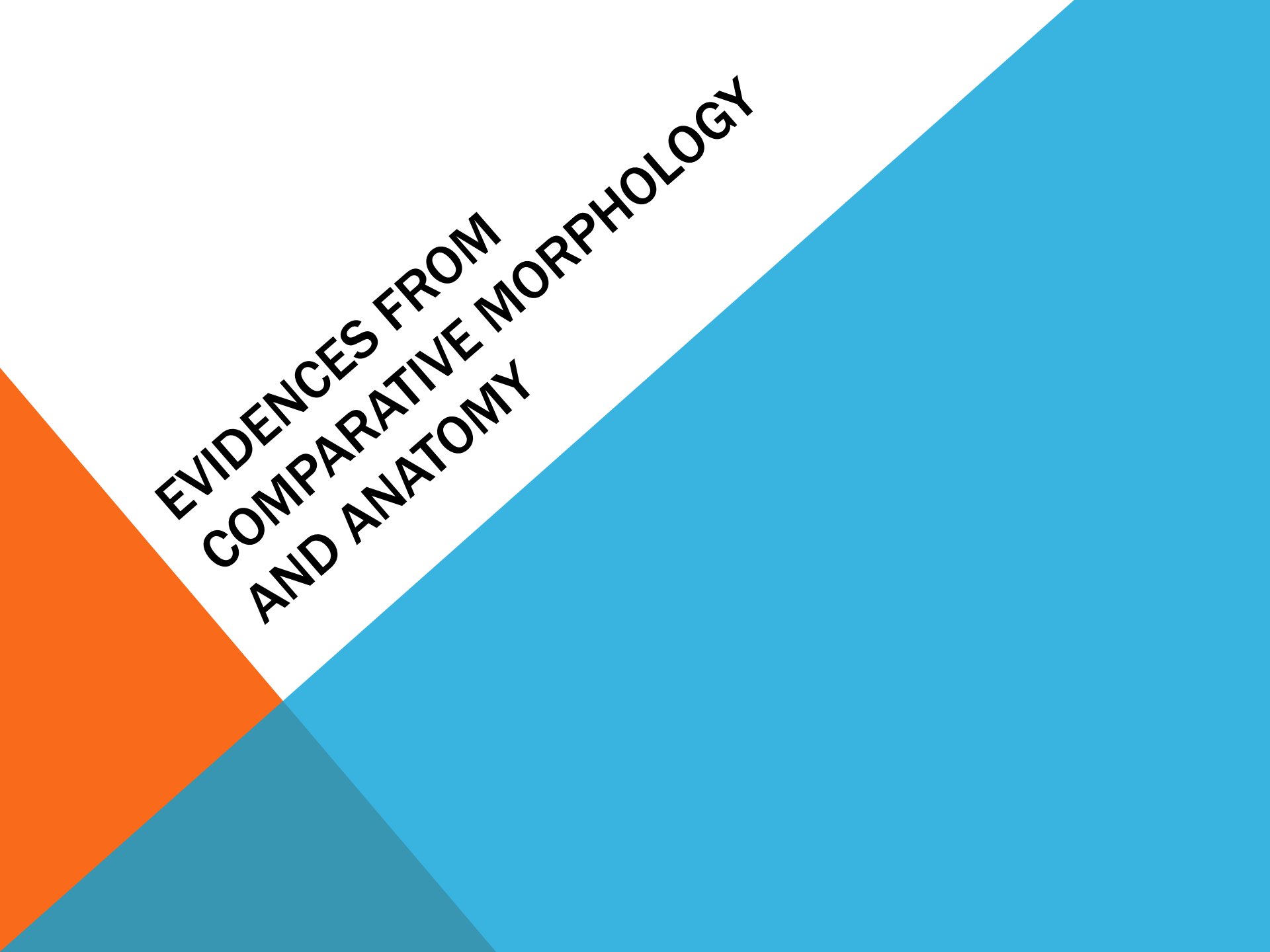


# EVOLUTION

V Sem B.Sc. Zoology – Core Course VII – Ethology, Evolution & Zoogeography

Swapana Johny  
Asst. Professor  
Dept of Zoology



**EVIDENCES FROM  
COMPARATIVE MORPHOLOGY  
AND ANATOMY**

# INTRODUCTON



- Structural similarities between groups of organisms  
– indications of relationship
- Comparative study of external and internal structures exhibits striking similarities between certain organs although they show gradual adaptive modifications
- Illustrated by structures like analogous organs, homologous organs, vestigial organs, etc

# INTRODUCTON



- Homologous organs
- Analogous organs
- Vestigial organs
- Divergent evolution
- Convergent evolution
- Atavism
- Connecting links

# HOMOLOGOUS ORGANS



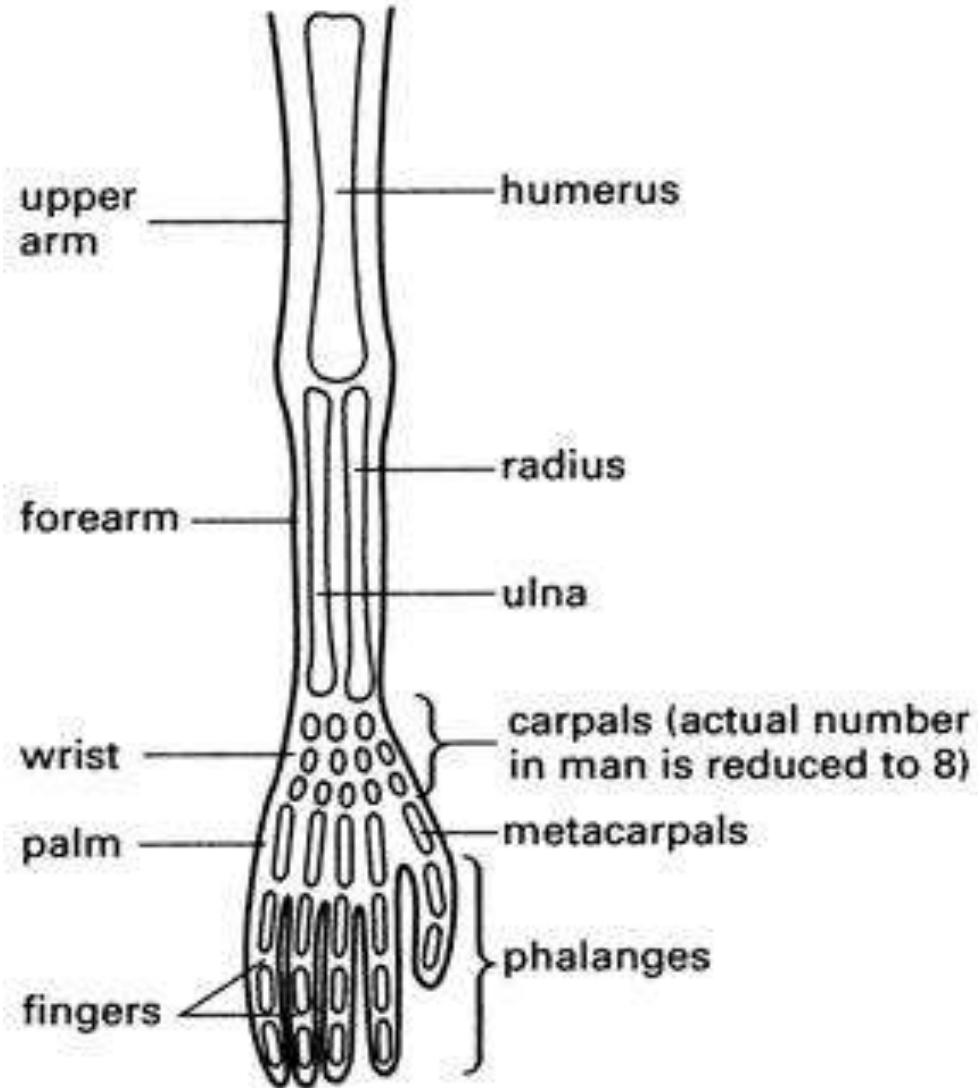
- Homologous organs – same embryonic origin and basic structure but different function
- Relationship between homologous organs – homology – due to inheritance from common ancestor.
- Analogous organs – different embryonic origin but similar appearance – similarity of function
- Relationship between Analogous organs – analogy

# HOMOLOGOUS ORGANS

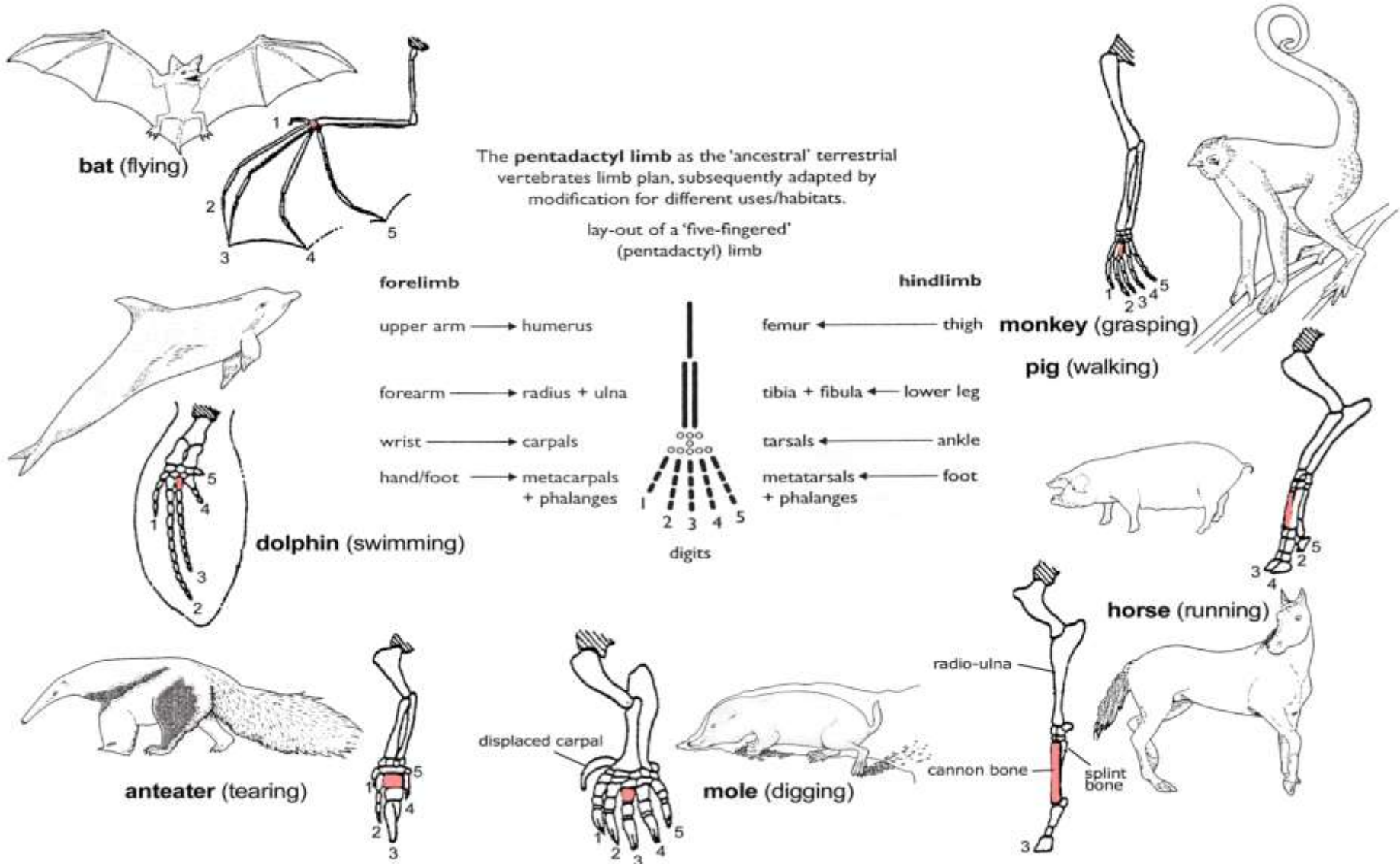


- **In Vertebrates -**
  - Forelimbs
  - Heart and aortic arches
  - Brain and sense organs
  - Vertebral column
  - Digestive tract
- **Invertebrates -**
  - Mouth parts of insects

# PENTADACTYL LIMB OF VERTEBRATES



# PENTADACTYL LIMB OF MAMMALS

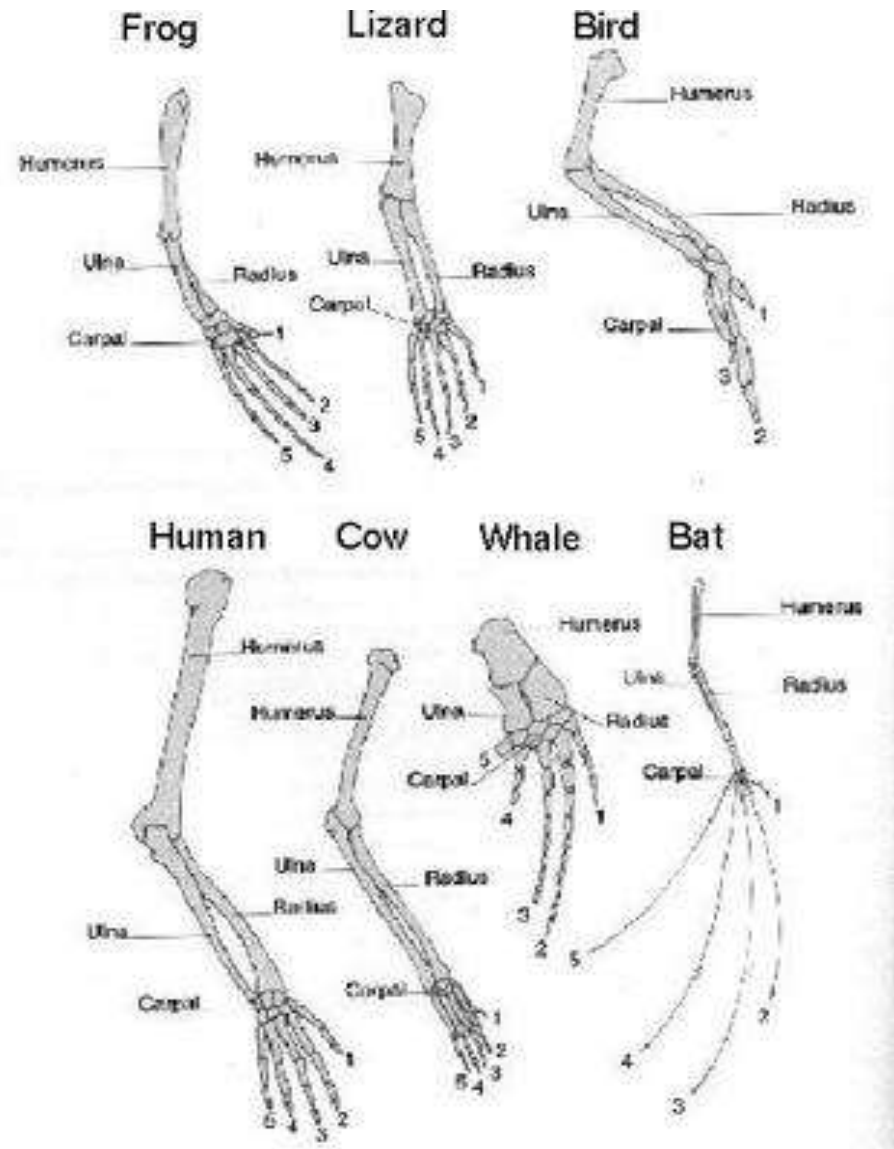




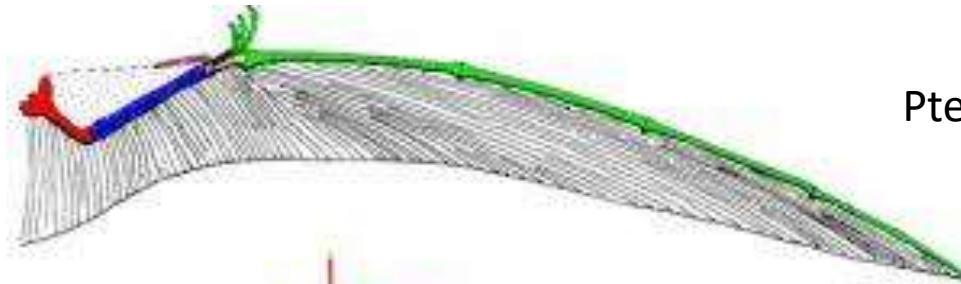
# HOMOLOGY OF PENTADACTYL LIMB OF VERTEBRATES

- Bones –Humerus, radius & ulna, carpels, metacarpels and phalanges
- Resemblances in minute blood vessels, nerves and muscles
- Diverged – flying, swimming, digging, running, walking and grasping
- Variations – size & shape; shortening or lengthening; reduction or fusion of bones – adaptive modifications

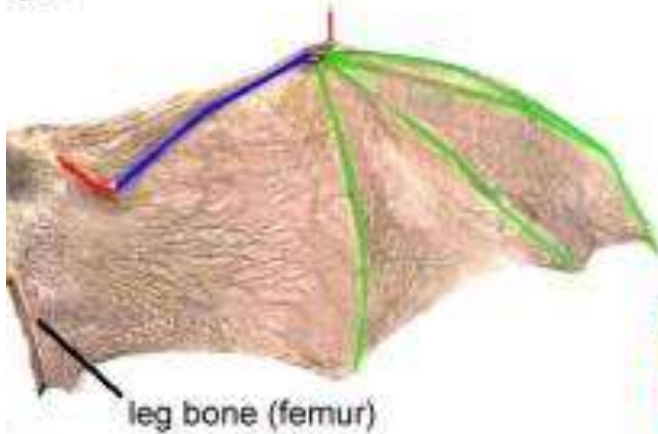
# PENTADACTYL LIMB OF VERTEBRATES



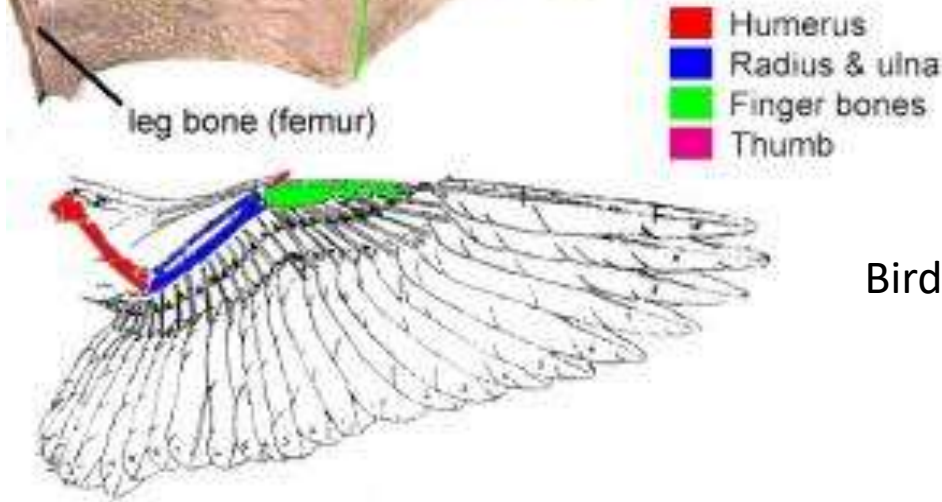
# FORELIMBS OF FLYING VERTEBRATES



Pterodactyl – long 5<sup>th</sup> digit



Bat – four long digit (2-5) digits

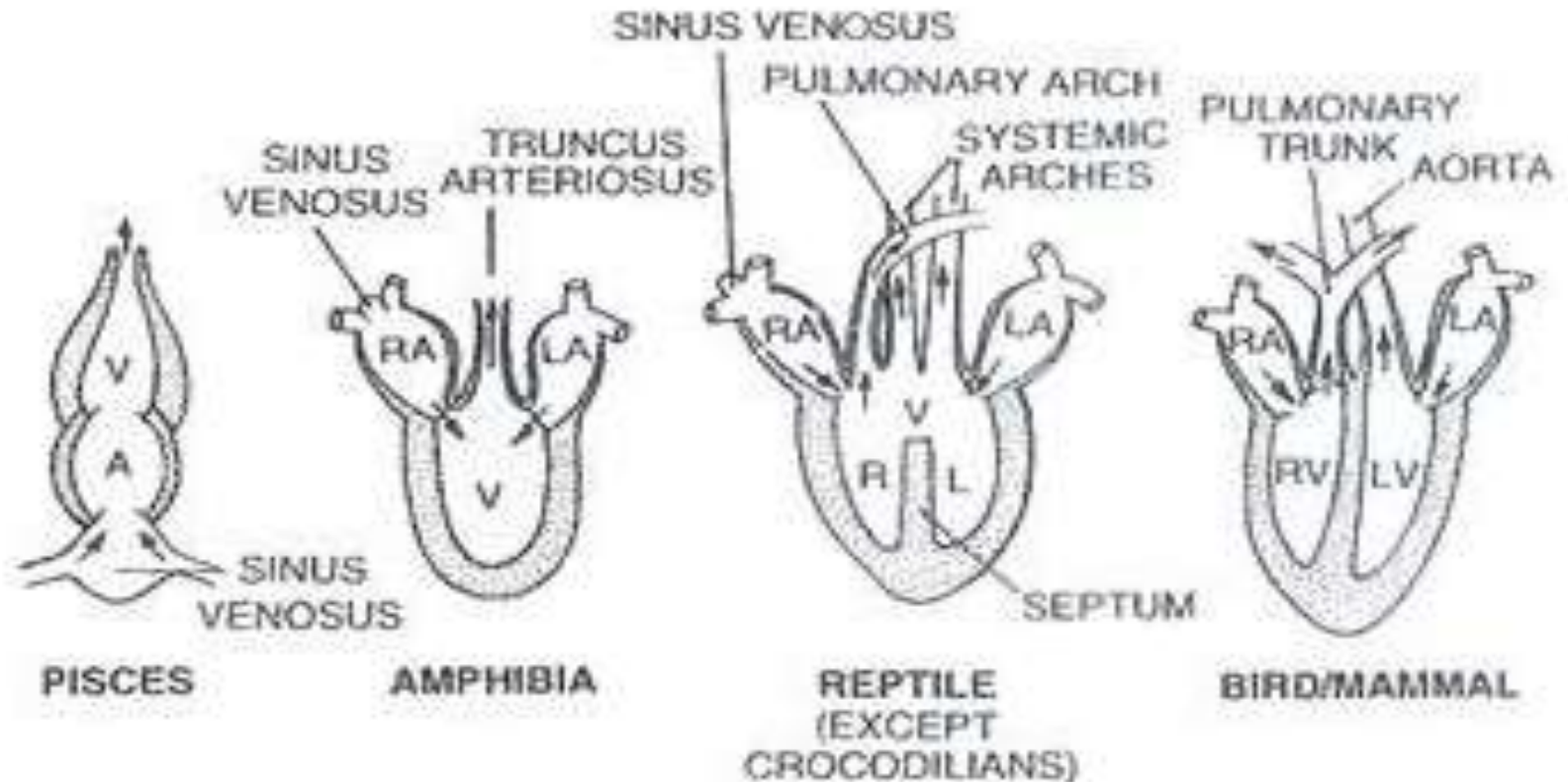


Bird – three digits except 4 & 5

# HOMOLOGY OF HEARTS

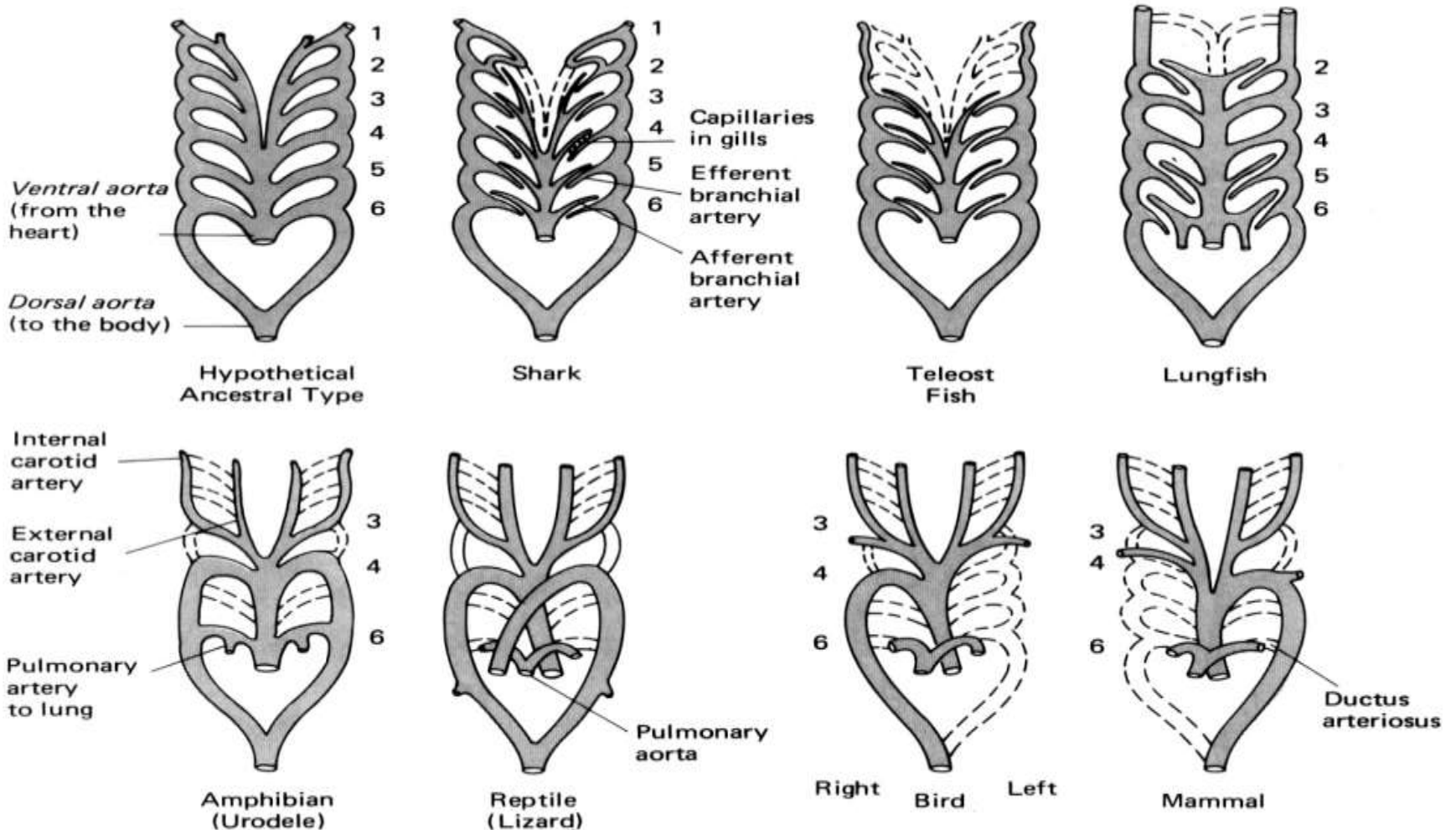
- Invertebrates – heart ventrally placed with closed system of circulation containing blood with red and white corpuscles
- 2 chambered – Fish
- 3 chambered – Amphibians & lower Reptiles
- Four chambered – advanced reptiles- crocodiles, birds and mammals

# HOMOLOGY OF HEARTS



Hearts of different vertebrates Note the progressive complexity. A = Auricle, V = Ventricle, R = Right, L = Left.

# HOMOLOGY OF AORTIC ARCHES



**Figure 5.8.** Diagrams of aortic arches in adult vertebrates (ventral views).

# HOMOLOGY OF VERTEBRAL COLUMN AND CERVICAL VERTEBRA



- Vertebral column develop from similar embryonic rudiments – separate vertebrae that support body – encloses nerve chord
- Parts – centrum, neural arch and other processes
- Mammalian cervical vertebrae – 7 – irrespective of length and size of neck – developed from single ancestor with 7 cervical vertebrae

# HOMOLOGY IN OTHER SYSTEMS



- **NERVOUS SYSTEM** – brain – olfactory lobes, cerebral hemispheres, optic lobes, cerebellum, etc
- Paired cranial & spinal nerves and single dorsal nerve chord – indicates a common ancestor.
- Excretory, digestive and reproductive systems show homology



# HOMOLOGY IN INVERTEBRATES

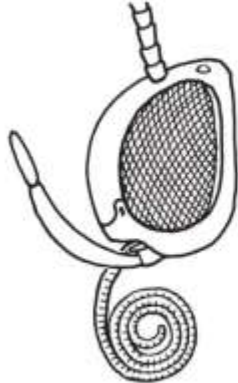


- Arthropods – jointed foot, chitinous exoskeleton, segmented body, double ventral nerve chord

# INSECT MOUTH PARTS

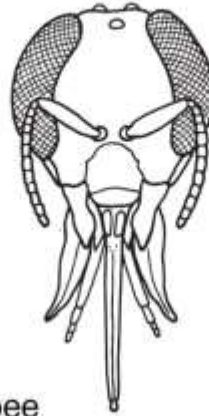
## Insect mouthparts

sucking



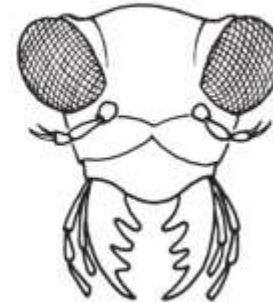
butterfly  
*(side view)*

lapping

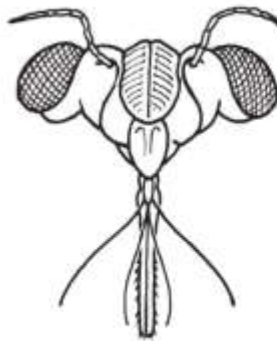


bee  
*(front view)*

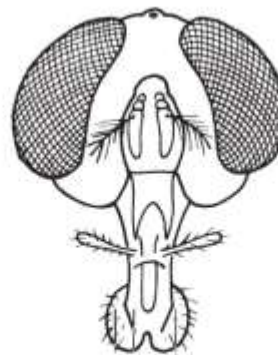
chewing



beetle  
*(front view)*



cicada  
*(front view)*



housefly  
*(front view)*



grasshopper  
*(side view)*

# INSECT MOUTH PARTS

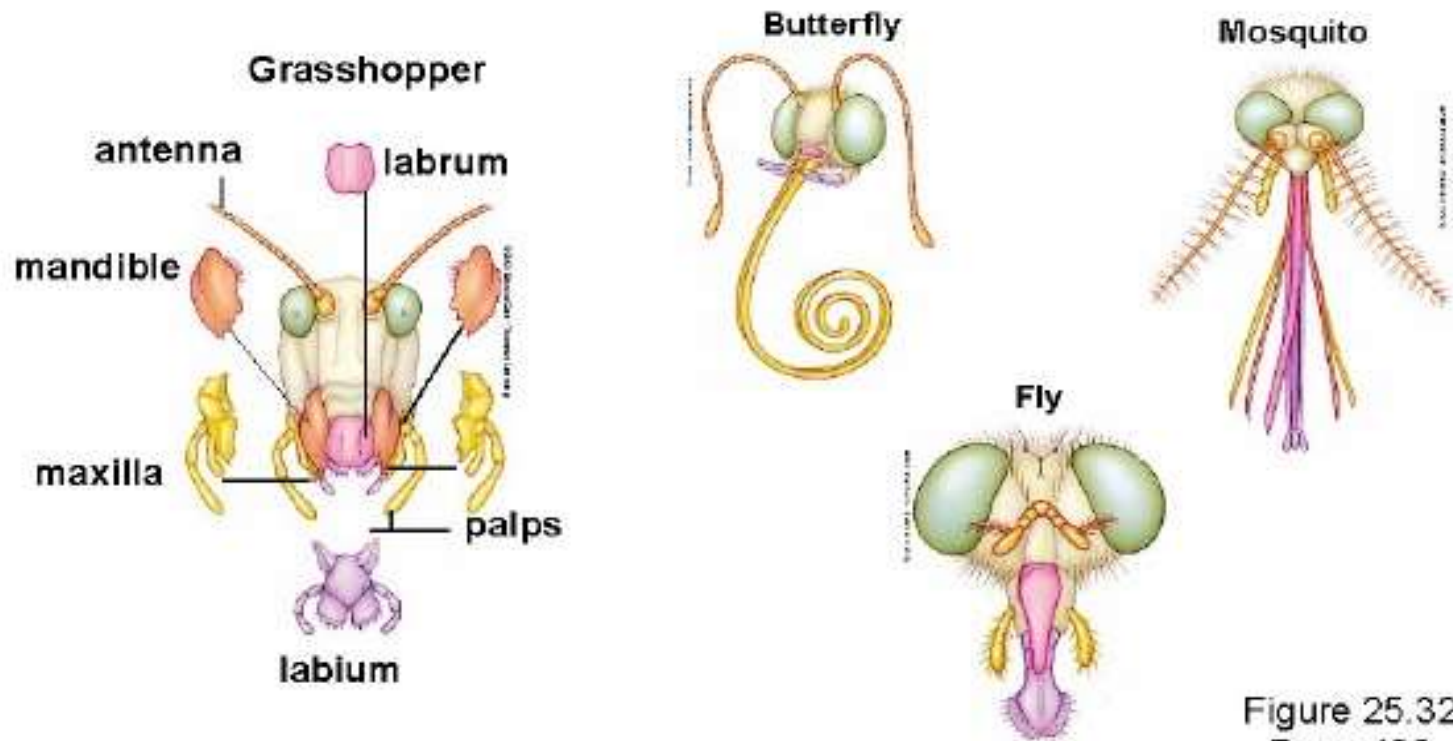


Figure 25.32  
Page 436



# SERIAL HOMOMOLOGY



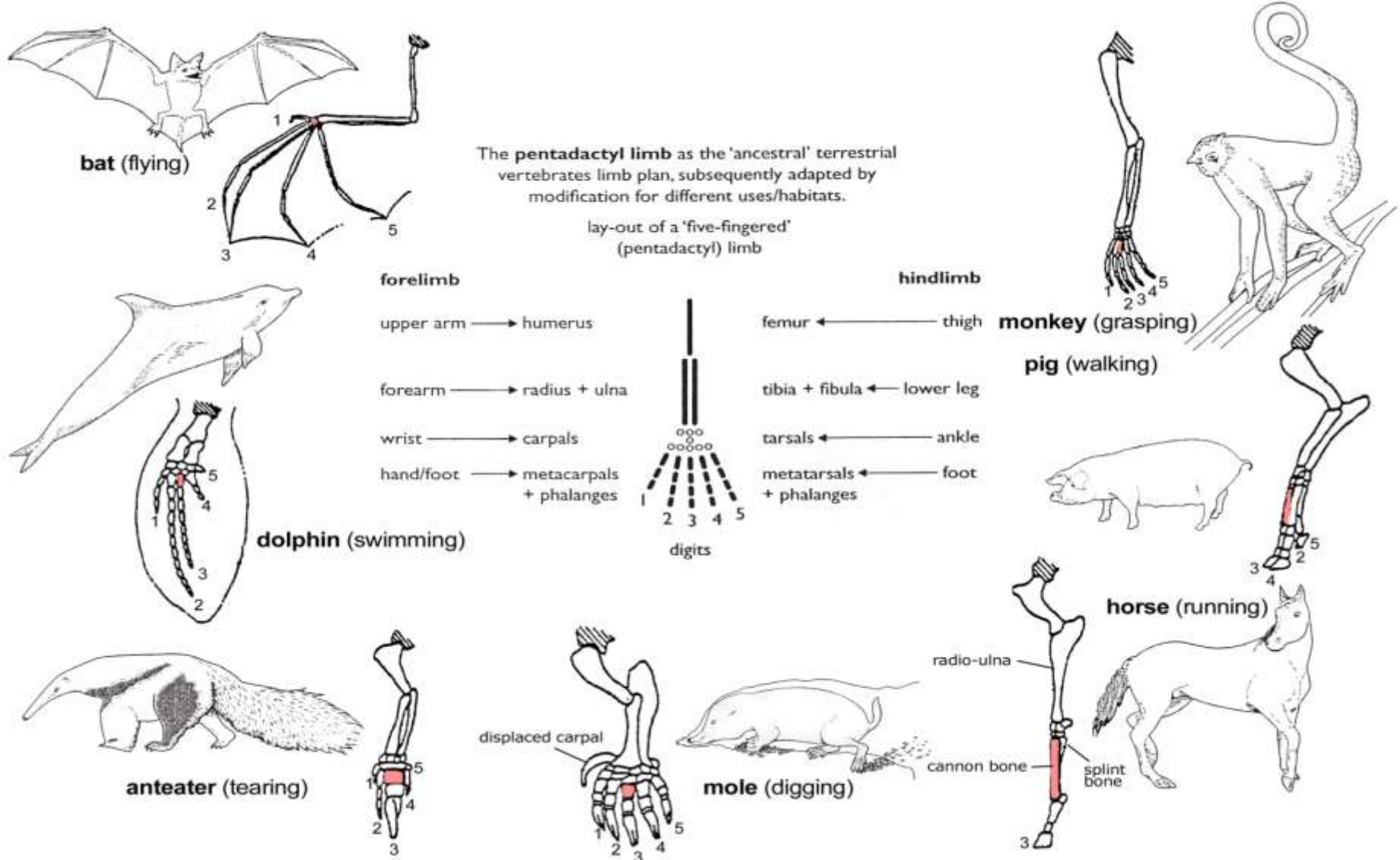
- Two or more structures in one individual are compared
- Fundamental similarity between one part and another part of same animal.
- Egs – arms and legs of man.
- 19 pairs of appendages of Cray fish – all in same plan but serving different function

# DIVERGENT EVOLUTION & ADAPTIVE RADIATION



- Enabled the descendants to occupy a wide variety of ecological niches
- Pentadactyl limb – different function
- Divergent evolution – adaptive radiation – evolution of animals in several directions from single ancestor.
- Darwin's finches of Galapagos Islands
- Marsupials of Australia

# PENTADACTYL LIMB OF MAMMALS

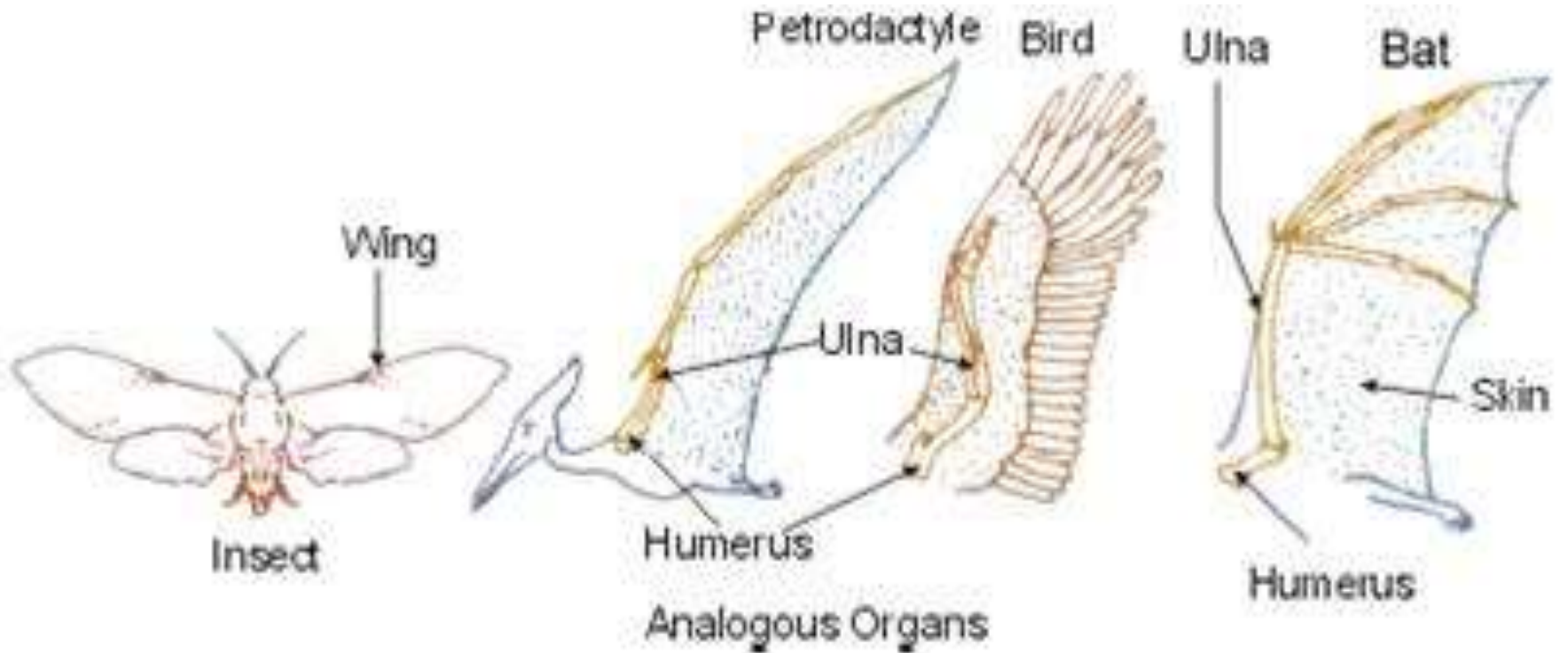


# ANALOGOUS ORGANS



- Superficially similar in appearance and perform similar function but different basic structure and embryonic origin.

# ANALOGOUS ORGANS





# ANALOGOUS ORGANS



- Wings of birds and insects
- Legs of insects and mammals
- Fins of fishes and flippers of aquatic mammals

# CONVERGENT EVOLUTION

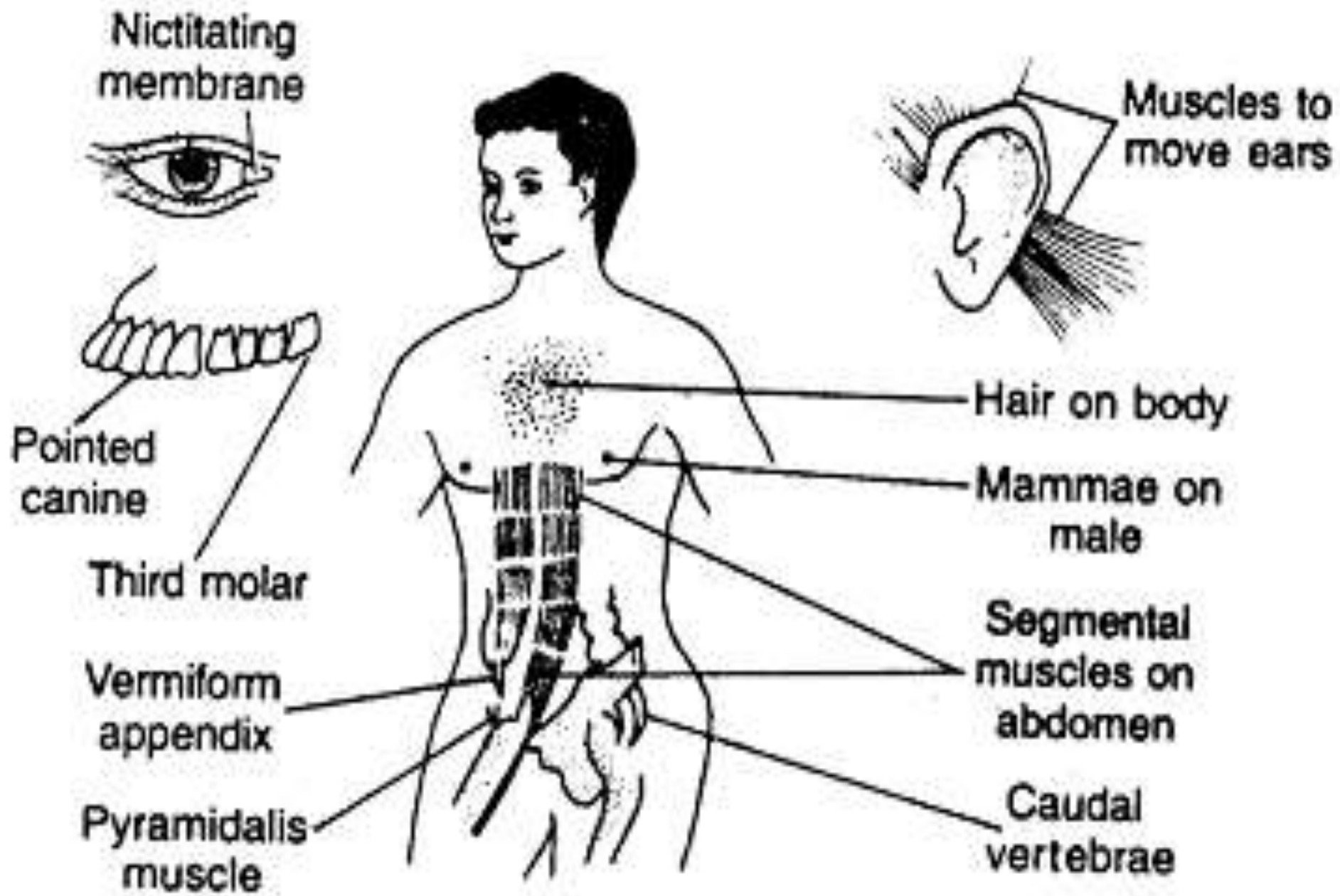


- Development of similar adaptive features by distantly related animals
- Convergence due to similarity in mode of life
- Wings
- Streamlined body of aquatic organisms

# VESTIGIAL ORGANS

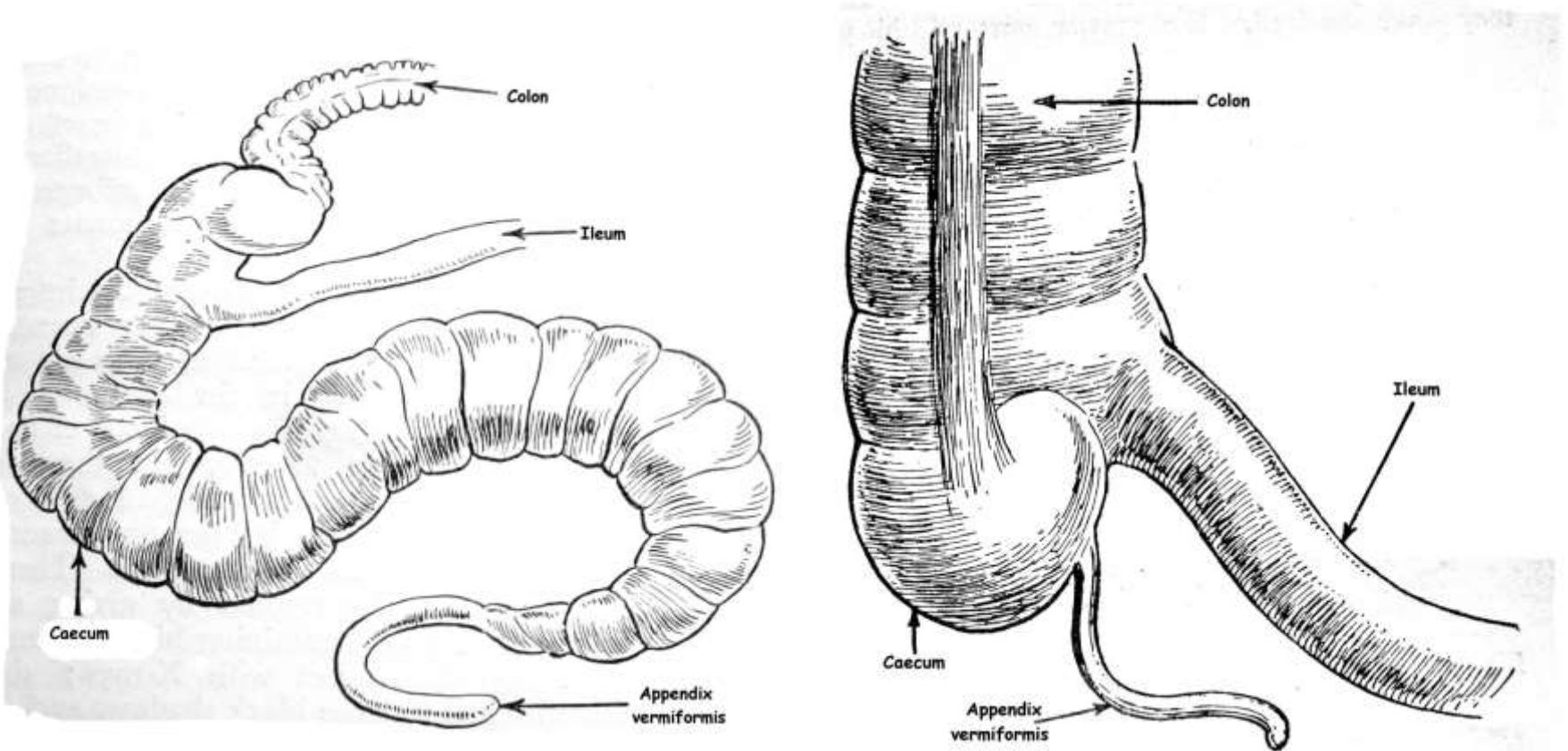


- Non functional and reduced organs in animals are called vestigial organs
- Egs: - caecum & vermiform appendix of man and rabbit

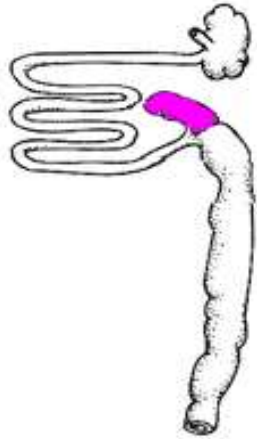


**Vestigial organs of man**

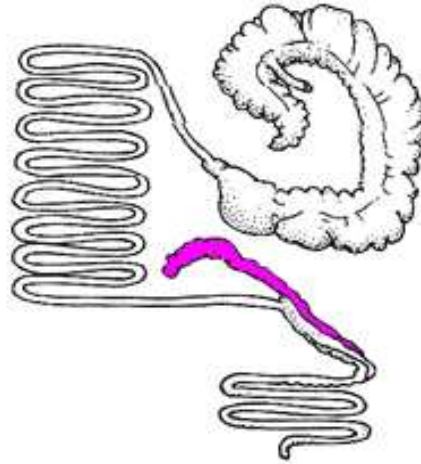
# RABBIT & MAN



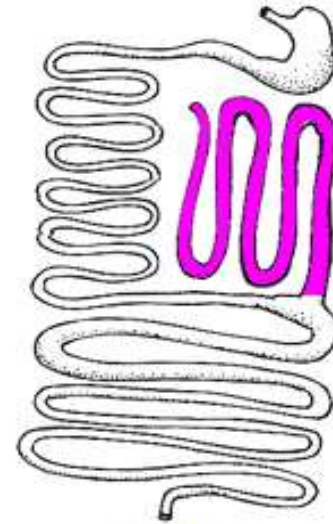
# GUTS OF DIFFERENT ANIMALS



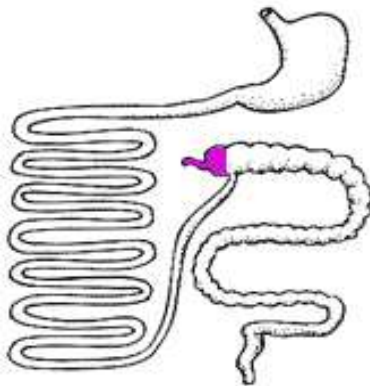
Opossum



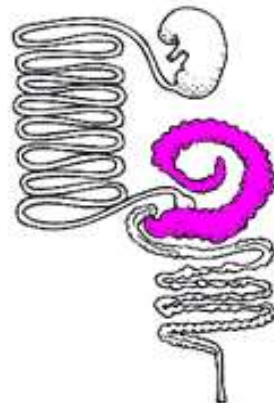
Kangaroo



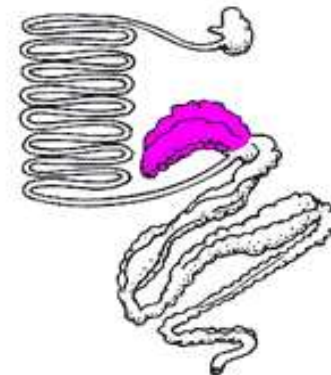
Koala



Human



Rabbit



Zebra

# ATAVISM



- Reoccurrence of an ancestral characters after an interval of several generations.
- EGS :- small tail in child, third nipple in man, cervical fistula – the pharyngeal pouch corresponding to the gills of fishes, profuse hair development on body and face

# ATAVISM





# CONNECTING LINKS

**ARCHEOPTERYX**



**PERIPATUS**





THANK YOU