Sri Chaitanya
Educational Institutions

FUSION INTENSIVE

Day 13

ZOOLOGY

Animal Kingdom

Lecture 13

Sri Chaitanya
DIGITAL EDUCATION

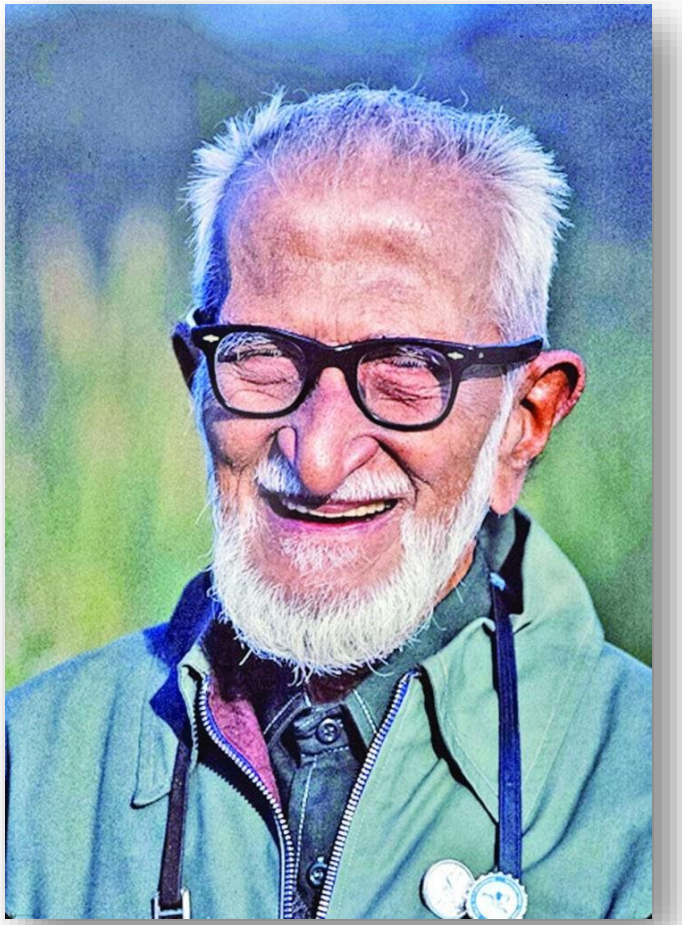
AVES

Did you know?

- Crop milk is a secretion from the lining of the crop of parent birds that is regurgitated to young birds.
- It is found among all pigeons and doves where it is referred to as pigeon milk.
- An analog to crop milk is also secreted from the esophagus of flamingos and the male emperor penguin.

Origin

- Aves originated from theropod dinosaurs in Jurassic period.
- Modernised in Cretaceous period.
- Ornithology is the study of birds.
- Dr. Salim Abdul Ali – ‘Birdman of India’



Origin

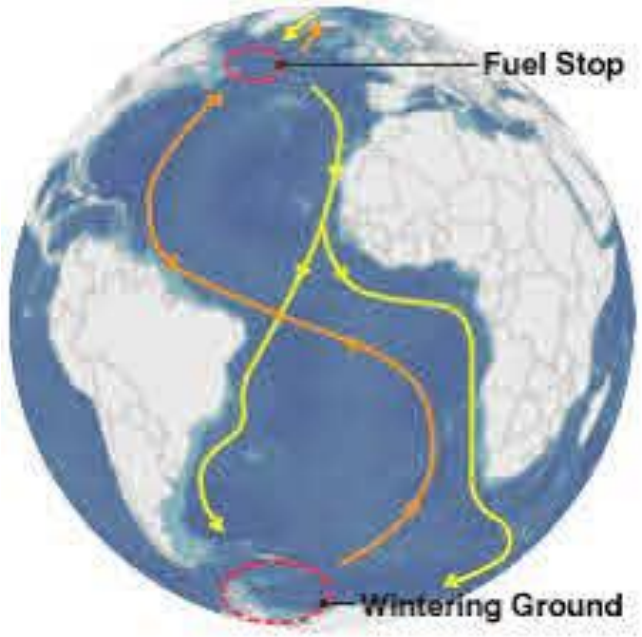
- T.H. Huxley called birds '**glorified reptiles**'.
- Aves exhibit many reptilian features such as
  - Scales
  - Interclavicle
  - Uricotelism
  - Megalecithal eggs
  - Development of four extraembryonic membranes.
- Aves are advanced over reptiles in having an
  - Insulated body
  - Homeothermy
  - High metabolic rate
  - Complete separation of venous and arterial blood

Archeopteryx lithographica

- *Arcaheopteryx* (=ancient wing)
- Popularly known as ‘Lizard bird’.
- Discovered in a limestone quarry, Bavaria, Germany.
- Connecting link between reptiles and birds.

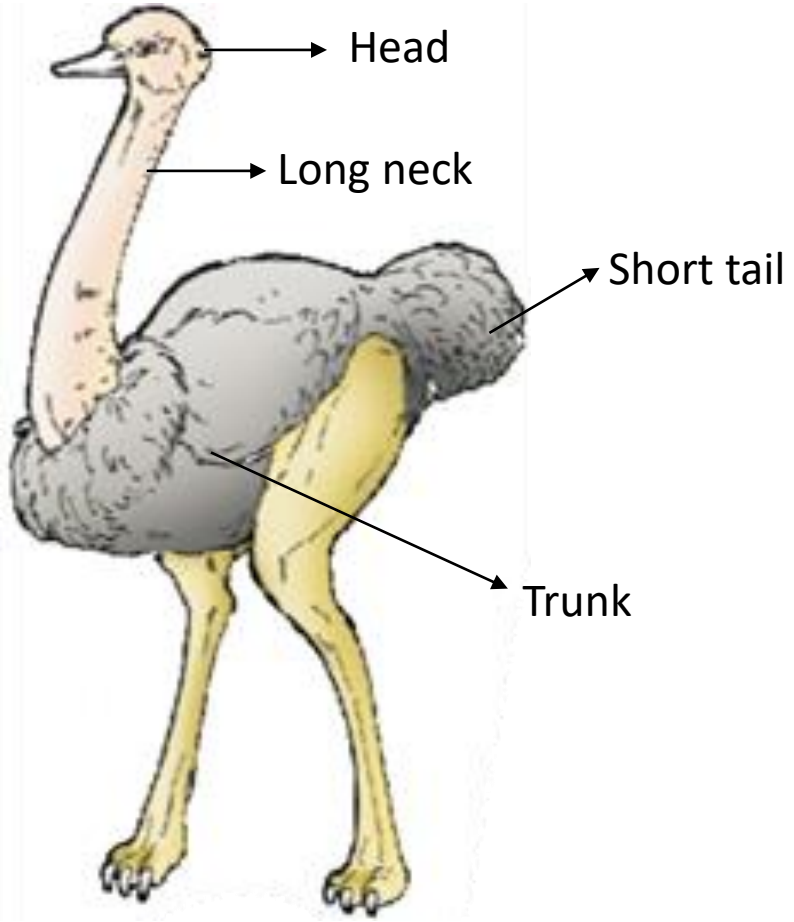
Habits

- They are warm-blooded (homoiothermous) animals, i.e.,they are able to maintain a constant body temperature.
- Birds have high metabolic rate and high body temperature.
- Endothermy allows birds and mammals to be active at night and in cold weather.
- Birds are capable of migration over long distances.



Body divisions

- Body is streamlined.
- Body divisions:
  - Head
  - Long neck
  - Trunk
  - Short tail.
- Birds, in general, are smaller than mammals (flight requires high surface-weight ratio).

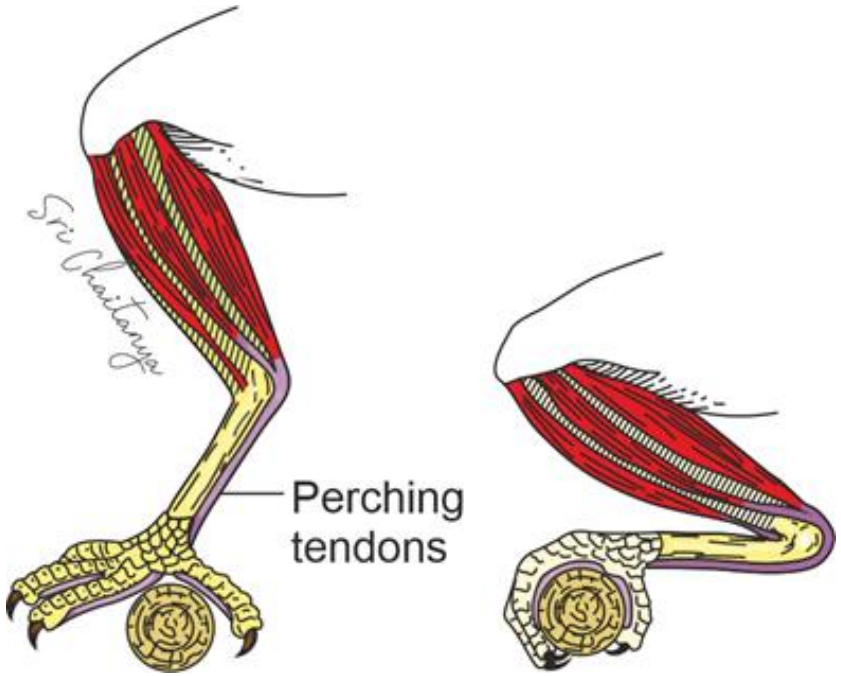


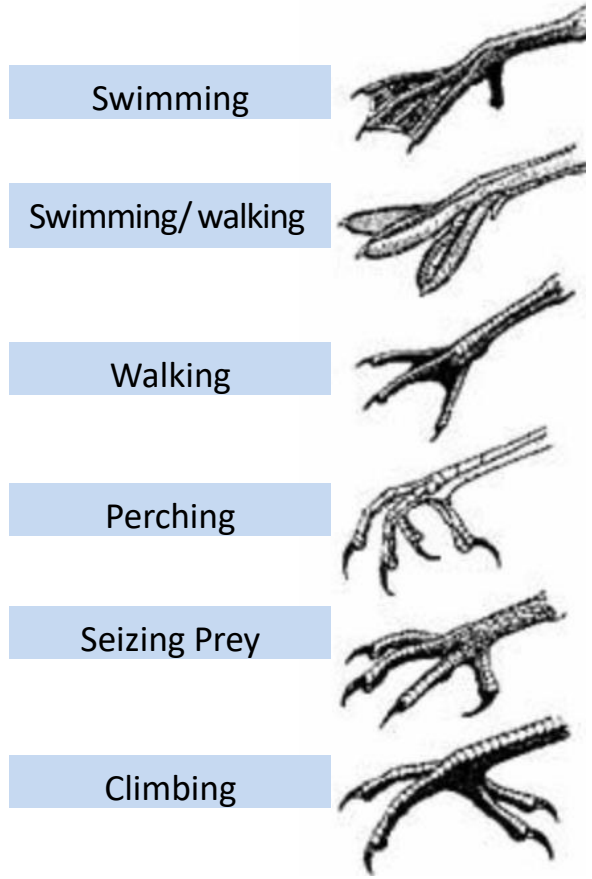
Limbs

- Aves are bipedal
- Forelimbs are modified into wings.
- Most of them can fly except flightless birds (e.g., Ostrich).
- J.Z. Young called them ‘Masters of Air’.

Limbs

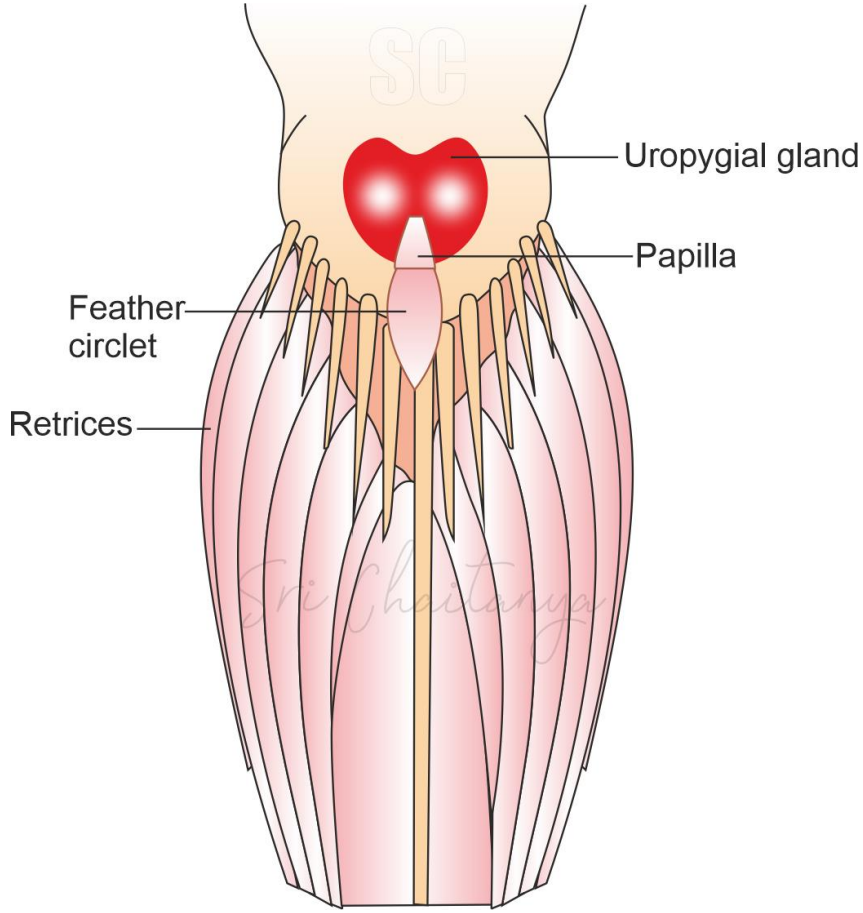
- Hindlimbs bear the whole weight of the animal.
- The hind limbs generally have scales and are modified for walking, swimming or clasping the tree branches.
- Generally, each wing has 3 digits and leg has 4 digits





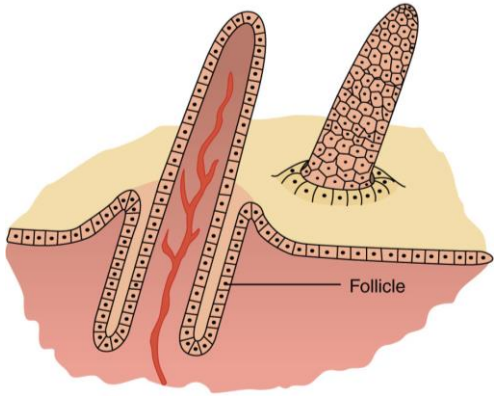
Skin

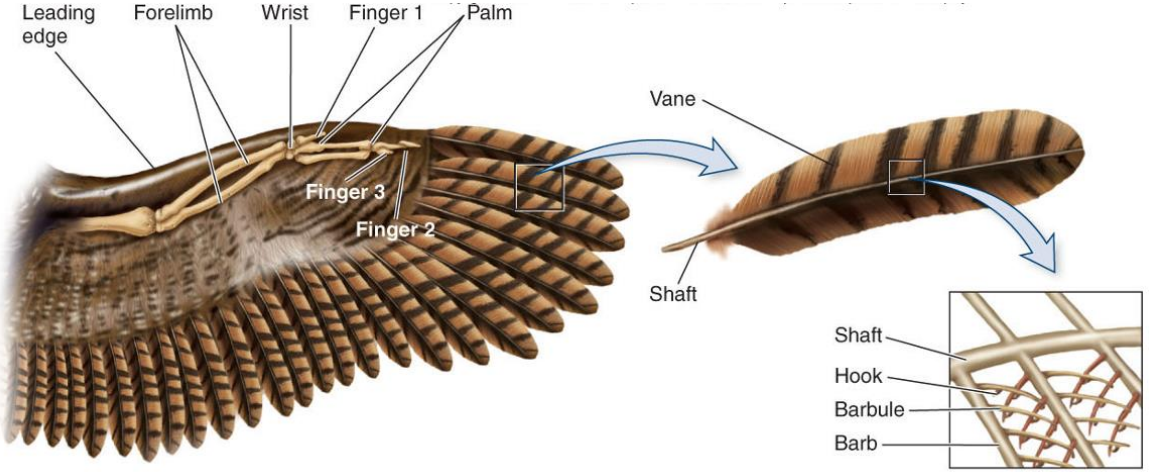
- Skin is dry without glands except the oil gland at the base of the tail.
- Oil gland also called uropygial or preen gland.
- Helps in cleaning, adding sheen and making feathers water-repellant.
- Protects from parasites like lice as well.



Exoskeleton

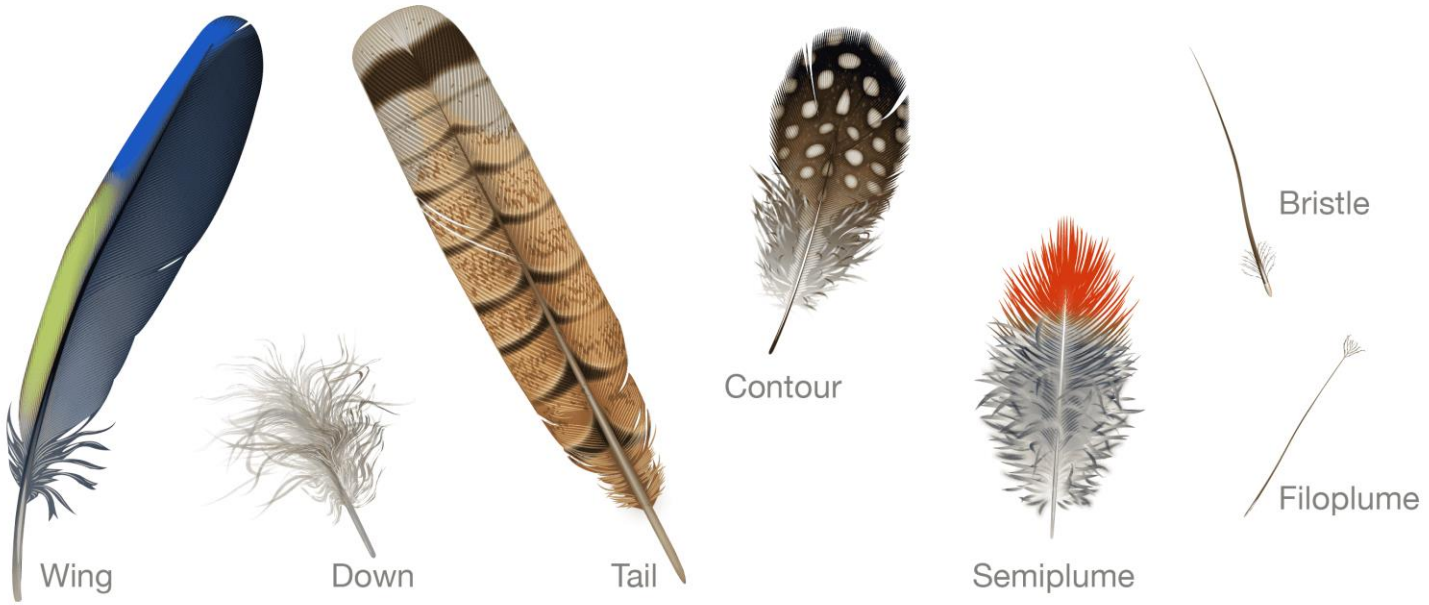
- The characteristic features of Aves (birds) are the presence of feathers
- Most of them can fly except flightless birds (e.g., Ostrich).
- Epidermal feathers
- Scales on legs
- Claws on toes
- Rhamphotheca (horny sheath) on the beak.





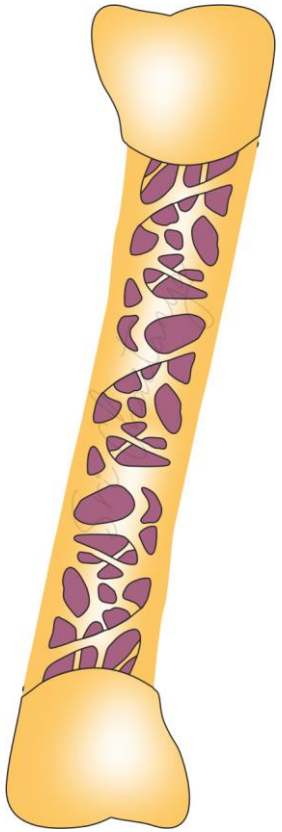
Feathers

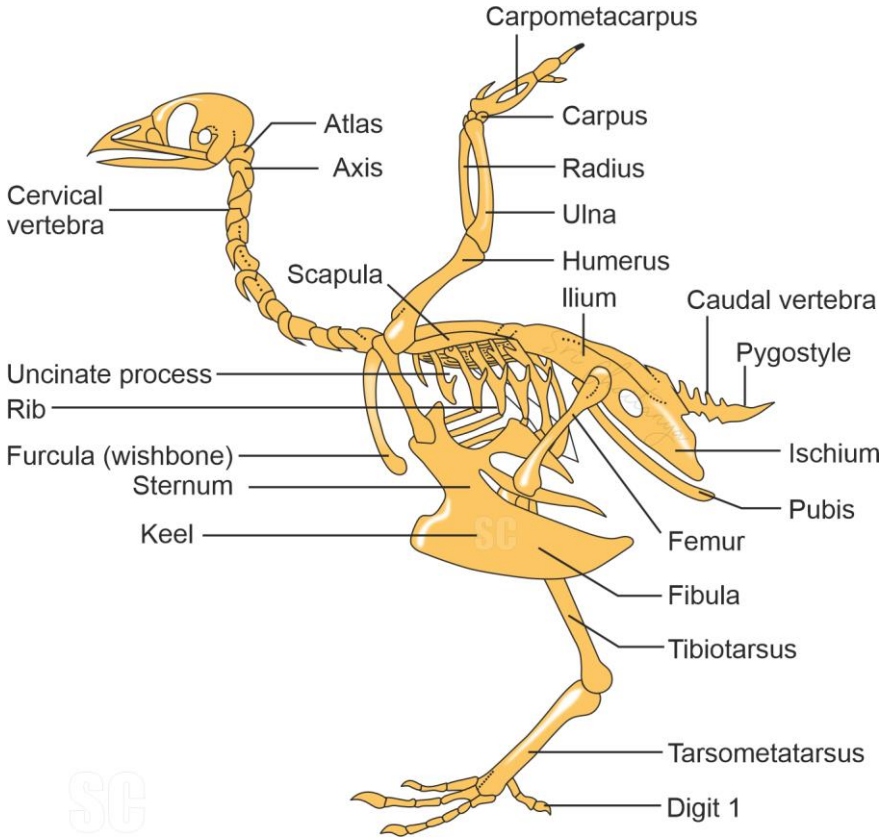
- Functions of feathers:
  - Flight
  - Thermal insulation
  - Body contour
  - Provide coloration
- Types of feathers:
  - Quill feathers (flight)
  - Contour feathers
  - Filoplumes
  - Down feathers (cover the nestlings)



Endoskeleton

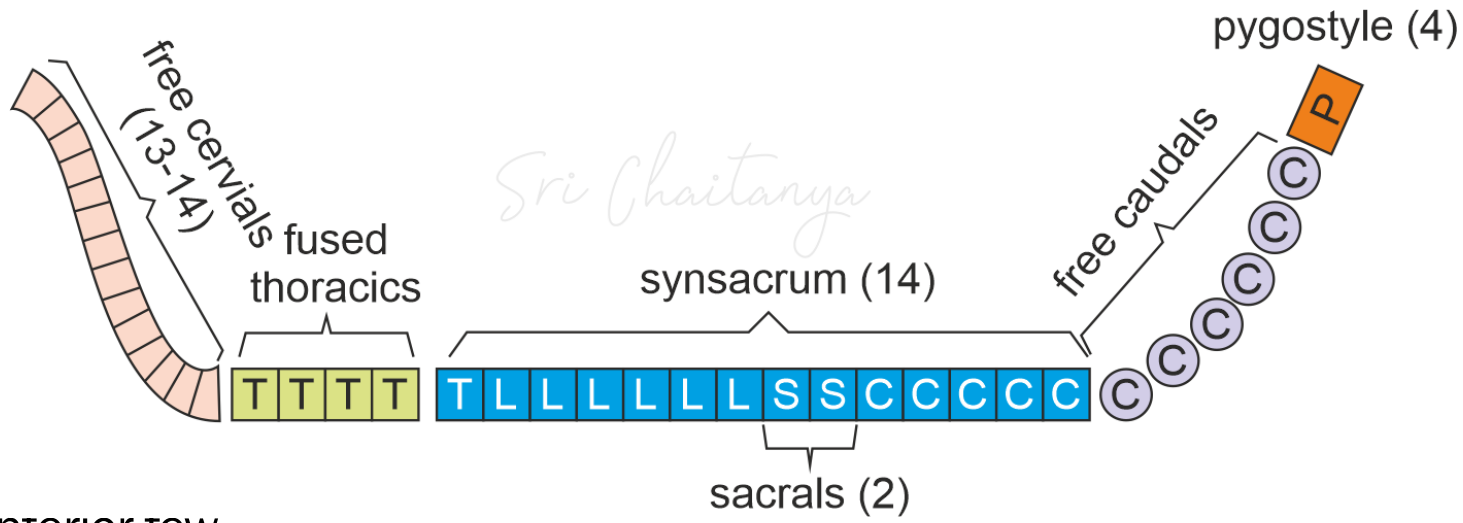
- Endoskeleton is fully ossified (bony)
- Long bones are hollow with air cavities (pneumatic).
- Skull is monocondylic.





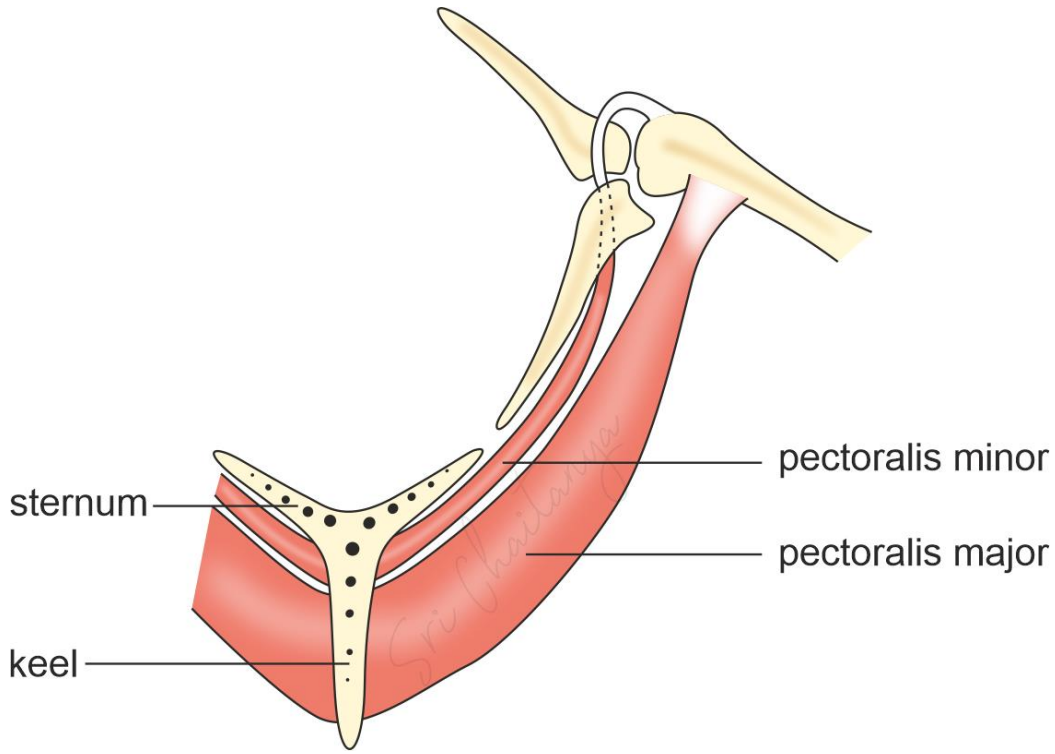
Endoskeleton

- Vertebrae are heterocoelous.
- Regions of Vertebral column:
  - Cervical
  - Thoracic
  - Lumbar
  - Sacral
  - Caudal
- Last thoracic, lumbar, sacral and anterior few caudal vertebrae fuse to form synsacrum.
- Synsacrum is fused with pelvic girdle giving support to hindlimbs.
- Last 3 or 4 caudal vertebrae fuse to form pygostyle that supports tail feathers.



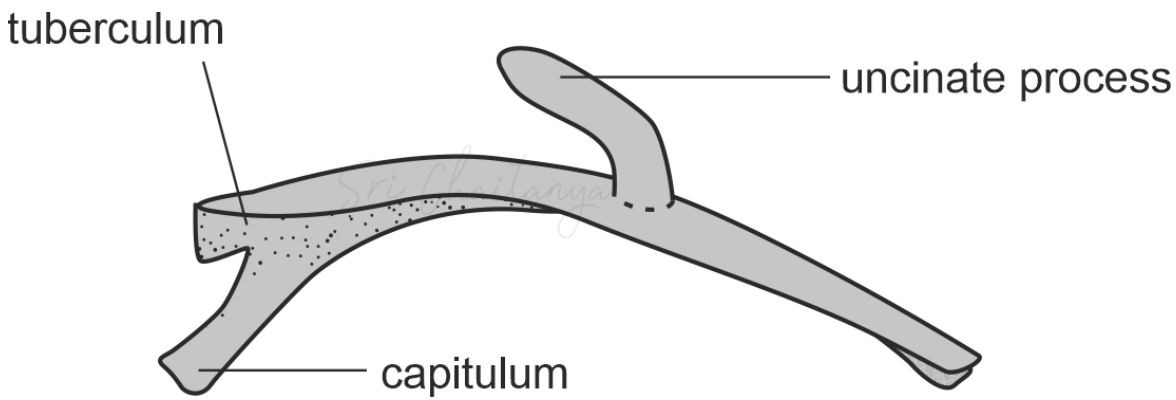
Endoskeleton

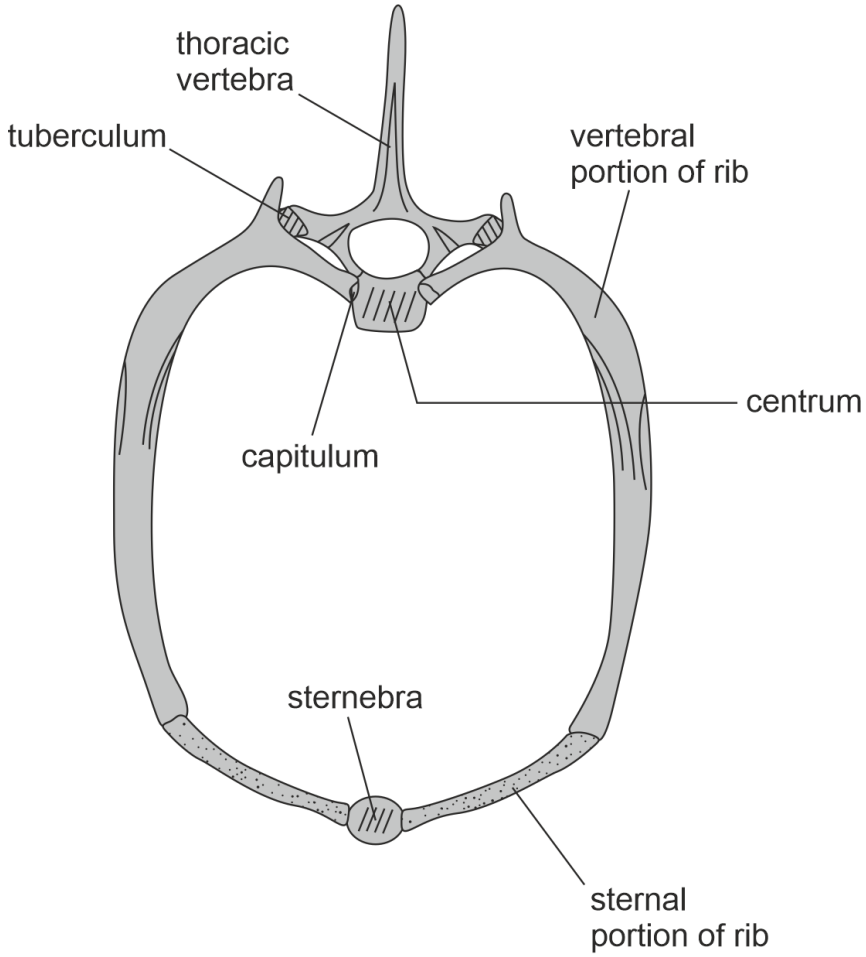
- Sternum is with keel or carina for the attachment of the flight muscles (e.g., pectoralis major and pectoralis minor)



Endoskeleton

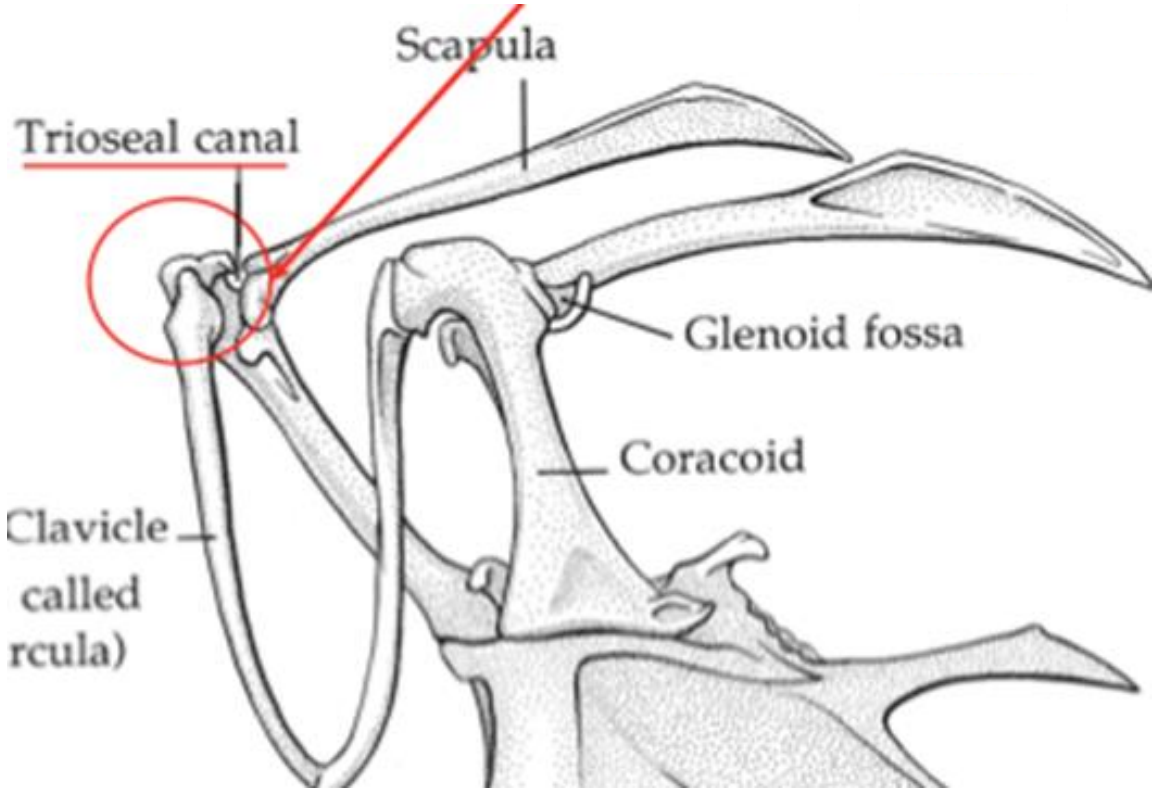
- Ribs are double headed



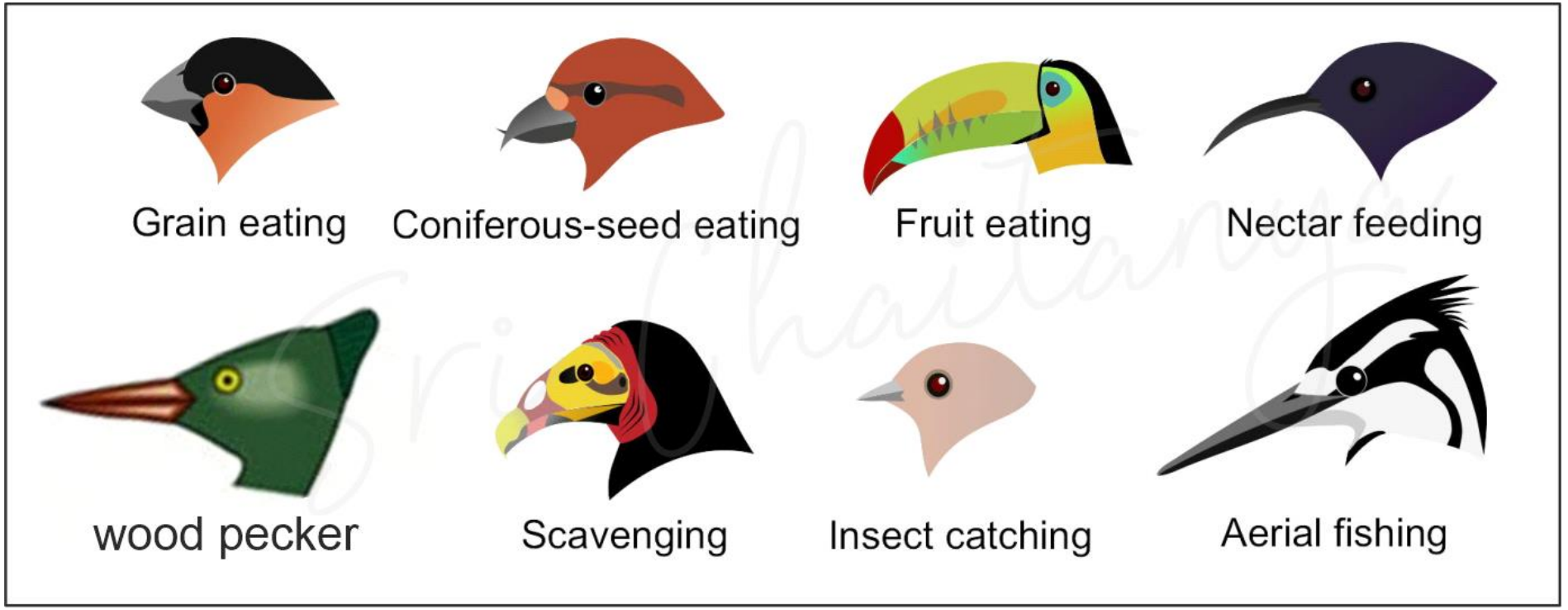


Endoskeleton

- Clavicles unite to form furcula or wishbone or merrythought bone.



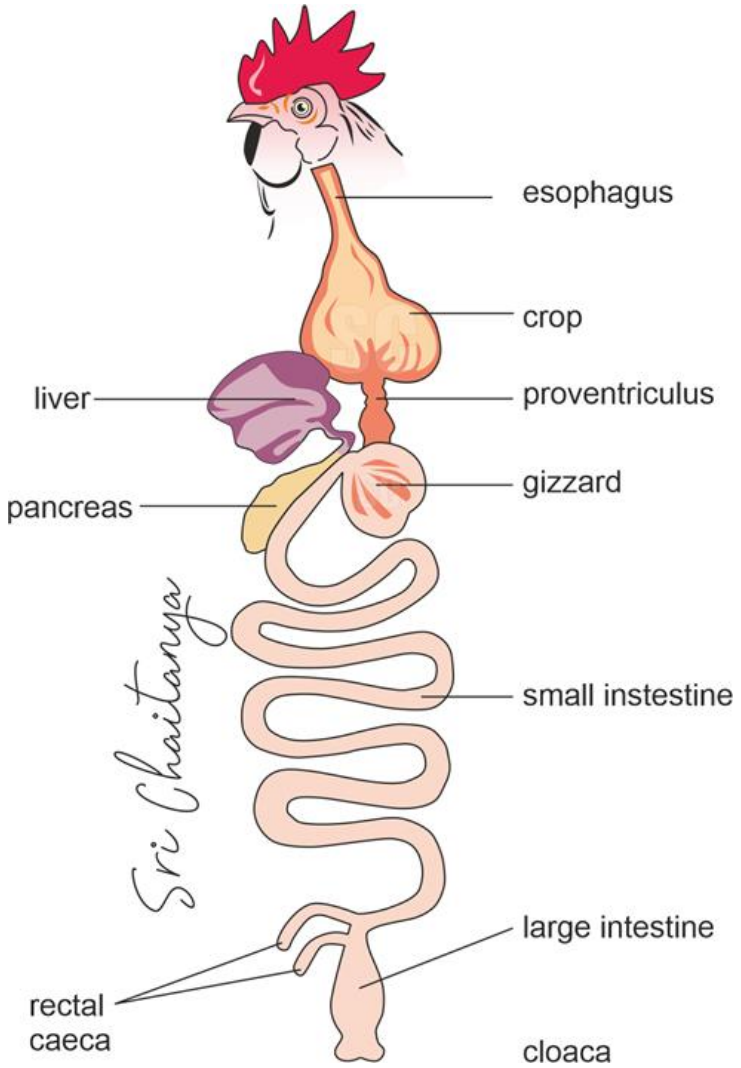
Beak



- Birds possess a beak.
- Beaks are variously adapted for different types of feeding.

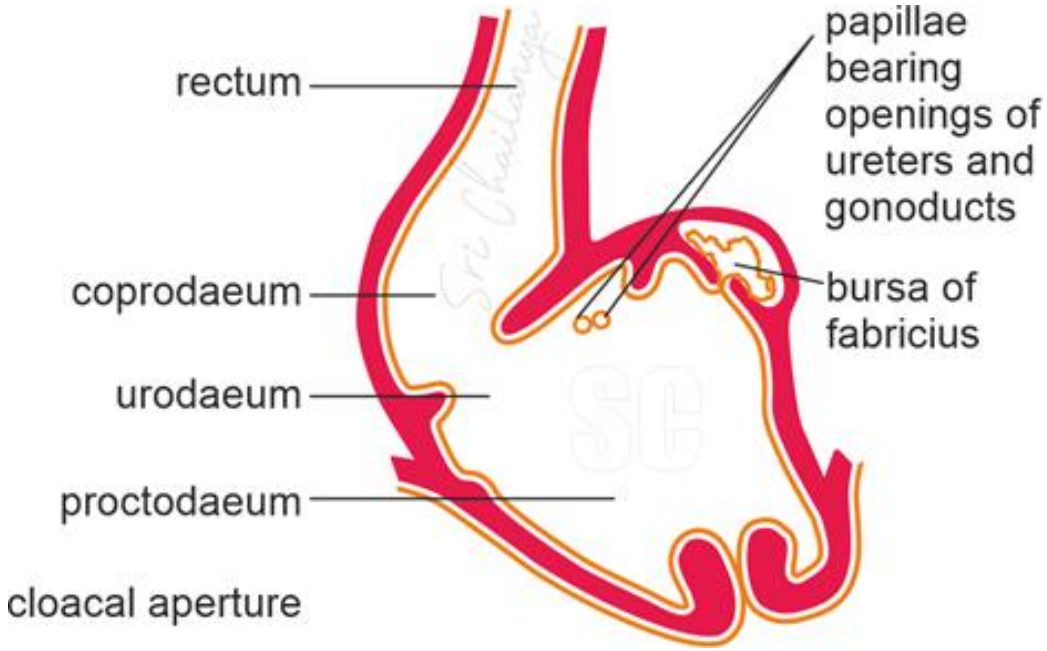
Digestive system

- Teeth are absent.
- The digestive tract of birds has additional chambers, the crop and gizzard.
- Oesophagus is dilated into a crop which stores food.
- Stomach is divided into:
  - a glandular proventriculus
  - a muscular gizzard (grinding mill).
- At junction of small intestine and rectum, a pair of rectal caeca is present.



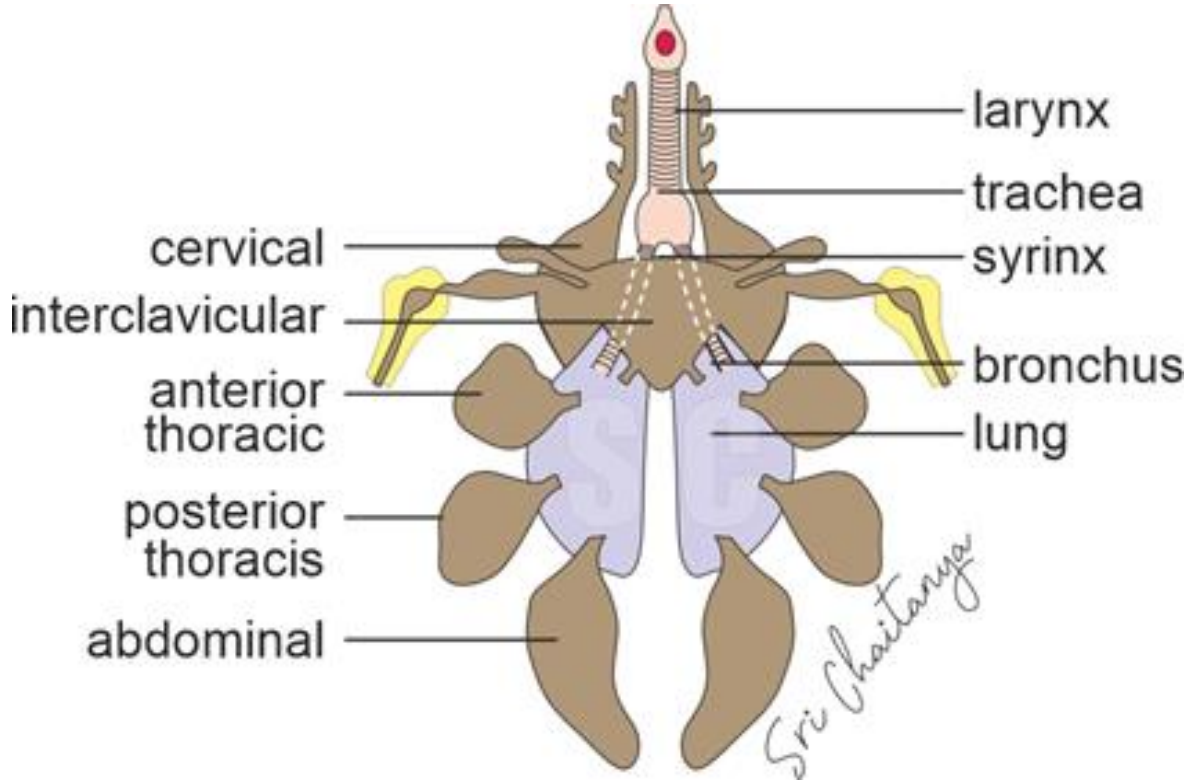
Digestive System

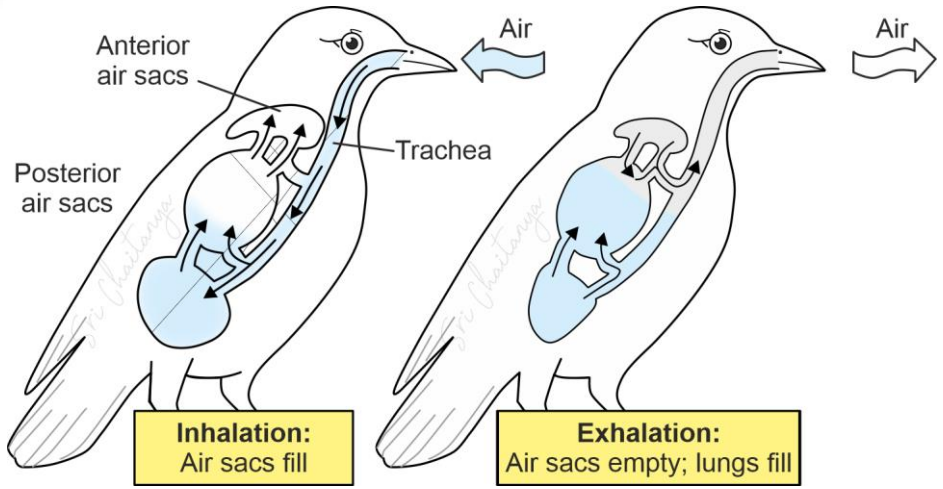
- Cloaca is divided into coprodaeum, urodaeum and proctodaeum.
- A blind sac with lymphoid tissue, the **bursa of Fabricius** (cloacal thymus) opens into proctodaeum.



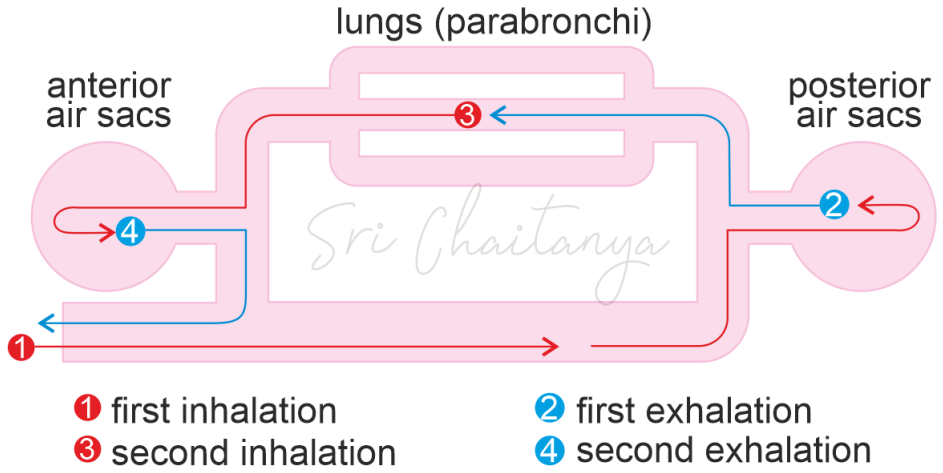
Respiratory system

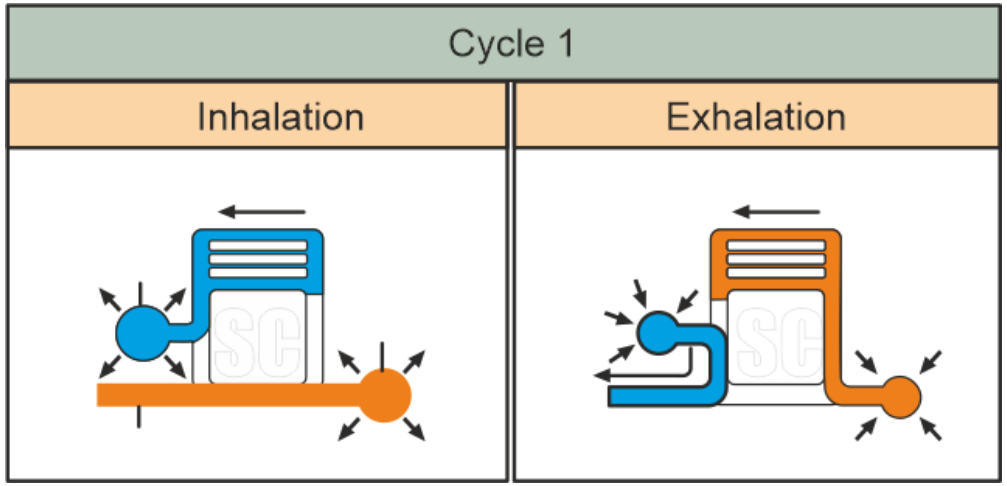
- Respiration is by lungs.
- Air sacs connected to lungs supplement respiration.
- Lungs are spongy and without alveoli.
- Air sacs help in double ventilation and contribute to the pneumaticity of bones.
- Syrinx is the sound producing organ.
- Syrinx is present at the junction of trachea and bronchi.
- Larynx is without vocal cords.

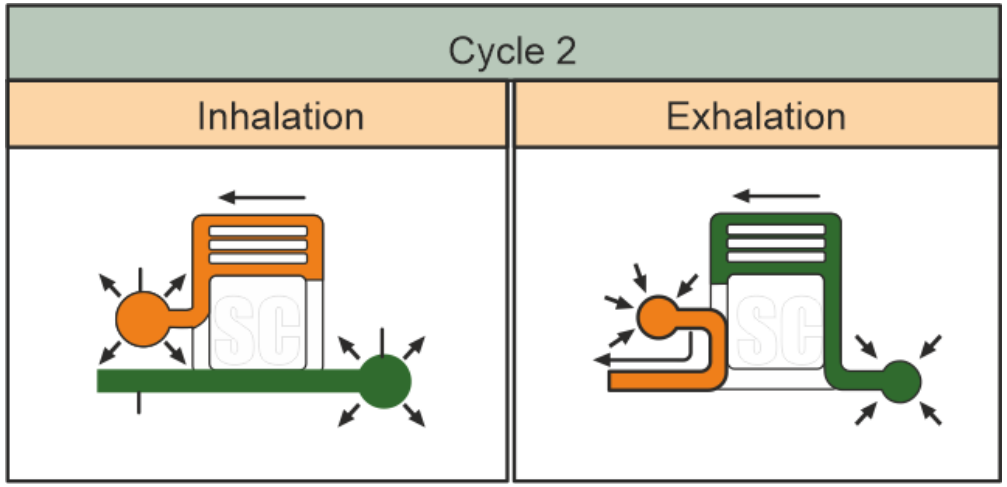




A bird's lungs receive a constant supply of fresh air during both inhalation and exhalation (**double ventilation**).

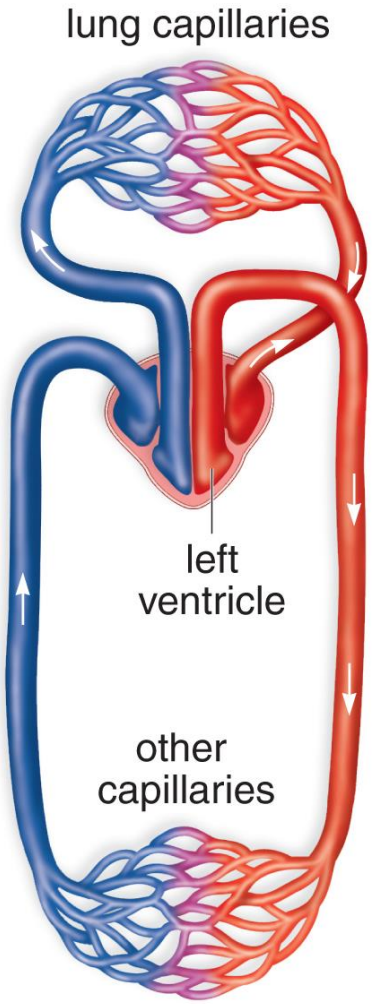






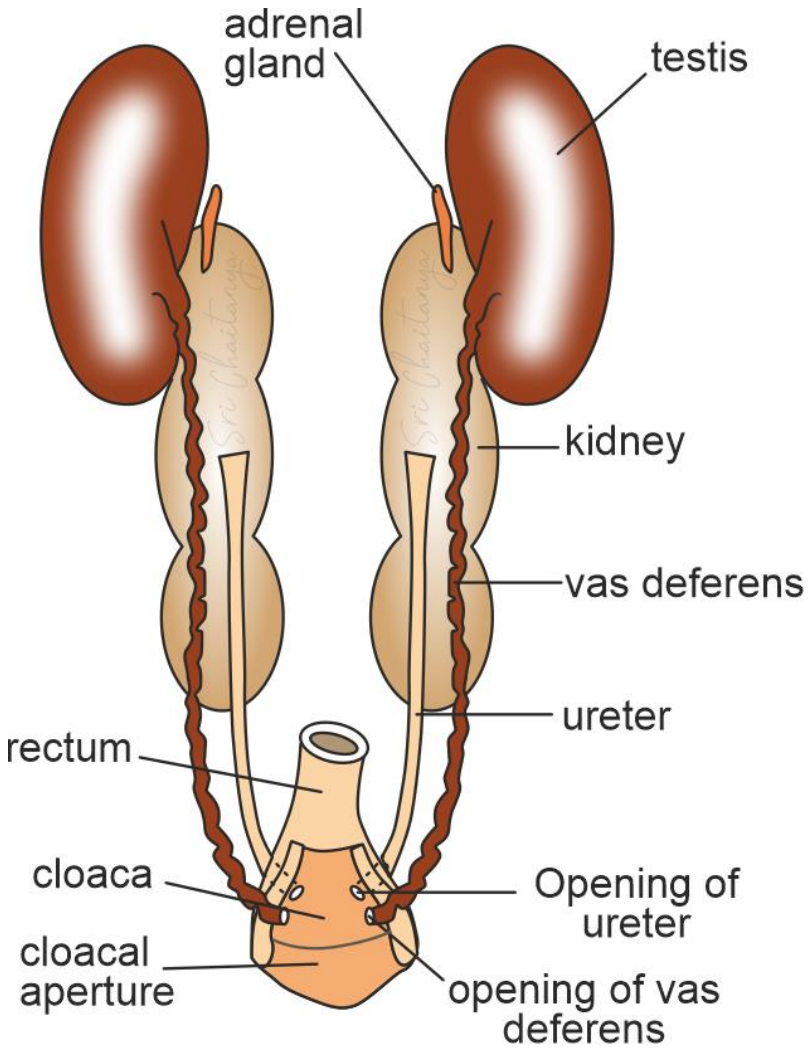
Circulatory system

- Heart is completely four-chambered.
- Two atria and two ventricles.
- Double circulation
- Sinus venosus and conus arteriosus are absent.
- Renal portal system is reduced.
- RBCs are oval and nucleated.
- Birds have maximum number of RBC per unit volume.



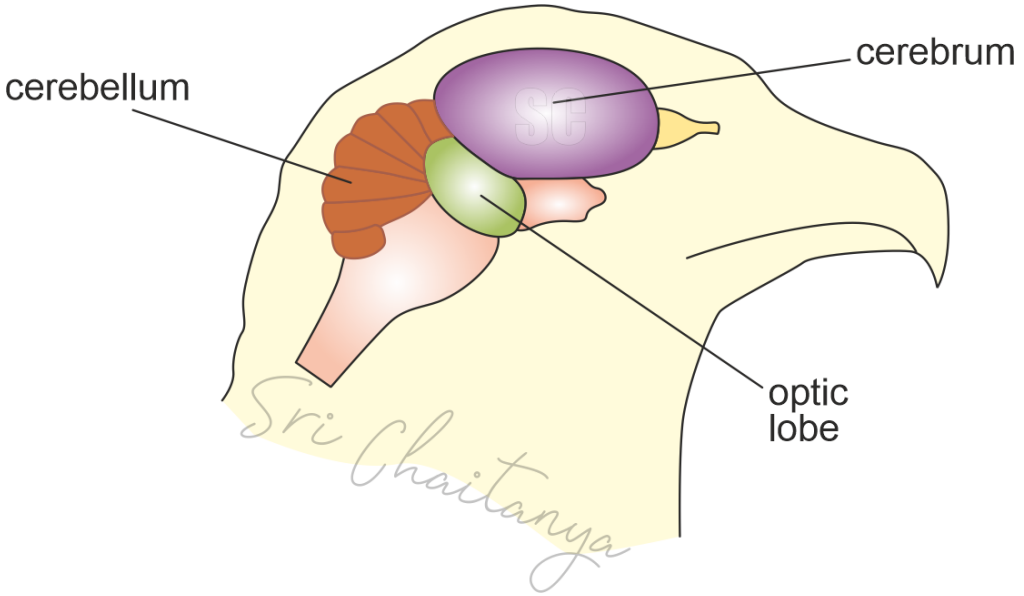
Excretory system

- Functional adult kidneys are metanephros and are three-lobed.
- Urinary bladder is absent (flight adaptation), except in ostrich.
- Aves are uricotelic.



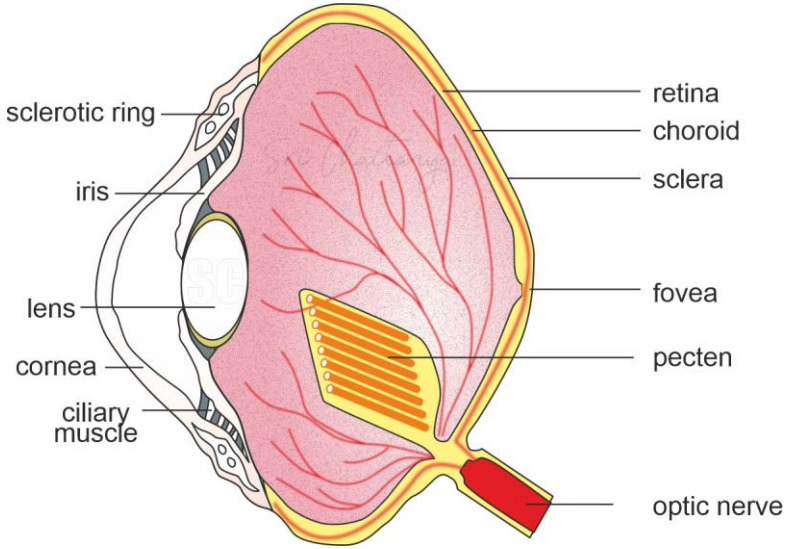
Nervous system

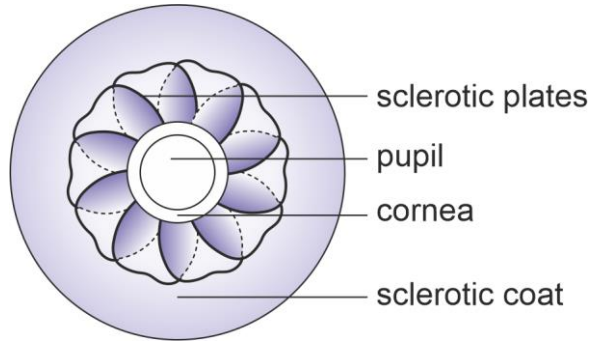
- Brain is large.
- Olfactory lobes are reduced.
- Optic lobes and cerebellum are well-developed.
- Cranial nerves are 12 pairs.



Sense organs

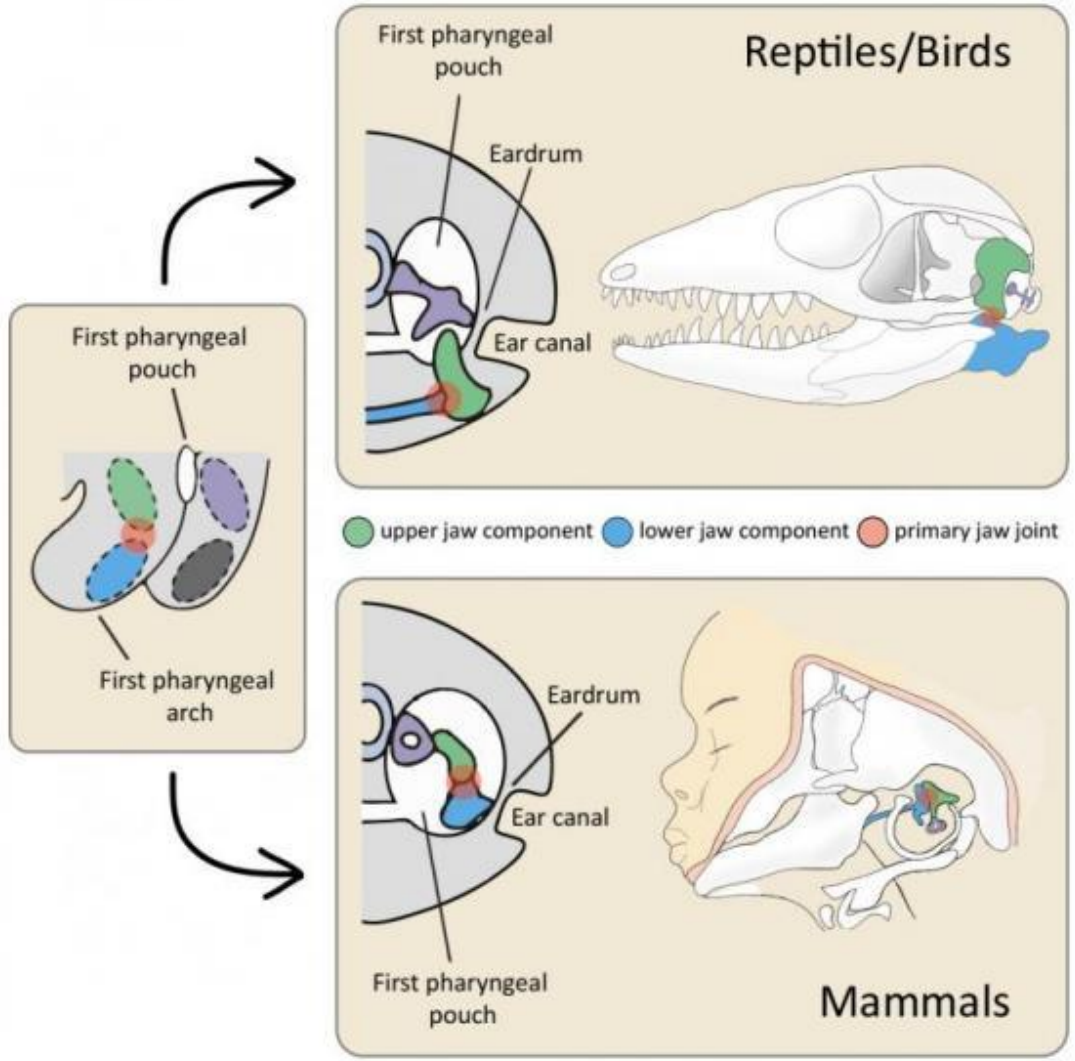
- Olfactory sense is poorly developed in birds, except in kiwi.
- Birds have large eyes and good sense of sight.
- This is required to forage food, prey, landmarks and resting places from a height while flying.
- A comb-shaped vascular **pecten** projects from the retina into the vitreous humour (except in kiwi).
- It probably nourishes the retina and removes metabolic wastes from the vitreous humour.
- Sclerotic plates are found in the sclerotic layer and help to maintain the shape of the eye.





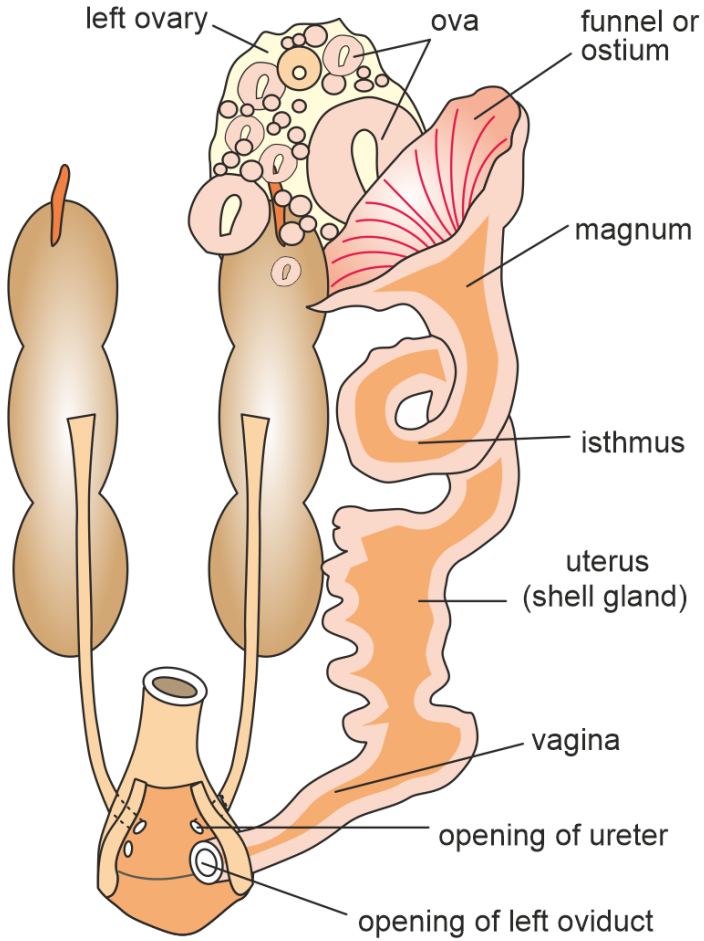
Sense Organs

- Middle ear has a single ossicle, the columella auris.



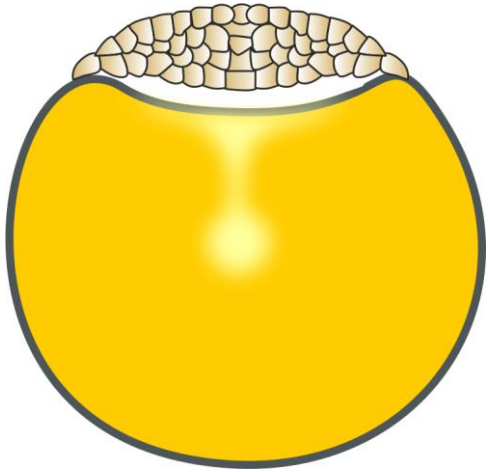
Reproduction

- Sexes are separate.
- Sexual dimorphism well-marked.
- Right ovary and oviduct are atrophied (flight adaptation).
- Fertilisation is internal.
- Copulatory organs are absent except in flightless birds.
- Copulation involves cloacal apposition.
- They are oviparous.



Reproduction

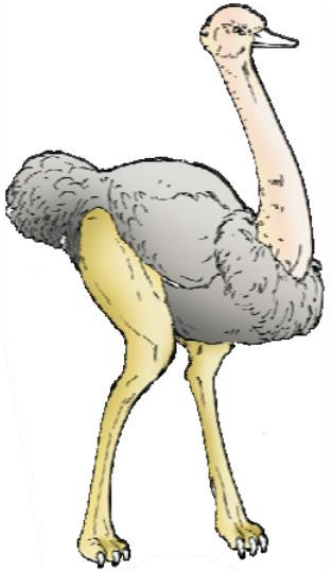
- Eggs are megalecithal, telolecithal and cleidoic.
- Cleavage is meroblastic and discoidal.
- Development is direct.
- Hatchlings of flying birds are **altricial** (dependent on parents)
- Hatchlings of flightless birds are **precocial** (not dependent on parents).



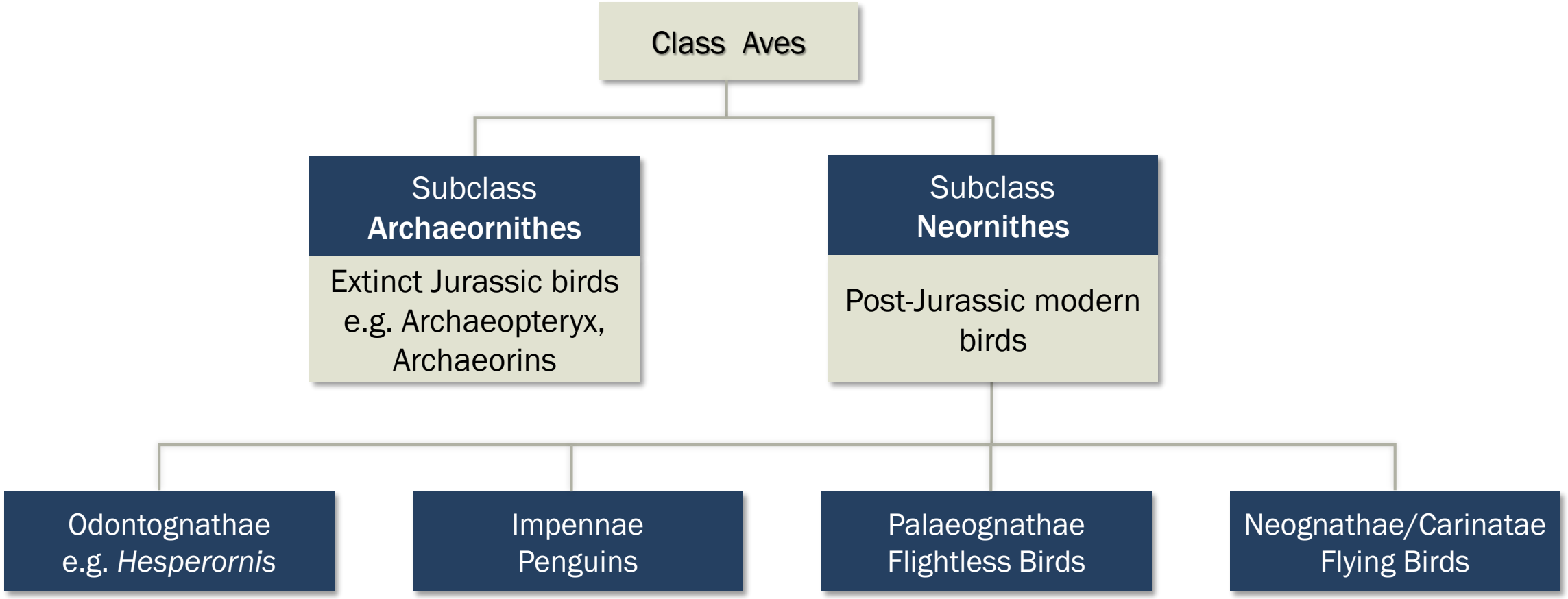
Flight Adaptations in Birds

- Feathers
- Wings
- Flight muscles
- Pneumatic bones
- Enodthermy
- High metabolic rate
- Keen sense of vision
- Absence of urinary bladder

NCERT Examples

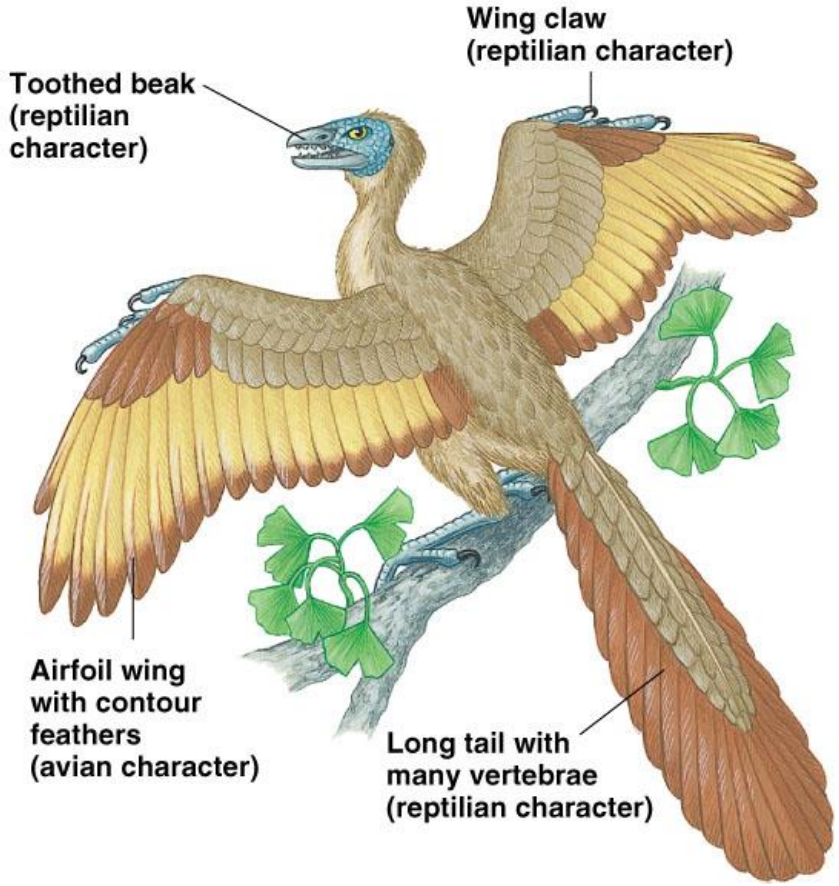


Generic Name	Common Name
Corvus	Crow
Columba	Pigeon
Psittacula	Parrot
Struthio	Ostrich
Pavo	Peacock
Aptenodytes	Penguin
Neophron	Vulture


Class Aves
Subclass
Archaeornithes
Extinct Jurassic birds
e.g. Archaeopteryx,
Archaeorins
Subclass
Neornithes
Post-Jurassic modern
birds
Odontognathae
e.g. Hesperornis
Impennae
Penguins
Palaeognathae
Flightless Birds
Neognathae/Carinatae
Flying Birds

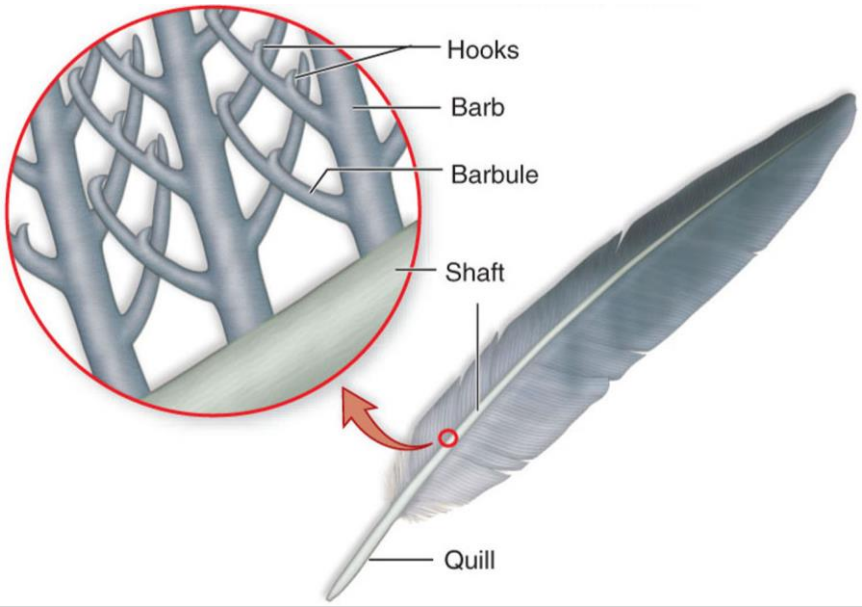
Archaeopteryx

- ***Archaeopteryx lithographica*** is a Jurassic fossil bird.
- It exhibits both reptilian and avian features.
- It is considered **connecting link** between Reptilia and Aves



Flightless Birds Vs Flying Birds

Character	Palaeognathae (Ratitae)	Neognathae (Carinatae)
Common forms	Modern flightless birds	Modern flying birds
Wings	Reduced	Well developed
Interlocking mechanism in feathers	Absent	Present
Preen gland	Absent	Present
Pygostyle	Absent	Present
Sternum	Without keel	With keel
Syrinx	Absent	Present
Penis	Present	Absent
Young ones	Precocial	Usually altricial
Distribution	Discontinuous	Cosmopolitan



Ratitae - Examples

Generic Name	Common Name
Struthio camelus	camel bird
Kiwi, *Rhea*	American ostrich
Dromaeus	Emu
Apteryx	Kiwi

- Kiwi is the national bird of New Zealand.
- It is the smallest flightless bird.

Examples of Flying Birds (superorder Neognathae, or Carinatae)

Generic Name	Common Name
Columba	pigeon
Passer	sparrow
Corvus	crow
Eudynamys	koel
Psittacula	parrot
Bubo	owl
Gallus	Fowl
Pavo cristatus	Peacock
Coracious bengalensis	blue jay
Alcedo	Kingfisher

Examples of Flying Birds (superorder Neognathae, or Carinatae)

- Peacock (*Pavo cristatus*) is the National Bird of India.
- Humming bird is the smallest bird.
- Alpine swift (*Apus melba*) is the fastest flying bird.

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DIGITAL EDUCATION

Thank you