CLASS: REPTILIA

SUBCLASIS: ANAPSIDA

SUBCLASIS: DIAPSIDA (LEPIDOSAURIA)

Class Reptilia is the paraphyletic and includes 9500 species in the world.

Occupy a great variety of aquatic and terrestrial habitats

- **The first amniotes (First Reptiles)** appeared during the **Carboniferous period of the Paleozoic age.**
- However, **radiation of reptiles** has during **the Permian period of the Paleozoic period.**

Mesozoic era is known as "The Age of Reptiles"

ORIGIN AND EARLY EVOLUTION OF AMNIOTES

- Amniotes are a monophyletic group
- Appeared and diversified in the late Paleozoic era
- Early diversification of amniotes produced three patterns of holes (fenestra) in the temporal region of the skull

Anapsid: Skulls have no temporal openings.
The temporal region of the skull is completely roofed by dermal bones.
This skull morphology was present in the earliest amniotes.
It also occurs in one living group, the turtles.
Synapsid: Skulls have one temporal openings
Diapsid: Skulls have two temporal openings

Diapsida
(Birds and all amniotes considered Reptilies - except Turtles)

Synapsida
(Mammals and their extinct relatives – Therapsids & Pelycosaurus)

Represent seperate evolutionary derivations from the ancestral ANAPSID condition

Temporal openings are occupied by large muscles that adduct the lower jaws

Reptiles derived from LABYRINTHODONT AMPHIBIANS at the beginning of the Permian

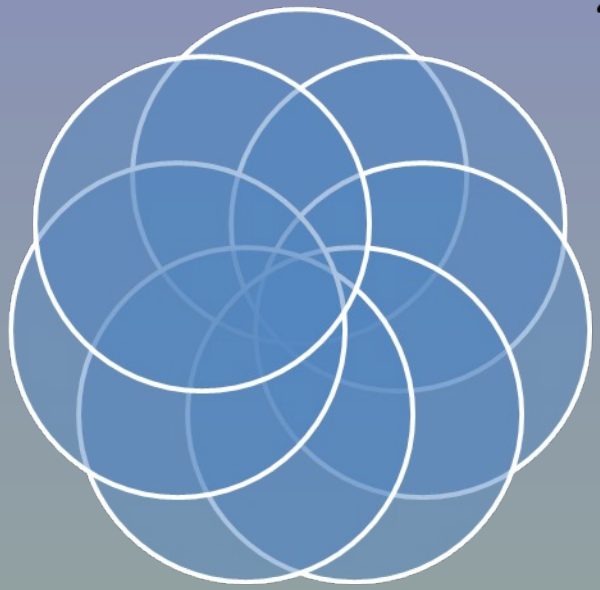
REPTILES EVOLVED IN FIVE MAIN LINEAGES

1. Mammal like primitive reptiles

2. ICHTYOSAURIA (fully adapted to marine life)

5. ARCHOSAURIA

Dinosaurus, Crocodilians; Pterosaurus



3. SYNAPTOSAURIA (with long neck and living in the sea)

4. TURTLES

EVIDENCE THAT REPTILES ARE A MORE ADVANCED GROUP THAN AMPHIBIANS

Dry and squamous skin that adapted to the land life

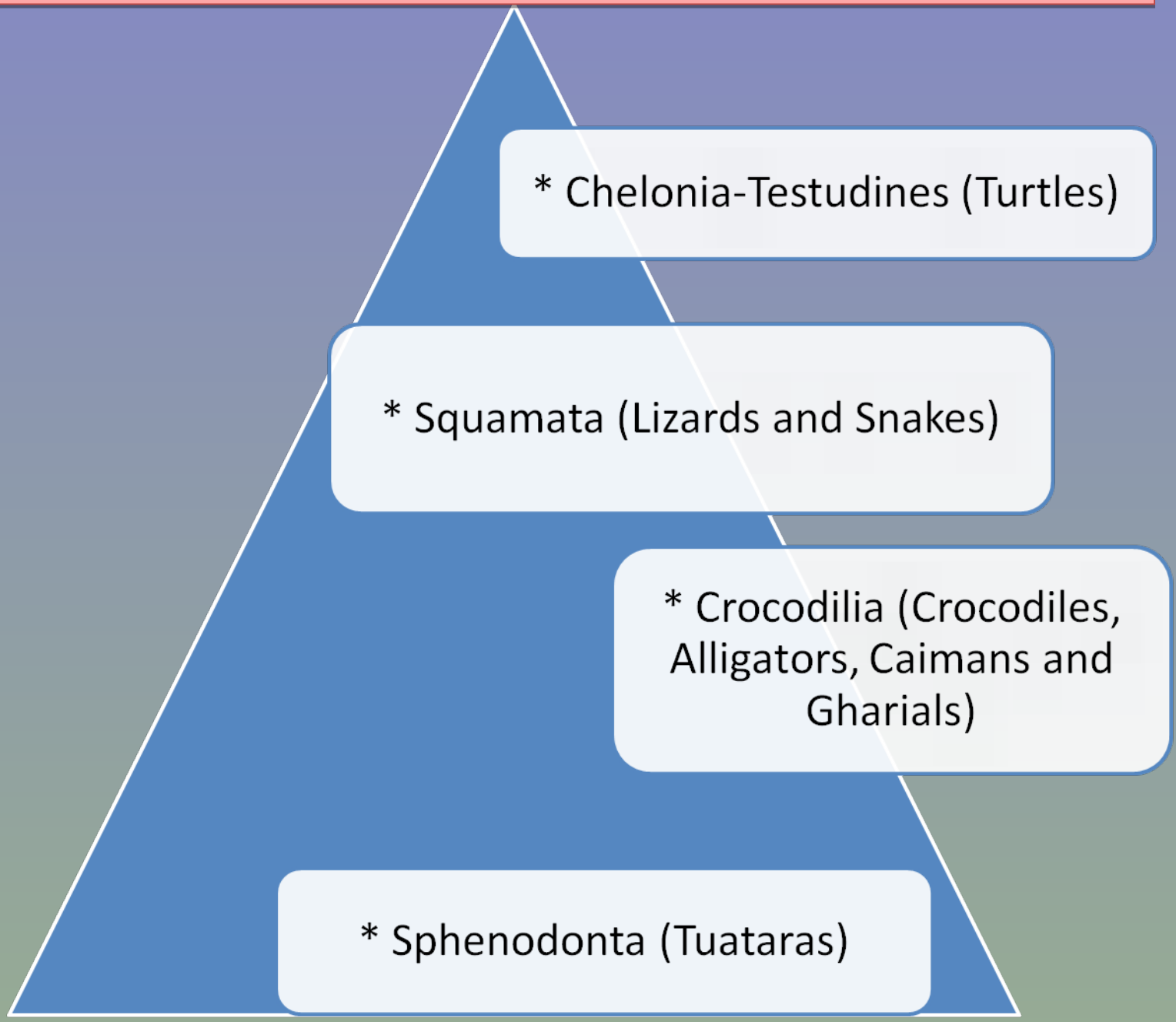
Existence of legs (forelegs and hindleg) for faster movement

Amniotic egg

Heart that allows partly the separation of clean and dirty blood

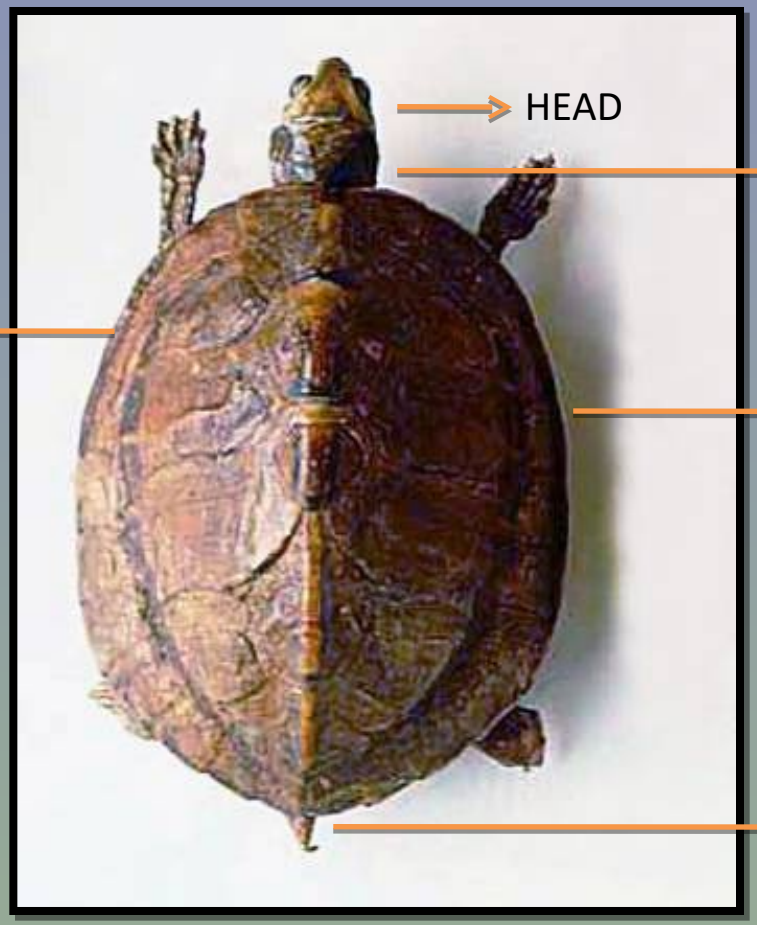
Completely ossified skeleton

Today, the Reptilia class is represented with 4 orders



MORPHOLOGY OF CHELONIA

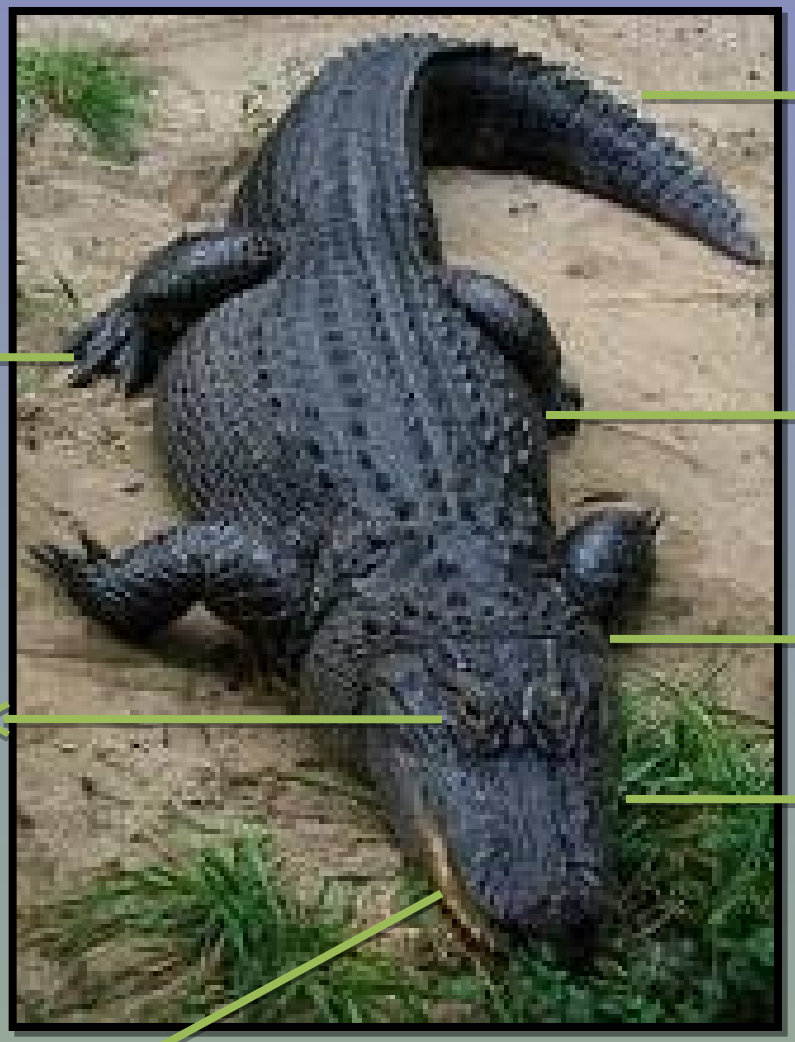
Body is located in an oval shell



PLASTRON

CARAPACE

MORPHOLOGY OF CROCODILIA



TAIL

TRUNK

NECK

HEAD

Keratinezed nails
Web between fingers

Eyes;
*On the side of head;
*Mobile;
*Upper and lower eyelids
* 3rd transparent eyelid under eyelids

Conical Teeth

MORPHOLOGY OF SQUAMATA (LIZARD-SNAKE)

LACERTILIA (LIZARD)

Round and long body

Flattened body

flattened as dorso-ventral body

OPHIDIA (SNAKE)

SLENDER-LONG

No eyelids
The eyes are covered with a transparent layer of keratin.

No eardrum and opening

Boa
Snake

Phython

PELVIC GIRDLE REDUCED
HINDLEGS BECOME BLIND AND REMAIN UNDER SKIN

SKIN

EPIDERMIS + DERMIS

- The most important feature of the skin is **DRY.** It contains a small amount of secretory glands, unlike the Amphibian.

- Snakes can easily swallow large nutrients
  Some lizards swell in the breeding period

SKIN IS FLEXIBLE STRUCTURE

- Two types of scales:
  1. Epidermal Origin- Located on the body surface and desquamate at regular intervals (Snake-Lizard)
  2. Dermal Origin-Embedded under skin and stay there

- In lizards and snakes, the layer of keratinous epidermis, which is found at the bottom of the body, is changed at regular intervals, 2-6 times a year. This is called **ECDYSIS**

- **Ecdysis** is provided by the secretion of holocrine type of gland which is called **Generation Gland.**

In this peroid;

1. Epiderm cells form a new layer of keratin under the old keratin layer.
2. By means of secreted gland between the old and new layers, the old keratin layer at the top begins to separate from the new one from the head.
3. At this time, seeing is weakened due to the keratin layer on the eye.

Ecdysis is in one piece in snake, small-legged or legless lizards while it is in pieces in some lizards

- Rattles of epidermal origin are not lost in rattlesnake during ecydsis.
- A new rattle is formed in each ecydsis.

It is not possible to determine age from rattle because more than one ecydsis occurs in one year

- There are epidermal scales on the carapace and plastron in Turtles, and these scales are not change.
- There are no scales in some forms.

When the stratum germinatium layer in the epidermis grows and pushes the flakes on it, **the old scales are gradually eroded and replaced with new ones.**

The accumulation of large epidermal origin scales is composed of interlocking rings on dermal origin plates.

- Body of the Crocodilian is covered with epidermal scales.
- These scales are not change interval periods, but deformed scales replace new ones.
- In reptiles, scales have different arrangement, shape and structure.
- In snakes and lizards, the scales are in longitudinal, transverse or diagonal rows. Ventral scales-Gastrosteg (Single row). Scales in ventral part of tail-Urosteg (1-2 rows)
- In snake, the scales on the head differ greatly from the body scales and are very important in the **systematic.**
- **T**he body scales of snake is **Cycloid and Qaudrangular** structure.
- The body scales of Reptilia is **Cycloid, Qaudrangular , Granular** and **Mucronate** structure

Color is provided by **chromotophores** in the dermis layer of the skin.

COLOR CHANGE: It is important for **protection; adaptation; copulation** and **arrangement of body temperature** (Color is Light color in high tempertaure; dark color in low temperature)

A sexual dimorphism in color is clear in lizard.

MORPHOLOGICAL DIFFERENCES BETWEEN THE SNAKE AND LIZARDS

	SNAKE	LIZARD
Front legs	None	Usually Present
Front legs gridles	None	Present
Hind legs	Rarely (blunt)	Usually
Hindlegs gridles	Rarely	Present
Sequence of single ventral scales	Usually	None
Mobile eyelids	None	Usually
Ear opening	None	Usually
Highly forked tongue	Usually	Rarely

SKELETON SYSTEM

1. **AXIAL SKELETON:** Head, Vertebra and Ribs

There are 5 types of vertebral bone

1. Cervical (Neck)
2. Thorasic (Thorax)
3. Lumbar (Waist)
4. Sacral (Coccyx)
5. Caudal (Tail)

REPTILIA SKULL HAS GOT ONE OCCIPITAL CONDYLE-OPENING

- The skull is connected to the first vertebra which is called **ATLAS VERTEBRAE** by occipital condyle
- **Quadratum bones** are fused with skull in turtles, crocodiles and Tuataras whereas it is moving in snakes and lizards.

- The ribs are very well developed in the chest (thorasic) area.
- There are short ribs on the cervical vertebrae in the neck area.
- Cobra snakes lift short ribs sideways in any danger and loose skin in the neck area turn into **collar shape.**
- Ribs on the thorasic vertebrae combined with the ventral sternum (with the exception of non-member reptiles and sea turtles)
- Caudal vertebrae and ribs on them are increasingly smaller in the tail to the tip in snake.
- All the vertebrae except cervical and caudal fused with the dermal origin of the carapace in Turtles

2. APPENDICULAR SKELETON

Extremities (legs) and gridles that connect the legs to the body are generally similar to the Amphibians.

Extremity of the sea turtles have ability to swim.

Extremity of the terrestrial turtles have the ability to carry the heavy body.

MUSCULAR SYSTEM AND MOVEMENT

Axial or trunk muscles are well developed depending on the movement pattern and have a similar structure to mammals.

Trunk muscles are well developed in snake.

Trunk muscles are not well developed in Turtles because of immobile shell.

Dermal and skin muscles are well developed in reptiles and especially snakes.

Extremity muscles are well developed in fast moving and climbing lizards

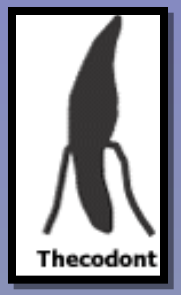
DIGESTIVE SYSTEM

The tongue is quite well developed in snakes and lizards.

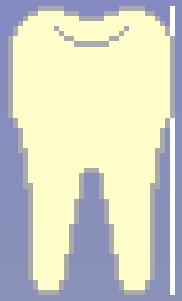
Bifurcated tongue uses chemical stimuli in snakes.

Most reptiles have **HOMODONT** (Uniform) dental array

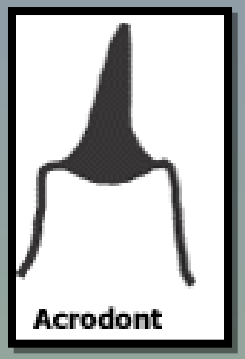
Turtles have no teeth, there is a keratin layer.



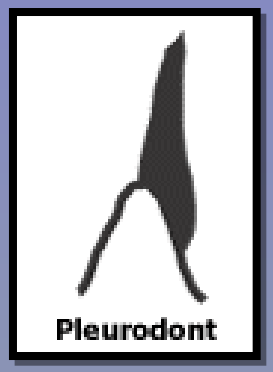
Crocodiles have **THECODONT** type teeth in the homodont array as in mammals.



In most lizards the teeth are located on the jaws, while others are located on the ceiling of the mouth.



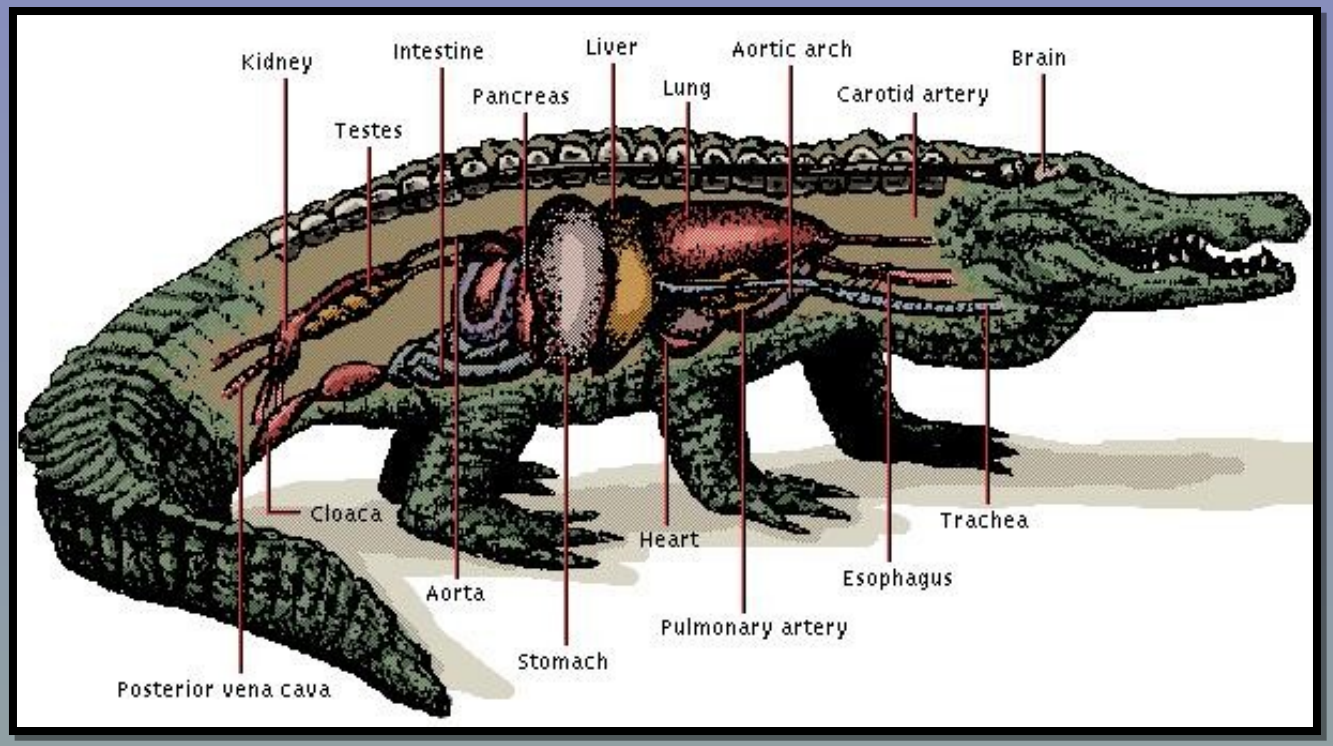
If the teeth are not embeded in the jaws., it is called ACRODONT



In some reptiles teeth are adherent to the inner edges of the jaw. It is called **PLEURODONT**

Poisonous snakes are a pair of Poison Fangs.
Poison fangs are lying back in rattlesnake and used only when the mouth is opened.

Mouth → Short pharynx → Eosephagus → Stomach → Small Intestine → Rectum → Cloaca



In the crocodiles there is a structure called **VELUM** at the back edge of the tongue. This structure is seperatre the oral cavity from the pharynx.

Its task is to prevent water from entering the lungs when the crocodile opens its mouth in water.

CIRCULATORY SYSTEM

- Poikilotherm (Ectothermic) .
- Heart with a sinus venosus, two atria and ventricle incompletely divided into three chambers.
- Crocodilian heart with sinus venosus, two atria and two ventricules
- Pulmonary and systemic circuits incompletely separated.
- Nucleated red blood cells

RESPIRATORY SYSTEM

- Lungs filled with aspiration (negative ventilation)
- Air enters the outer nostrils and passes to Glottis.
- Glottis combines with the trachea
- The trachea is divided into two bronchi, each of which is connected to the lung, in the anterior part of the chest.

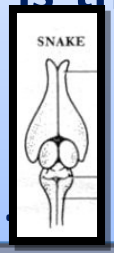
CLOACA RESPIRATION: It is seen in aquatic turtles. when they are under water they use cloacal respiration.

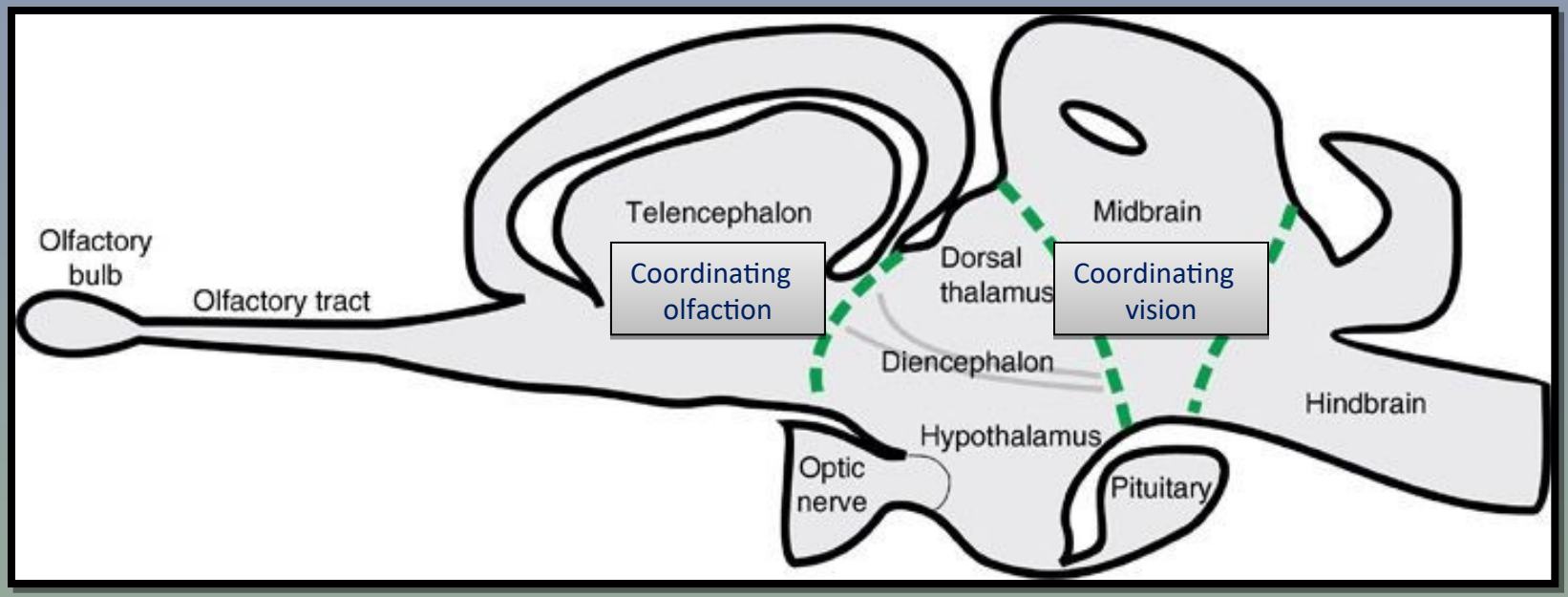
EXCRETORY SYSTEM

- Kidneys are **Metanephric**.
- **The kidney is in the back (dorsal).**
- The urine channel exist from each kidney opens to the back of the cloaca.
- **No urinary bladder in snakes, crocodilian and lizards.**
- **Uric acid** usually main nitrogenous waste terrestrial reptilia.
- Main nitrogenous waste usually **ammonia and urea** in aquatic reptilia.

NERVOUS SYSTEM

- Central, peripheric and autonomic nervous systems are examined.
- **In all amniotic vertebrates, the midbrain is the most active center of the brain.**
- Brain hemispheres are quite large.
- 12 double nerves come out of their brains.





SENSE ORGANS

- In most of the Reptilia they have got taste buds on the tongue and pharynx
- Olfactory cells are in the nasal cavity.
- **Jacobson organs** which take chemical stimulation are well developed
- The corneal layer in the eyes is kept moist by the **lacrimal** and **harderian gland** secretions.
- Some of the lizards have a third eyelid (transparent)
- There are outer ear canal (under the skin), middle ear and inner ear parts in most of the Reptilia.
- Each internal ear contains **3 Semicircular canals**
- Eustachian tube present and it is opened to upper part of the pharynx

- **There are no tympanic organ, middle ear and eustachian tube in snakes**
- **Hearing is weak**
- **Thermosensor organ** in rattlesnakes
- Tongue in some snakes are responsible for detection of touch, smell and sound.
- Some snakes with heat-sensitive pit organs

REPRODUCTIVE SYSTEM

- Usually separate sexes
- Some lizard reproduce asexually by parthenogenesis
- Internal fertilization; usually oviparous development; rarely ovoviviparous and viviparous
- No larval stage (no metamorphosis)
- Male has got copulary organ **a penis, hemipene**, or rarely absent.
- The gonads are double.
- The ovaries open the cloaca with oviduct.
- Fetal membranes present: A**mnion, chorion** and **allantois**

Classification of Living Non-Avian Reptilia

Phylum: Chordata, Grup: Craniata

Subphylum: Gnathostomata,

Super Class: Tetrapoda

Class: Reptilia

1. Subclass: Anapsida
   Ordo: Chelonia (Turtle)

2. Subclass: Lepidosauria
   Ordo: Rynchocephalia
   Ordo: Squamata (Lizard and Snake)
      Subordo: Lacertilia (Lizard)
      Subordo: Ophidia (Snake)
3. Subclasis: Archosauria
   Ordo: Crocodilia