

REPHILIA



- Reptilia wre orginated during **carboniferous** period of palaeozoic era. Mesozoic era is Golden age of Reptile.

- The branch of biology which deals with the sdtudy of reptiels is known as **"Herpetology"**

- Class Reptilia's animals are the **fist suuccessful terrestrial animalss.**

- First reptiles are alled **Stem reptilia** or **Cotylosaurs.**

GENERAL CHARATERS:

- These re, normally, terrestiral animals, but some animals are aquatic in nature, also.
- Body is divided into head, neck, trunk and tail.
- Their sking is **dry, cornified, rough, nonglandular** (Femoral gland in male lizard).
- In these animals, each limb has **five digits.** Each digit has **incurved naials.**
- Some **lizards** and **snakes** do not have limbs .e.g ***Ophiosaurus*** lizard is a limbless lizard.
- Their exoskeleton is made up of horny **epidermal scales** or **bony scales** or **bony plates.**
- A compelte alimentray canal is found in these animals, which opens into cloaca.
- Teeth are **acrodont** and **thecodont pleurodent** type. Tounge is **pprotrusible.**
- Respiration in these animals is by lungs, through out the life, but members of order **Chelonia** can rspire through their coloaca, it is known as **"Cloacal respiration"**
- In these animals, ehart is incompletely four chambered 2 complete auricles and two incomplete
- ventricles. Right and left both systemic arches are present.
- Ventricle of animals of oder **Crocodilia** is completely divided into two, i.e. heart is **four chambered** in **Crocodiles.**

- Sinus venosus is ill developed and trunkus arteri ous is absent. RBCs are **oval** and **nucleated.**
- **Endoskeleton** of these animals is made up of **bones.**
- Only **one occipital** condly is present in skull, this type of skull is caleld **nomocondyl** skull.
- Ribs are present in nech and thorax Ribs of thoracic region make true sternum.
- Centrum of vertebrae are **procoelus** type. Sternum is well developed. **Sternal ribs** are found in reptiles.
- A **chevron bone** is found in caudal vertebae of these animals.
- One pair of **Metanephric** kidneys help in excretion.
- These animals are **uricotelic** for water conservation.
- There are **12 - pairs** of cranial nverces in these animals.
  Brain is well develped.
- Lateral line system is absent. At the rood / ceiling of buccal cavity **Jocobson's organ** (olfactory) is present.
- Genital aperture is not separate from anus. Ureters, genital ducts and alimentray canal open into a **single cloacal aperture.**

- These are unisexual animals. Fertilization is **internal.**
  One or two penis (Hemipenis) is found in male animals as copulatory organ.
- These are mostly **oviparous,** but some animals are viviparous also. Amount of yolk is very much in their eggs, i.e. eggs are **Polylecithal** & **Telolecithal.**

- Eggs are cleidoic, i.e. eggsa re covered by a shell up of $CaCO_3$.
- Cleidoic eggs is an adaptation for terrestrial habitat. Eggs are leathery.

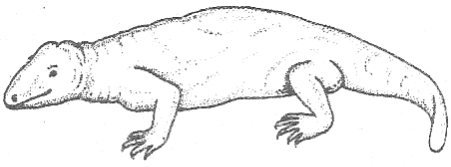
- All the thre embryonic membranes **amnion, chroion** and **allatois** present in the embryo. **Yalksac** is also atached with embryo. So this class is grouped under **Aminota group.**
- Cleavage is **Discoidal, Meroblastic.**
- Developemtn direct i.e. larva stage is absent.
- Parental care is often marked.
- These are **Cold blooded, Poikilothermal animals.** Their body temperature varies according to climate.
- Class Reptillia is classfied on teh basis of presence of absence of **temporal fossae** in the temproral reion of skull and on their number.
  Class reptilia is divided into following Major Five sub-classes :
  (1) Anapsida
  (2) Eurypsida
  (3) Parapsida } Extinct
  (4) Synapsida
  (5) Diapsida

Subclass - Anapsida

- Temproral fossae are absent int he temporal region of the skull i.e. roof of skull is compelte.
- Limb are strong.

(1) Order - Cotylosauria
e.g. ***Seymouria :*** Connecting link between Amphibia and Reptilia.

(2) Order - Chelonia

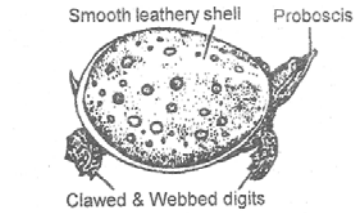


A cotylosaurus Seymouria
(First / Stem reptile)

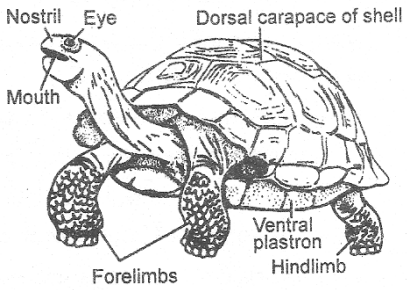
- Body is broad and oval.
- They are terrestrial, marine and fresh water animals.
- This order includes live and extinct both the animals.
- Whole body is covered by firm bony shell. Exoskeleton of dorsal region of body is caleld **carapace** and skeleton of vetnral region of body is caleld **plastron.**
- Jaws are horny and **teeth less, beak like** jaws are found.
- **Sternum** is absent.
  Bony plate present on the body are caleld **osteoderms.**
- Nails are found on digits. Web or membrane is found in the diits for swimming.
- Scales are found on **neck, limbs** and **tail.**
  All these three organs can be pushed into the **carapace.**
- Thoracic vertebrae and ribs are attached with carapace.
- Cloacal aperture is vertical and it helps in respiration.
- **Single** compulatory organ is found in male animal.
- Animals are **oviparous.**

e.g.

- ***Testudo*** - Land tortoise
- ***Triyonyx*** - Fresh water terrapins (edible)
- ***Chelone*** - Marine (tortoises) turbles
- ***Kachhuga tactum***



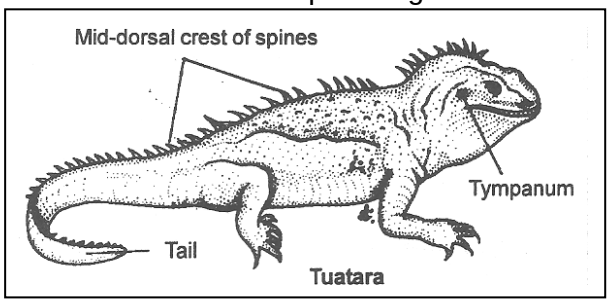
Soft shelled turtle (Trionyx spiniferus)



Galapagos Giant tortoise
(Testudo abingdoni)

Sub-class Diapsida

- One pair superior and one pari inferior temproral fossea are found int eh temporal region of skull.
  Subblas Diapsida is divided into two super orders :
  (1) Lepidosauria
  (2) Archosauria



(1) Super order Lepidosauria :

This super order is divided into two oders.

(1) Order - Thynchocephalia

- Most of the speices of tthis order are found int eh form of fossils.
- Only **Sphenodon punctatum** species is live only. It is found in New Zealand.
- Body is small and lizard like. Tail is compressed laterally.
- Limbs are pentadactyl and digits are with nails.
- A functional **thrid eye** or **pinal** or **parietal eye** is found int eh head.
- Vertabrae are **amphicoelous** type.
- Teeth are **acrodont** type.
- Penis or copulatory organ is absent in male animals
- Long living ~ 100 years

e.g. **Sphenodon punctatum -** *Tuatara* (**living fossil**) It is found only **Newzealand.**

(2) Order - Squamata :'

- Largest number of species of reptiles is found in this order in modern era. All the lizards & snakes are included in this order.

- One or two pairs of temporal fose are found in temporal regioin of skull, which disappear afer sometimes.

- Limbs clawed, Limibs are absent in snakes and some of the lizards.

- Horny scales are found on body, i.e. their exoskeleton in made up of horny paltes.

- Vertebrae are procoelus type.

- Teeth are pleurodont, i.e. tooth is situated at lateral side of jaw hone.

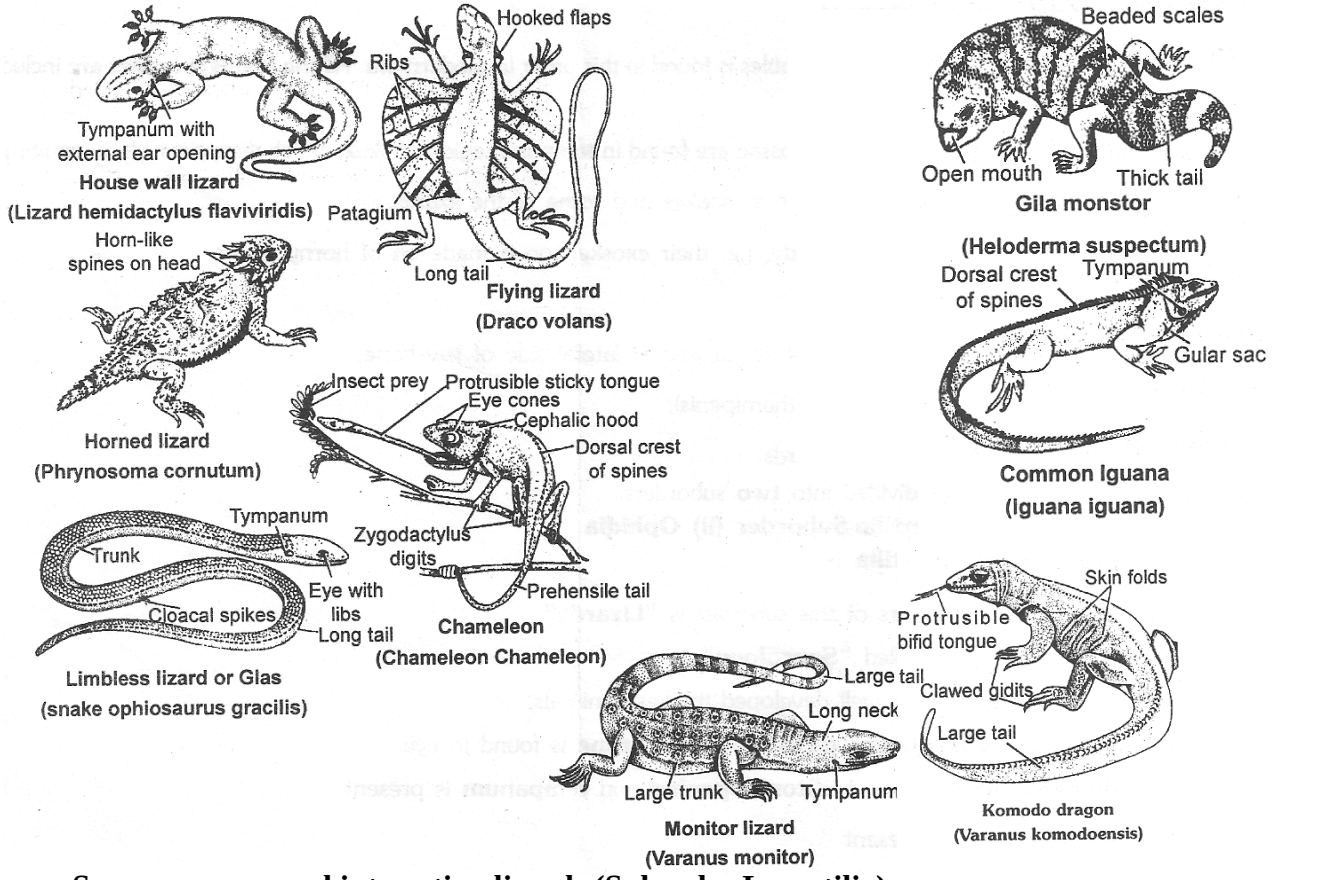
- Copulatory organs are paired (hemopenis).

- Autotomy phenomenon in lizards
  Order squamata is divied into **two** suborders
  Suborder (i) Lacertilia Suborder (ii) Ophidia
  Suborder (i) Lacertilia :

- Normally the members of this suborder is **"Lizards"**
- Study of lizarda is caleld **"Saurology '**
- Limgs and girdles are well developed i nt hese animals.
- Eyelids are **movable** and **nictitating membrane** is found in eye.
- **Auditory aperture or auditory opening** and **Tympanum** is present
- Urinary bladder is present
- **Foramen of penizzae** is present in the heart of lizard.

e.g.

- ***Hemidacylus*** - Common lizard, **wall lizard.** It can shed its onwn tail at the time of emergency. it is called **autotomy.** Power of regneration is well makred.
- ***Calotes*** - Blood sucker, Garden lizard Girgit. It can change its colour according to environment.
- ***Draco*** - Rlying lizards. Its body skin expands in the form of 2 wings or **patagia.** With the help of these patagia, it can glide from one tree to another tree or its branches. It van not fly.
- ***Chameleon*** - Arborial lizard (Viviparous) (Girgit)
- ***Varanus*** - Goh, Monotor lizard. ***Varanus komodensis-*** Ferocious Drgon - ***Largest living lizard***
- ***Ophioaurus*** - It is **limbless lizard.** It is also caleld **glass - snake.**
- ***Anguis*** - limbles liazard
- ***Burkudia*** - LImbless lizard found in south India.
- ***Heloderma*** - Gila - monster, Hela moster. It is the **only poisonous lizard**. Its poison glands are modified sublingual glands (Maxico & USA).
- ***Mabuya*** - Viviparous lizard.
- ***Phyrosoma*** - Horned toad (viviparous)
- ***Amblyrhynchus*** - Marine lizard
- ***Uromastix*** - Sand lizards or Sanda



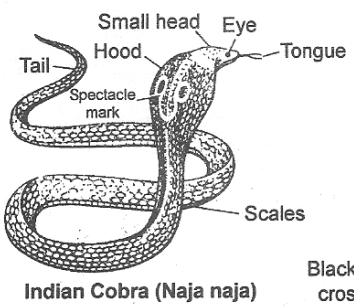
Some common and interesting lizards (Suborder Lacertilia)

Suborder (ii) Ophidia :

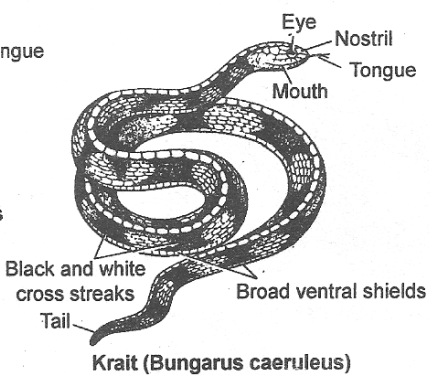
- Members of this suborder are nomarlly caleld **"Snakes"**
- The study of snakes is calel **ophiology** or **serpantology.**
- Body long, thin, smooth and limbless.
- Eyelids are immovable and nicitiating membrane in eye are absent.
- Girdles, sternum and urinary bladder **asbent.**
- **Auditory opening** and **tympanum** absent. No middle ear.
- Tongue thin, long and **bifid** and sensitive to odour and vibration
- Left lung is ill developed.
- Leathery ashell is found on egg of Snakes.

e.g.

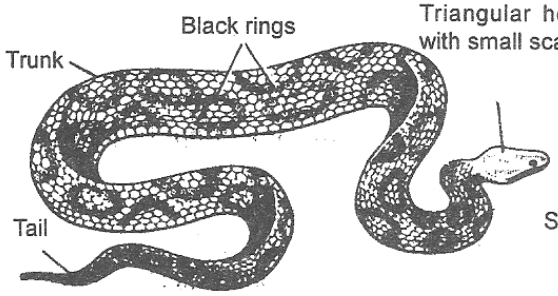
- ***Phyton molurus*** - Azgar. It is the **largest snake,** its lenght is about 25 feet. Radiments of hind limgs are found on the body. It is **non-poisonuous** snake.
- ***Ptyas muscosus*** - **Zamenis** or Rat snake. It is commoly caleld **Dhaman.** It feeds on rats, so it is also caleld "Friend of farmers". It is a **non-poisonous** snake.
- ***Eryx Johni*** - Sand boa. It is also caleld Dumuhi snake. It is a non-poisonuous snake.
- ***Typhlopos*** - Blind snake. Non poisonous.
- ***Hydrophis*** - Marine snake. It is a **deadly poisonuous snake.** Its tail is laterally compressed. It is a viviparous snake.
- ***Enhydrina*** - Sea snake
- ***Naja*** - **Indian cobra**. Poisonous snake. Its poision is **neurotoxic.**
- ***Naja bungarus*** - King cobra, poisonous snake. It is the largent snake among poisonous snakes or ***N.Hannah*** *(Head with one or two circular mark)*
- **Bangarus** - *Krait :* Poisonous (neurotoxic) snake
- ***Vipera*** - Viper snake : Head id diffentiated from body. Poisonous snake (viviparous). Its venom is **haemotoxic/Cardiotox. Loreal pit** is found which is a **thermoreceptor.** Largest viper is Russel viper (V mark on head).
- ***Micrurus*** - Coral snake.
- ***Crotalus*** - Rattle snake : It produces a characteristi rattile sound of "Rate - rat – rate", so it is caleld **rattle snake.** It is poisonous and ovoviviparous snake.



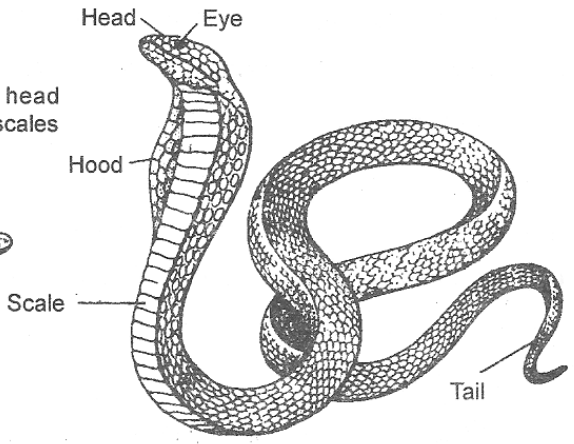
Indian Cobra (Naja naja)



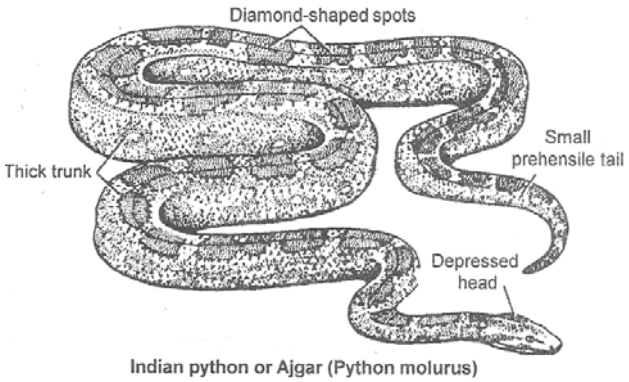
Krait (Bungarus caeruleus)



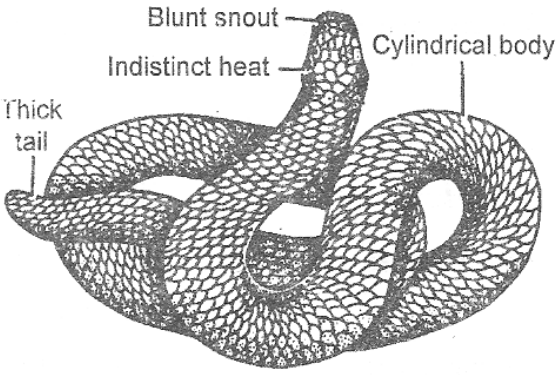
Indian pitless or Russel's (Vipera russelli)



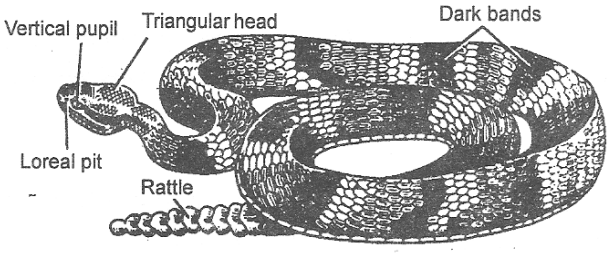
King cobra or Hamadryad (Naja hannah)



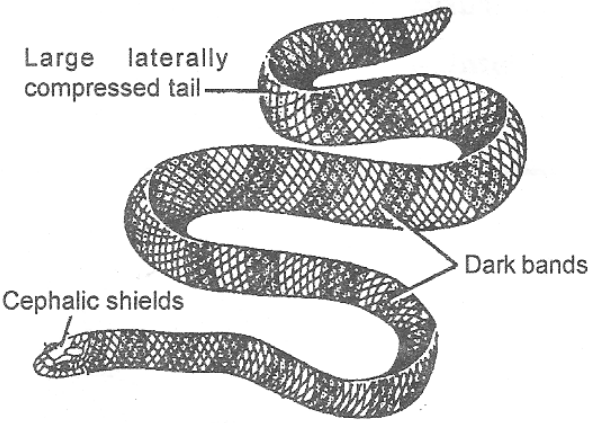
Indian python or Ajgar (Python molurus)



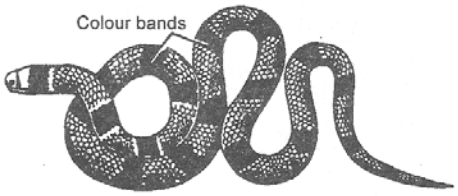
Sand boa or Double headed snake
(Eryx johnii)



Rattle snake (Crotalus horridus)



Sea snake (Hydrophis)



Coral snake (Micrurus fulvius)

Characteristic features of poisonous snakes :

- Smalle scales are found on head or hood.
- Laterally comporessed tail is present in marine snake.
- Vertrally placed scales of the body are board.
  Two teetch mark is ot poisonous snake. (V-shaped - Non posionous)
- Poison glans of poisonous snakes are modified **labial glands.** Probably these glands are homologous to paroiid salivary glands of Mammals.
- Poisonous teeth (fungs) ae modified maxillary teetch.
- Treatment of poisonous snake bite is done by **Antivenom dose. Antivenom** is produced at

(1) Cenral Research Institute Karusuali - Shimla

(2) Hoffking Institute, Mumai
Bisset **Serpentorium** is located in India - **Chennia**

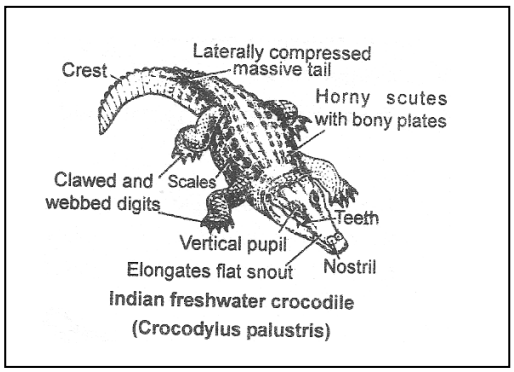
(2) Super order - Archosaurea

This super order is classified into

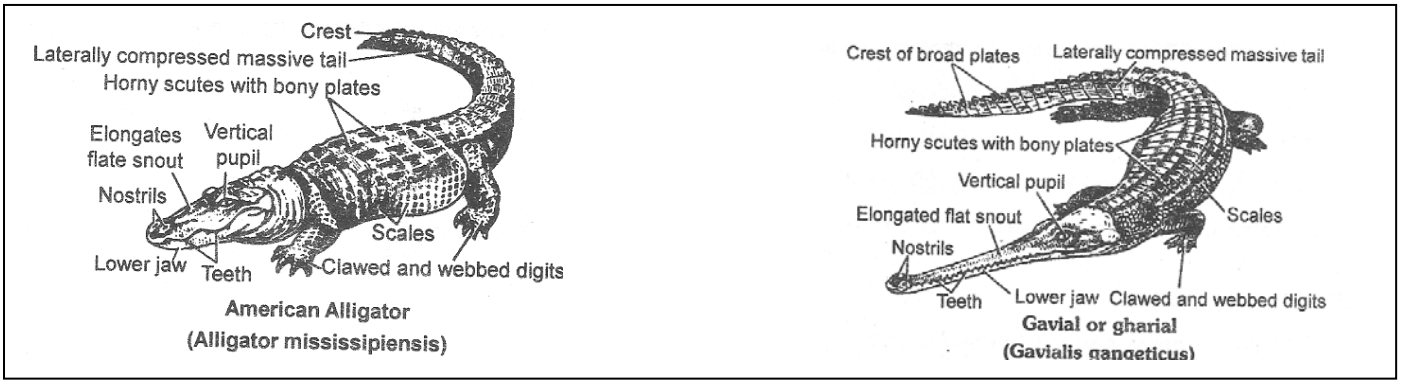
(1) Order - Crocodilia or Loricaa

(2) Order -Saurischia

Order - Crocodilia or **Loricata**



- Crocodiles, alligator etc. are included in this order.
- These are amphibious in nature these live is lakes or rivers.
- These are **largest modern reptiles.**
- Skin is covered by lines of **bony scutes.**
- Body is solid and massive.
- Snout is long. External nares are situated at the distal end of snout and nares have cover also.
- Diaphragm is present in between thoras and abdoman.
- Sternum and addiminal ribs are present.



- **Spicial features :**
  - Heart is completely four chambered
  - Ventricle is completely divided into two chambers.
  - Teeth are thecodont type.

- Urinary bladder **absent.**
- A median erectile grooved penis is present in male animals

e.g.

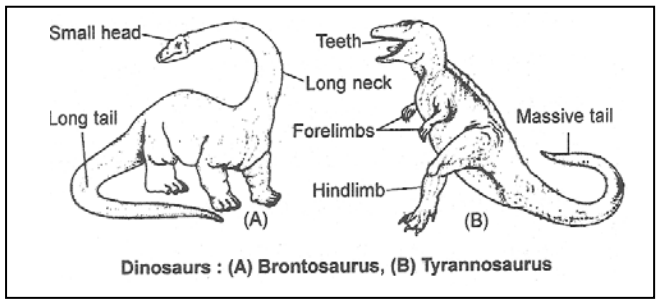
- ***Crocodilus / Crocodilus (Crocodile)*** - It is only found in Indian subcontinent.
- **Gavialius -** Gharial. Snouth very long.
- ***Alligator -*** Maxican crocodile.

Order - Saurischia

- The meaning of Danosours is danger or terrible lizard.
- Order of reptilian **Dinosours** (fossils)
- Origin of Dinosours in Triassic period of Mesozoic era. Extinct in Cretaceous period of Mesozoic era.

e.g.

- ***Brontosaurus -*** Thunder lizard. Largest Dinosoures (Herbivorous)
- ***Stegosaurus***
- ***Tyrannosaurus -*** Tyrant lizard. King of Dinosours



Dinosaurs : (A) Brontosaurus, (B) Tyrannosaurus

REVIEW

Reptillia (reptiles) : Dry scaly waterproof skin, digits of all the four limbs aremed with claws, well developed lungs for air breathing, imcompletely 4-chambered heart in most cases, males with copulatory organs eggs amnoitic and laid on land, fertiliazation internal, no larval stage.



CLASS - AVES



- Birds are orginated at the end of **Jursassic period** of Mesozoa era & modernisation in **cretaceaous**
- Study of birds is knowsn as **"Ornithology"**
- **Dr. Salim Ali** was the great ornithologits of India and known as **"Birdman of India"**
- Study of bird's egg is known as **Oology.**
- Study of birds' Nest is known as **Nidology.**
- Birds are glorified reptiles stated by **Huxley.**
- Arrangement of wings on the body of bird is known as **Pterylosis.**

MAIN CHARACTERS:

- All types of **birds** are included in this class.
- Body is boat shaped. It is divided into **head, neck, trunk** and **tail.** Neck is **long** and **flexible.**
- A cover of soft feathers (derivative of stratum corneum) is present all voer the body of all the birds that is called **"plumage"**
- Scales are found only on **hind limbs.**

- Skin is dry and without glands. But oil glands or **Preen glands** are found on tial or **Uropygium.** These glands secrete oil, which softens and makes greasy to the feathers.

- Two pairs of limbs are present.
  Forelimbs (with three digits) are modified into wings, which help in flying and in conserving heat.
  Four clawed didigts are found on hind limbs these are best adapted for siting on branches of treen for perching for walking on land, or for swimming in water. Birds are feathered bipeds.

- **Oesophagus** is modified into **Crop** for quick food ingestio and storage and **Gizzards** for crushing the food is swallowed unmastigated. **Pigeon milk** is secreted by **both sexes** (Crop product). Gall bladder is absent.

- A three chambered **cloaca** is present in the birds.
- Teeth are absent in jaws. Jaws are modified into horny beak. Beak os toothless. An epidermal horney sheath is present on beak, whcih is caleld **Tamphoteca.**

- Spongy lungs are present for repiration Air sacs are also found, these help in flying.
- Sound producing organs at the jucutin of trachea and bronchi of bird is called **syrinx.**
- Hear is four **chambered.**
- Hepatic portal system is well deeloped in birds, but renal portal system is ill developed. Sinus venosus is absent. Only Right aortic arch persist.

- R.B.Cs are **nucleated.**
- Endoskeleton is **bony.** These bones are hollow, in which is fileld, these bones are caleld **pneumatic bones.** These make the body light in weight and help in flying.

- A single occipital condly is found in skull i.e. birds are **monocondylic.**
- Centrum of the vertebra is **heterocoelus.**
- Some vertebrae of the posterior body portion joint together to form **synsacrum**
- Last four caudal vartebrae fuse to form **phygostyle.**
- Sternum is large. Swollen basal par tof sternu m is called **“Keel”** This keel offers a joint plane for **fling muscles.**

- Keel is highly developed in flying birds.
- Ribs of birds are **bifid** nd **unicinate processes** are present in ribs.
- Exoskeleton is in the form of soft **feathers** all over the body (except hind limgs)
- **Foramen of triosseus** is found in tehir pectoral girdle.
- Two bones, **clavicle and interclavicle** fuse to form **V - shaped furcula.**
- **Furcula** is also known s **Wish bone** or **Merry through bone.** Which Act as a spring between two girdles.

- Furcula is **absent** in flight less birds.
- Kidneys **metanephric** (Trilobbed). Ureters open into **cloaca.**
  Member of class Aves are always **Uricotelic.**
  Uric acid is a semisolid substance. Excreta of mrine birds is known as **guano.**

- Most of the birds do not have **urinary bladder** and **coupulatory organ.**
- Brain is large, smoth, highly developed. Cerebellum is well developed for aerial mode of life.

- Cranial nerves are **12 - Pairs.**

- The skin around the nostrils is sensory in birds, that is caleld **“Cere”**

- **Eyes** are large and well develped which are surrounded by rigns made up of bony plates known as **Sclerotic ossicles.**

- Eyes are large and **nictitating membrane** is presen in eye. Vision is **monocular.**
- A specific bomb like strucutre **Pecten** is found in the eyes of all birds except kiwi's eyes. Pecten helps in accomodation of eye and provides nutrition to eye balls. It also controls the pressure of liquid presnet in eye **Acutie vision** and **Telescopic vision** of birds is due to pecten.

- External ears are present but ear pinnae are absent. **Columella bone** (Stapes) (one ossicle) is found in middle ear. Cochlea (not coiled) is present in internal eart.

- Olfactory organs are less - developed.
- Birds are **monodelphic** i.e. only left ovary and left oviduct is functional in females. Birds are vovparous vertebrates.

- Birds are **unisexual. Sexual dimorphism** is well makred. Copulatory organ absent in males.
- Fertiliztion is **internal.**
- They are egg lying i.e. **oviparous.**

- Eggs are **lare, megalecithal, telolecithal** and **cleidoic.** Shell is perforated. Celavage is **meroblastic** and **discoidal.**

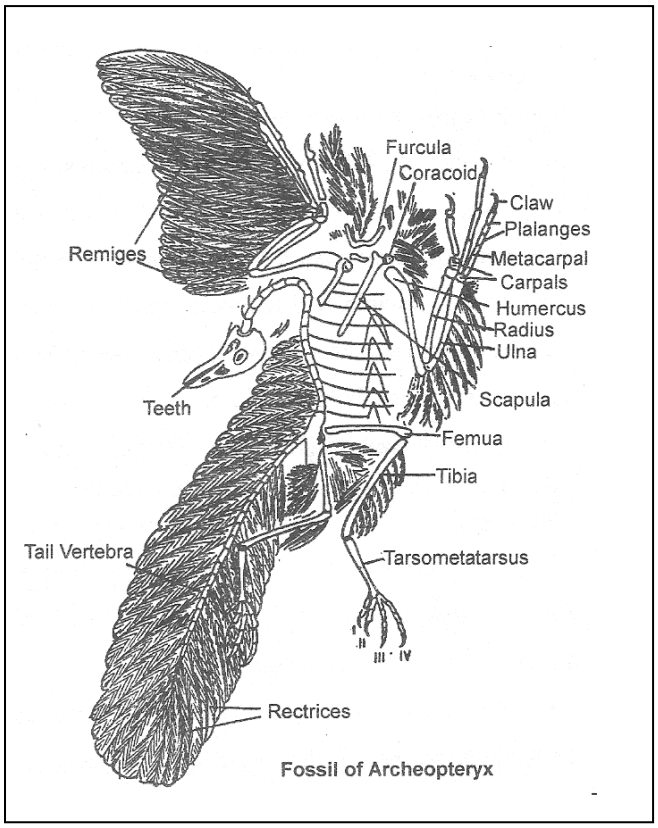
- Embryonic development is **direct.** Embryonic membraens are present, so birds are included under group amniota.
- All teh birds from nests. **Parental care** is well makred. Young one without feather is knows as **Nediculous** and with feather is known as **Nidifugous.**
- Birds ar **warm blooded** or **Homeothermic** or **endothermic animals** i.e. Body temperture remains almost constant, what ever may be the temperature of atmosphre around these birds.

Class Aves is divided into 2 subclasses :
Subclass (a) Archaeornithes Subclass (b) Neornithes

Subclass - Archaernithes

- Primitive **"Lizard link birds"** are included in this subclass, which belong to Jursassi period. All the members have become extinct/
- Wings are ill developed, i.e. capacity of flying was very less.
- Pygostyle was absent.
- Kell on sternum was absent.
- There were present 3 - 3 clawed digits of forelimb at the free edges of wings.
- Uncinate proesses on ribs were absent.
- Teeth were present in the jaws of skull.
- All the members of this subclass ae the **connecting links** between **reptiles** and **birds. e.g.**

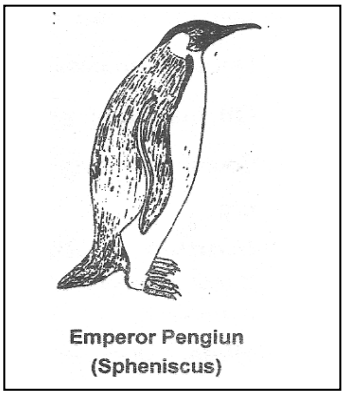
- ***Archaeopteryx*** **-** Lizard bird. (Extinct in Cretaceous period) Its fossile was discovered by Andresa
  wagner in 1861 From Bavaria (Germany)
- ***Archaeornis***



Fossil of Archeopteryx

Subclass - Neornithes

- This sublass includes mostly live animals and **extinct** animals of post jurassic period.


Emperor Pengiun
(Spheniscus)

- Wings are well developed which are used in flying (except some birds)
- Last few vertebrae fuse to form **phygostyle.**
- Sternim is bigger and with keel.
- Digits of forelimbs are fused and claws absent.
- Thoracic ribs are having uncinate processes.
- Except some species (which are extinct) rest all the birds are toothless.
- In live members of this subclass, vertebrae are **heterocoelous.**

This subclass is classfied under four superorders.

(i) Super order - Odontognathae :

- These extinct animals were having teeth
- Pygostyle was absent
- Keel in sternum is absent

e.g.

- ***Hesperornis***

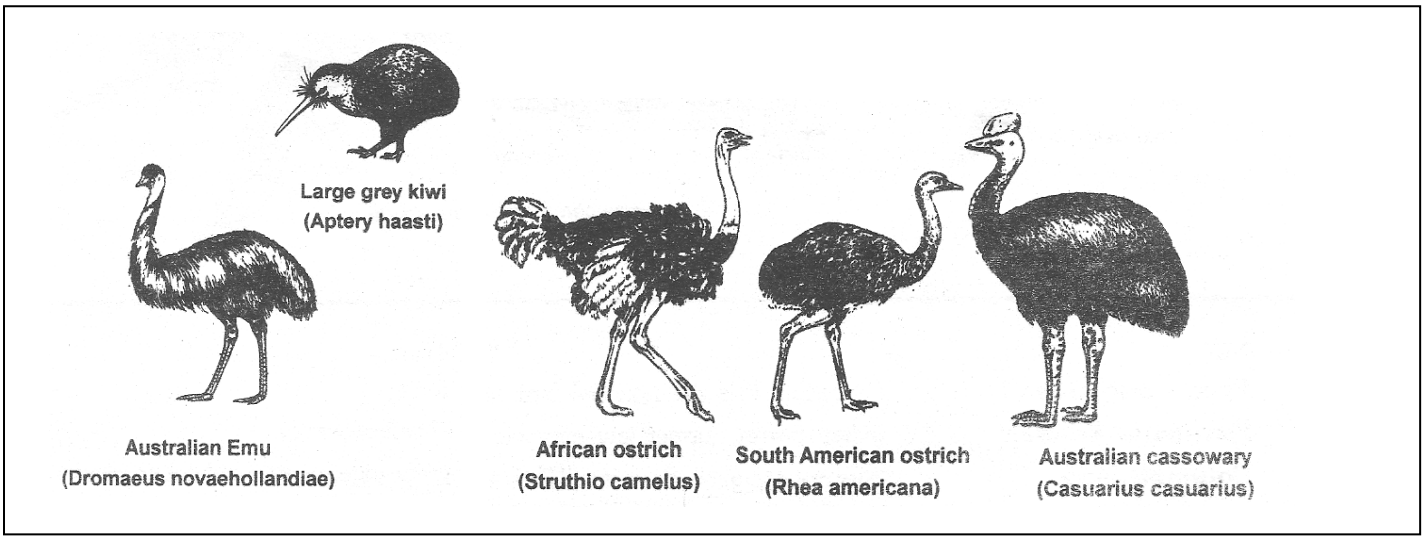
(ii) Super order - Impennae

- All the members of this super order and aquatic birds
- forelimbs are modified into flippers
- Limbs are webbed.
- Teeth are absent
- Sternum without keel.

e.g.

- ***Spheniscus*** **-** Penguine - It is caleld **"sea bird of Antarcica"**
- ***Aptenodytes*** **-** Penguince

(iii) Super order- palaeognathae or Ratitae



- It included lage and massive birds, which are flight less in nature.

  These are able to trun fast. Wings are reduces, rudimentray, vestigeal or asent.

- Caudal vertebrae are free and **phygostyle** is absent.

- Sternum is **raft like** which lacks **Kell.**

- Uncinate processes on ribs are absent.

- **Oil glands** or **preen glands** absent.

- Sound producing organ syrinx is absent.

e.g.

- ***Struthio-*** Aftican ostrich or Camel-bird -It is the **largest living bird** of modern period. It is almost 8 feet is height. Polygamous, male incubate the eggs (Largest egg) In this bird **urinary bladder** and **pernis** is present.
- ***Rhea -*** American ostrich : It also has **urinary - bladder** and **penis.**
- ***Apteryx -*** Kiwi - It is National bird of New zealand. It has hari like feathers all over its body. It is smallest flighless birds.
- ***Dromaeus*** - Emu - It is monogamous bird is which only males look after their young ones and eggs.
- ***Aepyornis -*** Elephant bird
- ***Casuarius -*** Cassowary (found in new Guina)/Austrails

(iv) Super order - Neognathae or Carinatae

- This super order included small sized **flight birds** of modern era. Wings are well developed

- **Pygostyle** is present

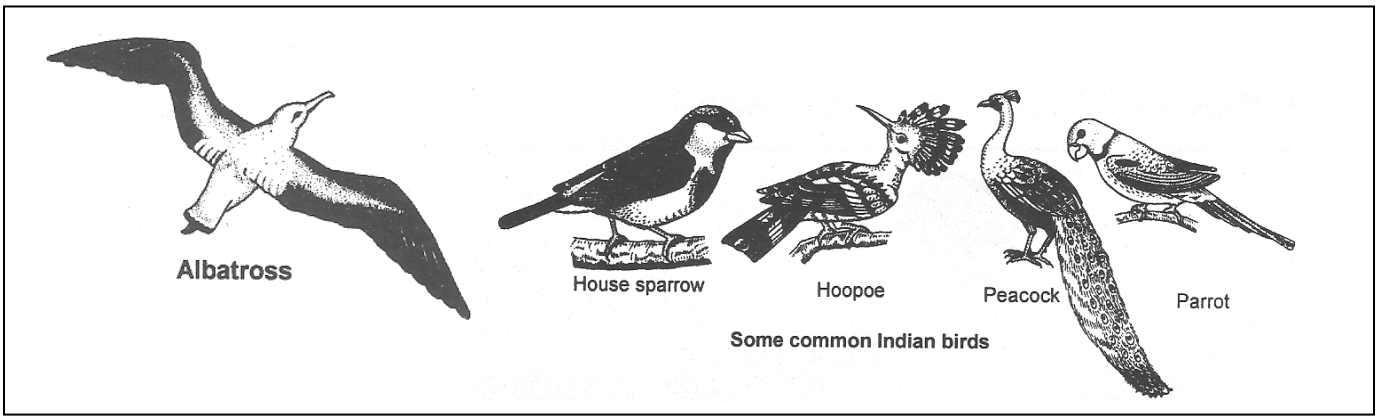
- **Keel** in sternum is highly developed - Its crop glands secrete pigeion mikl

- Uncinate processes at ribs are well marked.

- Oil glands or preenglands are found.

- Beak is **toothless**

- Sound producing **syring** is present



Some common Indian birds

e.g.

- ***Pavo - cristatus*** - Peacock - It is the national birds of India.
- ***Psittacula kramari*** - Indian parrot. (upper jaw movable - Psittaciformes)
- ***Columba livia*** - Blue rock pigeon is crop glands secrete pigeon milk (columbiformes)

- ***Streptopelia*** - Dove
- ***Passer domestieus*** - Sparrow - It shows commonosalism with man.
- ***Corvus spelndens*** - Crow
- ***Molpaste*** - Bulbul
- ***Cygnus*** - Swan - Aquatic bird having wbbed limgs
- ***Bobo bobo*** - Bubo or owl or “Ill of omon”
- ***Cuckoo*** - It lays its eggs in the nest of other birds (Crow)
- ***Anas*** - Duck
- ***Phoenicopterus*** - Flemingo
- ***Alcedo*** - King fisher
- ***Raphus didus*** - Dodo (Mauritian extinct bird in 17th centuary)
- ***Dinopium*** - Wood pecker - Kathphorva
- ***Diomedea*** - ***Albatross -*** Marie bird with **largest wings** in flying birds.
- ***Milvus*** - Kite (Predotory birds)
- ***Falco*** - Falcon (Predatory birds)
- ***Neopharon*** - Vulture (Scavenger bird)
- ***Choriostis - nigriceps*** - Great Indian bustard. It is also called Gondavan. It is the **state bird of Rajasthan.**
- ***Helena*** - hemming bird - It is also called sunbird. It feeds on nector of flowers. It is the smallest bird. It is found in cuba. It can fly in forward and backward both the directions. It can bly like helicoptor. Its size is about 3 to 4 cm.
- ***Ploceous*** - Weaver bird (Baya)
- ***Micropodus*** - Pitohiudicthous/pathua - It is the only one poisonous bird, which is found in Newguinea.
- ***Swift spine tailed*** - Feasters lying bird, it is found in **Japan.**
- ***Poor bill*** - Brid which shows sleeping stage and undergoes hibernation.

Migratory Birds

- ***Pluvialis dominica -*** It si an American bird which migrates from south to north and form north to south.
- ***Scolopax eusticola -*** It migrates from hill area to planes.
- ***Himalyan partiges -*** It can fly over 6000 miles
- ***Stema parasisaea -*** Champion bird - Arctic to Antarctic and back.

Feathers

There are different type of feather namely (1) **Quill** (filght feather) consists of (a) **Remiges** - feather of wings (b) **Retrices -** feather of tail (2) **Coverts** - small just like quill for filling gap on wings & tail (3) **Contours -** small feather to cover the body (4) **Filoplums -** Beneath the contours (5) **Down feather –** Cover the body of newly hatched bird.

REVIEW

Aves (birds) : Thin dry sking covered with feathers that conserve body heat, forelimbs modified into wings, fingers without claws, toes armed with claws, spongy little elatic lungs have air-sacs opening into them voice box-caleld syrinx, is at thebirfurcatio of trachea into bronchi, heart 4 chambered, eggs amniotic, fertilization internal, no larval sate, endotehrmic, generate body heat by rapid metabolism, nest building, parentail care, migratory behaviour.