


Diapsida

Diapsida
(Reptilia, Sauropsida)

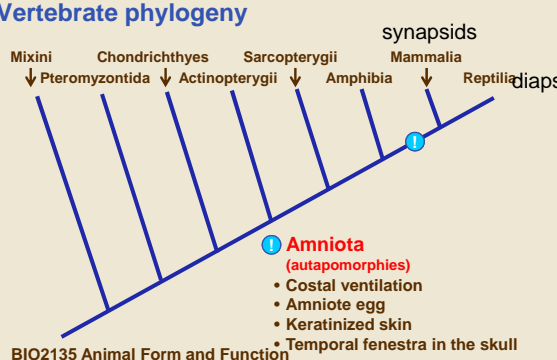


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Vertebrate phylogeny



Mixini Chondrichthyes Sarcopterygii synapsids Mammalia

↓ Pteromyzontida ↓ Actinopterygii ↓ Amphibia ↓ Reptilia

① **Amniota**
(autapomorphies)

- Costal ventilation
- Amniote egg
- Keratinized skin
- Temporal fenestra in the skull


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Amniote egg

- **Membranes**
 - Yolk sac
 - Amnion
 - Allantois
 - Chorion



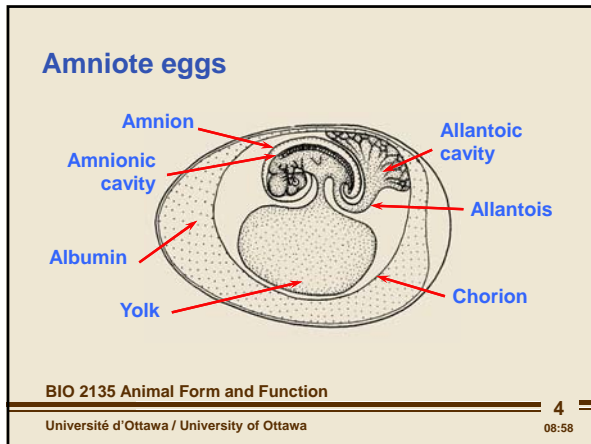
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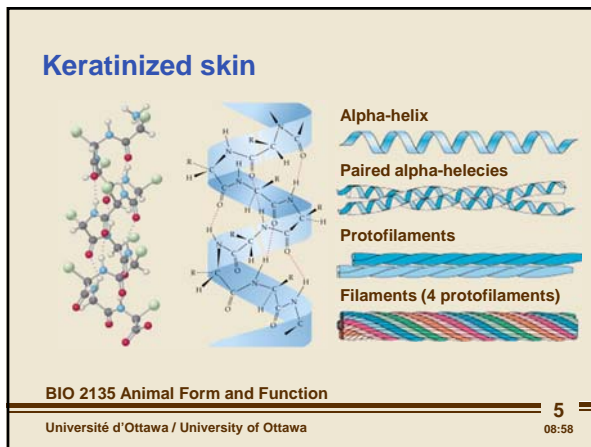
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Set of membranes. One surrounds embryo.

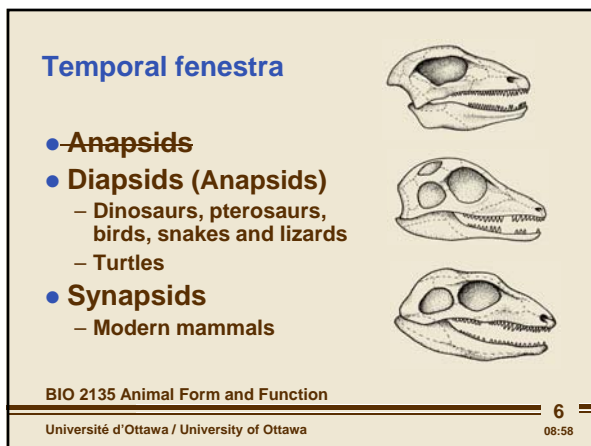
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Miniature ocean in which the embryo grows in. Egg has nutrients(yolk), membrane around yolk. Chorion is sac like structure which has albumin(protein)-a nutritional reserve of amino acids, when it breaks down it generates metabolic water. Allantois is a membrane where N waste is built up so it doesn't poison embryo. N waste makes uric acid, all amniote eggs use Uric acid in the allantoic cavity.



Protein with alpha helicies that wind in pairs, that find again into protofilaments, then again into filaments(4 protos). Disulfide bond makes it nearly undigestible. Keratin gives waterproof surface, and can't be damaged by abrasion or rubbing. Creating a layer of dead cells filled with keratin, with oils in it. Gives scales.





Holes in the head. Two openings is diapsid. Turtles have no holes, fused bones together to create shells in which they live in, don't have teeth in jaws, have weak jaws. Turtles are derived diapsids.

Diapsida

Major diapsid groups

- **Archosauria**
 - Pterosaurs (e)
 - Dinosaurs (e)
 - Crocodiles and birds
- **Lepidosauria**
 - Snakes, lizards, and turtles (?)



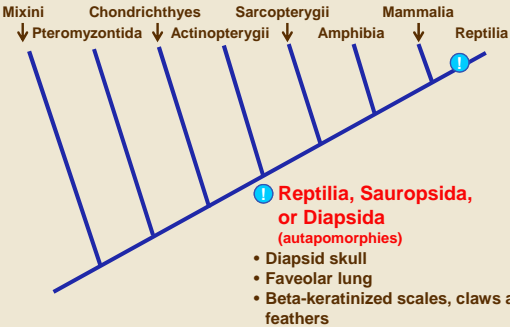
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Archosaurs all have 4 chamber hearts, gizzard in digestive tract where they put stones and pebbles to break food down.

Lepidosauria recognized by the structure of the scales on their body.

Vertebrate phylogeny



Mixini
↓ Pteromyzontida

Chondrichthyes
↓ Actinopterygii

Sarcopterygii
↓ Amphibia

Mammalia
↓ Reptilia

① **Reptilia, Sauropsida, or Diapsida**
(autapomorphies)

- Diapsid skull
- Faveolar lung
- Beta-keratinized scales, claws and feathers

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Diapsid skull. Certain is beta sheets. Lung is divided in walls(septa), when they breathe in, septa have holes, air is brought in and passed through the septa(thousands of little holes) and that's how we get this surface area for gas exchange. Air follows a directional path.

Scales and feathers



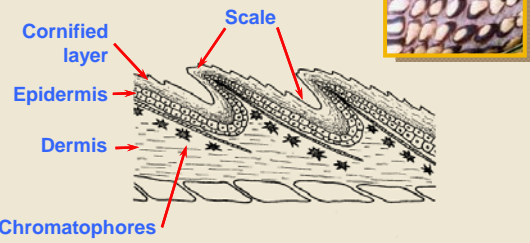
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Scales and feathers are homologues. Feathers derived from scales.

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Beta-keratinized scales, claws and feathers



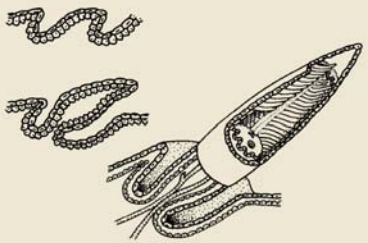
The diagram illustrates the structure of a scale. It shows a cross-section of the skin with several layers: the outermost **Cornified layer**, the **Epidermis**, and the **Dermis**. A **Scale** is shown as a raised, overlapping structure. **Chromatophores** are indicated as small star-shaped structures in the dermis. An inset image shows a close-up of a scale's surface, which has a hexagonal, honeycomb-like pattern.

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Scales are keratinized mass of material that grows at its base, forms a disk like structure. Secreted pocket of keratinized material.

Growth of a feather



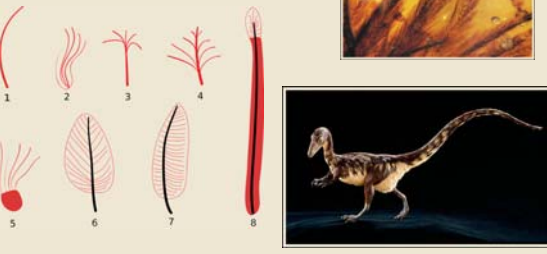
The diagram shows the growth of a feather in three stages. The first stage is a simple, wavy line representing the initial keratinized structure. The second stage shows the structure beginning to curve and form a more defined shape. The third stage shows a fully developed feather with a central shaft and branching barbs.

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Feather has a ring of cells that produce keratinized structure put out as a tubular structure. In a simple form it is a bristle.

Evolution of feathers



The diagram illustrates the evolution of feathers through eight stages, numbered 1 to 8. Stage 1 is a simple cylindrical shaft. Stage 2 shows the shaft beginning to branch at the base. Stage 3 shows the branching becoming more pronounced. Stage 4 shows the branching extending up the shaft. Stage 5 shows the branching becoming more complex and dense. Stage 6 shows the branching forming a flat, fan-like structure. Stage 7 shows the branching forming a more complex, multi-layered structure. Stage 8 shows a fully developed feather with a central shaft and branching barbs. An inset image shows a close-up of a feather's structure. Another inset image shows a dinosaur with feathers.

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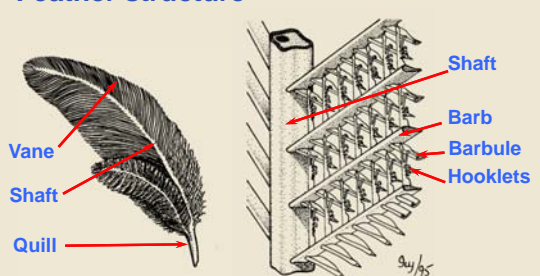
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First one is cylindrical shaft of keratinized material, a bristle. Then the bristle became to branch at the base. Then they branched up the shaft. Then the bristles became to lock together to create a contour feather. Bristles common in dinosaurs. Now the feather has a thin side and thick side, useful for flight.

Overtime, become branching and insulating.

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Feather structure




The diagram illustrates the hierarchical structure of a feather. On the left, a whole feather is shown with labels for the Vane, Shaft, and Quill. On the right, a detailed cross-section shows the Shaft (rachis) with Barbs branching off. The Barbs are further divided into Barbules, which are held together by tiny Hooklets. The Quill is the base of the feather that embeds into the skin.

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Barb and barbules put the two together. Quil is the shaft that sticks in the skin
— Dead tissue, have to keep it so it doesn't dry out and become brittle. Spend a
lot of time grooming, constantly relinking the barb and barbules in the vanes of
the wings. There is a uropygia gland that secretes the oils that they use to
groom the feather.

Feathers

- Bristles
- Down feathers
- Contour feathers
- Filoplumes



The image shows four different types of feathers: a large contour feather with a distinct vane, a soft down feather, a stiff bristle, and a long, thin filoplume.

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Mouling



The left photograph shows a bright green snake in the process of shedding its old skin, with a piece of the old skin peeling away. The right photograph shows a blue bird perched on a brick, likely during its mouling period.

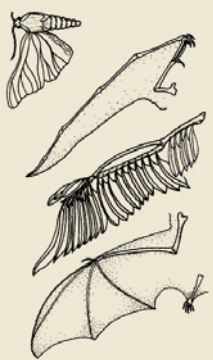
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Feather will become brittle and needs replacement. Birds replace feathers.
— Shedding in snakes. All diapsids moult their keratinized structure.

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Origins of flight

- Insects
- Bats
- Pterosaur flight
- Bird flight 2 theories
 - tree-down theory
 - ground up theory






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Pterosaur flight
Video 6:00





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Quadropeds.

Archaeopteryx (Transition fossil)



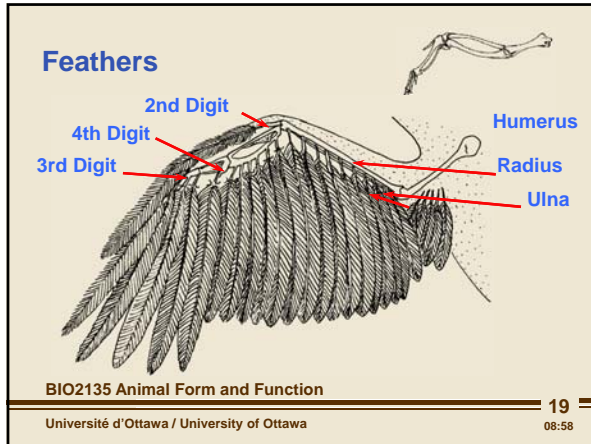
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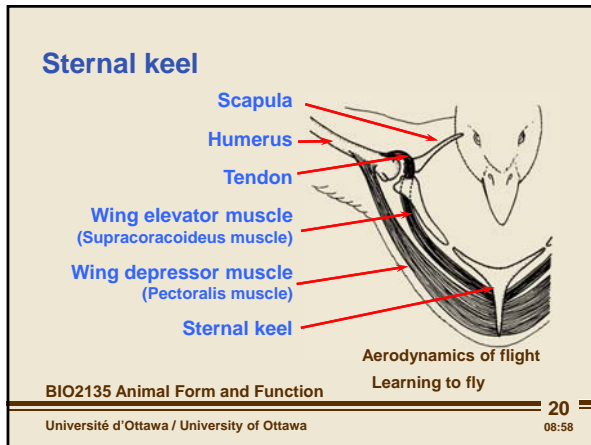
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Use hind limbs independently of fore limbs involved for flight. Use feathers for wings.

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Push against the air to push organism up. Adapting the animal to be light.



Concentration of the flight muscles in the center core of body. Requires a lot of metabolism (fueling muscle).

Body temperature

		Heat source	
		External	Internal
Regulation	No	Ectothermic heterotherm	Endothermic heterotherm
	Yes	Ectothermic homeotherm	Endothermic homeotherm

warm-blooded.

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Regulation meaning a temperature that doesn't modify much. Enzymes speed up with heat. If you can set temperature at a fixed number there is a predictable amount of enzymatic activity. Internal heat, endothermy, is muscle movement including shivering response when cold. Getting heat from outside but not being able to regulate body temperature (cold blooded).

Heterotherms can handle fluctuations in body temperature, camels typically overheat, not maintain a set point.

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Environmental heat exchange

- **Loss**
 - Respiratory evaporation
 - Surface evaporation
 - Conduction
 - Long wave radiation
 - Convection (wind)
- **Gain**
 - Radiant
 - Metabolic
 - Conduction

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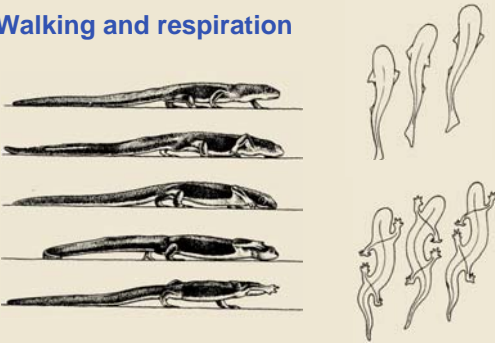
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Growth is uniform over life(has homeothermic)

Walking and respiration



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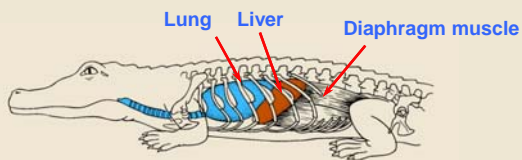
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Intercoastal muscles to breathe. Pelvic girdle interacts with rib cage, as leg moves forward, the rib cage is compressed on one side, the opposite happens on the other side.

Crocodiles



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Muscular diaphragm muscle attached to liver, which is attached to lung. Connection of internal organs. They can change the position of pelvic bones in a way that when its tipped back it pulls the muscle, the liver, the lungs and fills them with air. Another muscle shifts oppositely. Movement of hind limbs, a croc can airate its lungs.

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Turtles and tortoises



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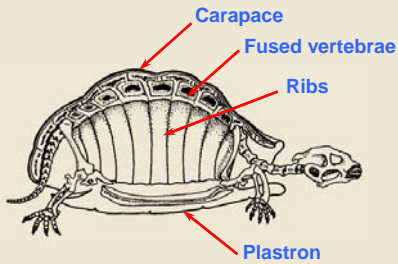
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Taken the bones of the body fused together to create the shell.

Turtle skeleton



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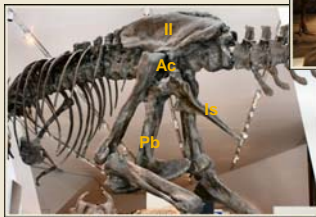
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Turtles do as the crocodiles.

Extinct Diapsids Saurischian dinosaurs



T rex, ROM

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Albertosaurus, Tyrell

- Pb pubis
- Is Ischium
- Il Ilium
- Ac Acetabulum

Leg attaching into the pelvic girdle. The ischium points forward or down.

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Extinct Diapsids
Saurischian dinosaurs

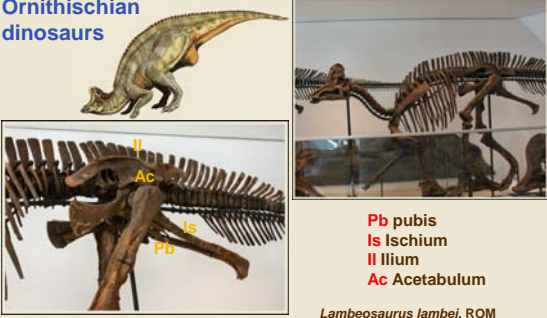


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Extinct diapsids
Ornithischian dinosaurs



Pb pubis
Is Ischium
Il Ilium
Ac Acetabulum

Lambeosaurus lambei, ROM

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Points backwards.

Bird hip dinosaurs.

Extinct diapsids
Ornithischian dinosaurs



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Skeletal organization

Neck vertebrae

Sternal keel

Fused trunk vertebrae

Reduced tail vertebrae

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Neck vertebrae become flexible. Have an eye that cannot move, therefore must swivel its head.

Perching

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Involves one of the toes pointing backwards. All birds have this set up. Hind limbs for walking and perching.

Air sacs

Lungs

Trachea

Anterior air sac

Syrinx

Posterior air sac

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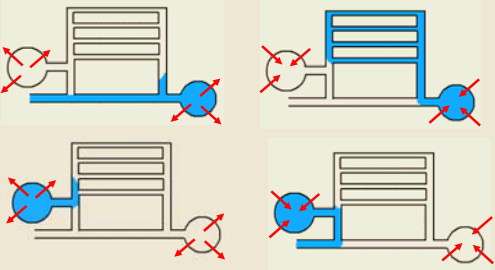
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Walls or septa with tubes or tunnels through them. Don't use muscle to expand contract. They expand and contract a series of air sacs. Air is pumped unidirectionally.

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Avian lungs




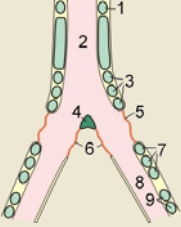
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Valves opening and closing. Pulling air from the posterior into the lungs into the anterior. Double pumping mechanism.

Bird songs – the syrinx



1,3,5,7 and 9 cartilaginous tracheal rings
5 and 6 membrane
4 pessulus

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Set of membranes. As air goes by the bird controls how flappy the membranes are. Have 4 sounds producing organs, can produce 4 notes at the same time. Gives communication and sociality.

Circulatory system

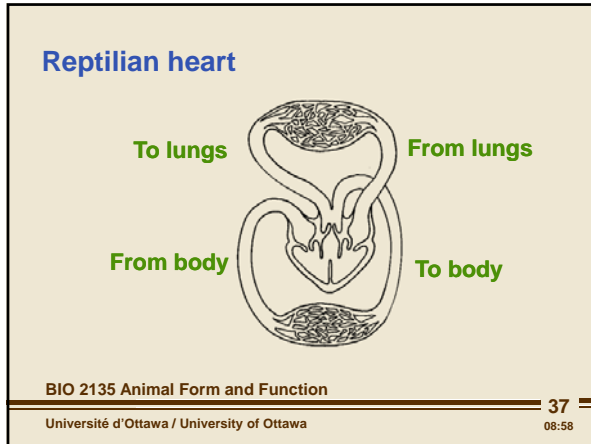
- **3 chambered heart** incomplete septum in the ventricle.
 - Most reptiles
- **4-chambered heart**
 - Crocodiles and birds

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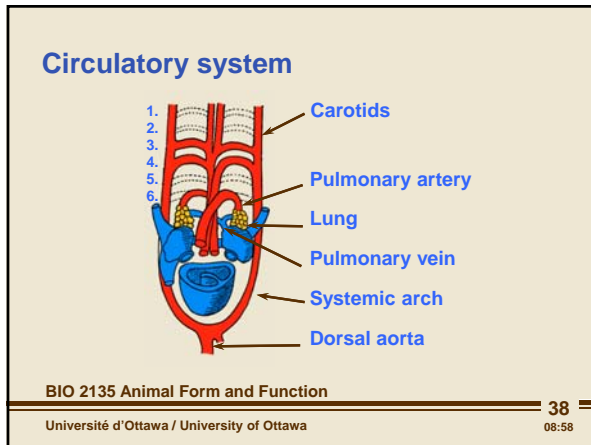
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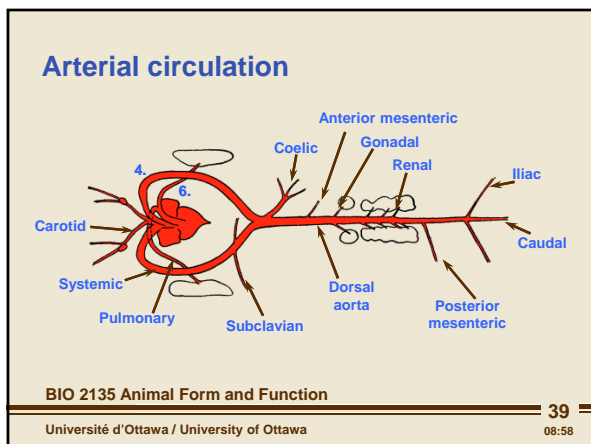
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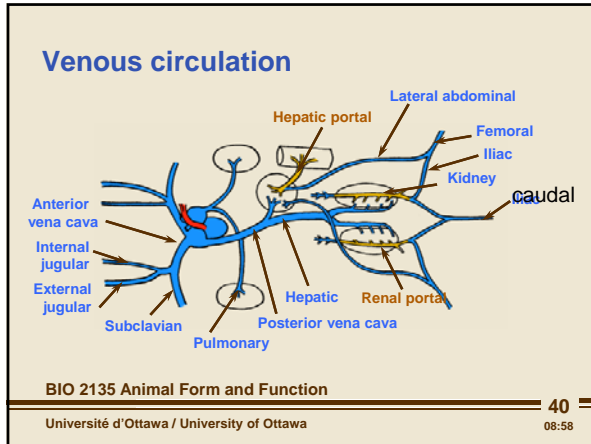
Septum in the ventricle only becomes complete in the crocodile and birds.

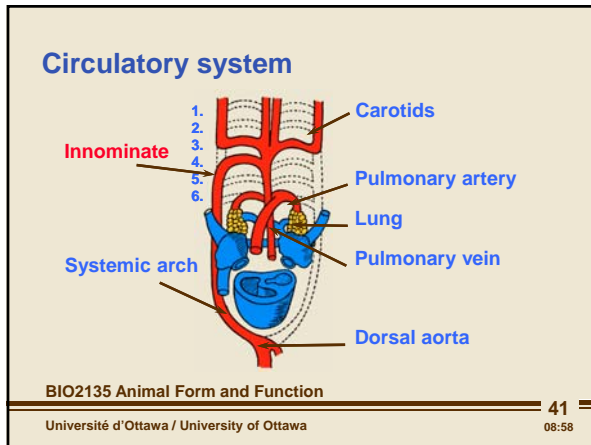


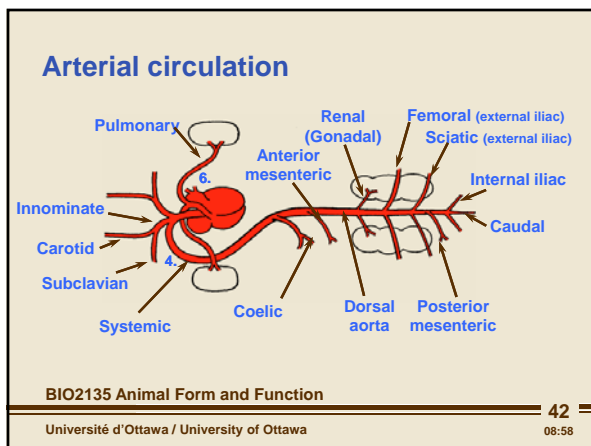


Two systemic arches. 2 aortic arches.

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One systemic arch, single blood root to deliver blood to everything. Heart makes one large branch that goes forward and one backwards and arches that come off it to supply.

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Venous circulation

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Crushing jaws

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Tear apart food they're consuming. Don't preprocess food. Gulp their food.
Gizzard is filled with stones and pebbles to pulverize food mass because the food is not chewed before ingestion.


Snake venoms

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No appendages. Must immobilize their prey. Either be constrictors and wrap themselves around the prey to suffocate. Or use venom.

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Snake's jaw



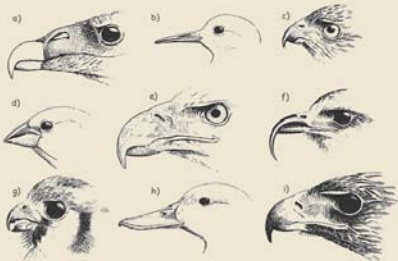
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Can open jaw extremely wide and swallow its prey whole.

Bird beaks



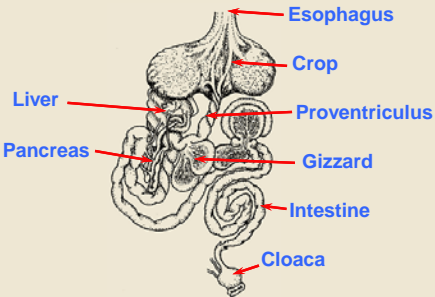
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Keratinized jaw and beak. Birds beak can be modified and shape change to match the type of food it feeds on.

Digestive system



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Reproduction

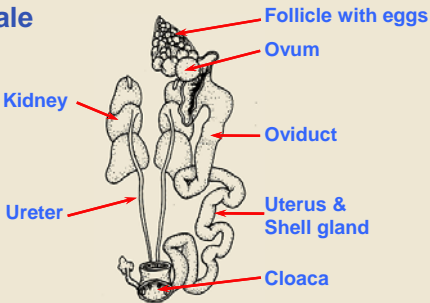


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Female



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Only one ovary. The ovary only grows and enlarges when its ready to mate.
~~Another way to make themselves light.~~

Parental care



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