

Unit 7:

Vertebrates



- 1. Characteristics of animals**
- 2. Mammals**
- 3. Birds**
- 4. Reptiles**
- 5. Amphibians**
- 6. Fish**

Think and answer?

- What animal can you see in the photograph?
- Why do you know it is an animal?
- Is it a vertebrate or an invertebrate? Why?
- How are vertebrates classified?

UNIT OBJECTIVES

In this unit you will learn:

- To define what is an animal
- To identify the differences between vertebrates and invertebrate animals
- To describe the morphologic characteristics of the different groups of vertebrates
- To describe the way the different groups of vertebrates perform the vital function
- To classify the vertebrates

1. Characteristics of animals.

Organisms of **Animal Kingdom** are **multicellular** living beings, made up of **eukaryotic animal cells** and **heterotrophs**.

Almost all animals have **organs** and **systems** so that they can perform vital functions very efficiently.

- **Nutrition:** They have a digestive system, a respiratory system, a circulatory system and an excretory system.
- **Interaction:** They have a nervous system, an endocrine system and a tegument.
- **Reproduction:** They have a reproductive system.

Traditionally the Animal Kingdom is divided into two groups:

- **Vertebrates.** They are the animals with internal skeleton.
- **Invertebrates.** They are the animals without internal skeleton.

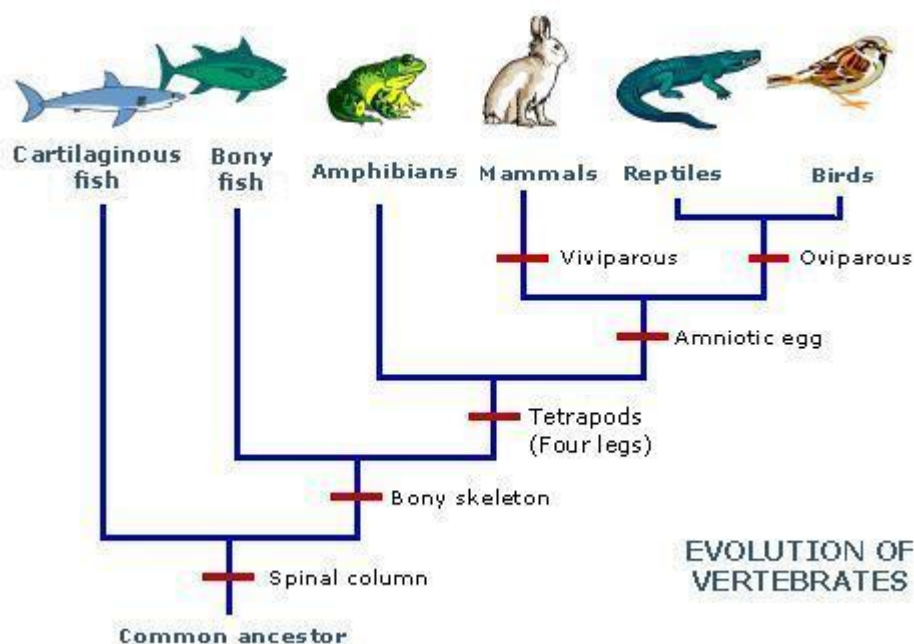
This classification is not scientific because invertebrates do not have evolutionary relationship among them. In contrast Vertebrates are related, that is they have a common ancestor. Vertebrates are the most evolved group of the **Phylum Chordates**.

1.1. Characteristics of Vertebrates

All vertebrates have in common the same organization body model. They share the following characteristics:

- They have internal skeleton (**endoskeleton**) with backbone (**spinal column**)
- Its body is divided into a **head**, a **trunk** and most have a **tail**.
- They have four **limbs**.
- They have **bilateral symmetry**.
- They have a **complete digestive tube** (with mouth and anus) with digestive glands.
- They have a **close circulatory system** (that is blood always flows within the blood vessels)
- They have a well-developed **nervous system** (encephalon, spinal cord, nerves and sense organs).
- They have **sexual reproduction** and sexes are separated (male and female)

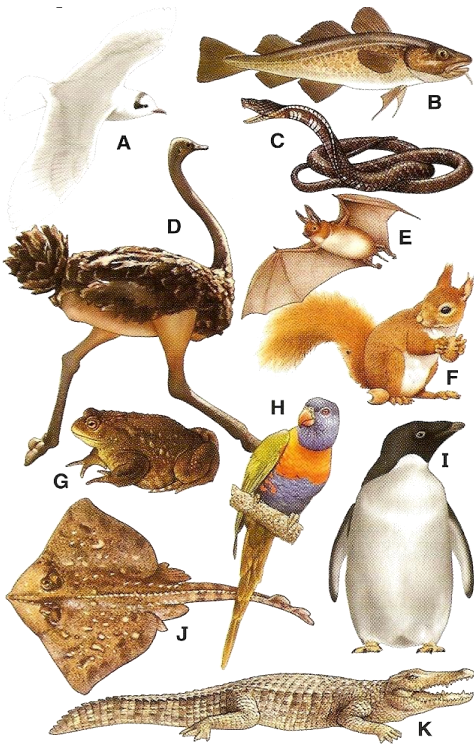
They are divided into five groups: **fish**, **amphibians**, **reptiles**, **birds** and **mammals**.



READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:
Remember: you must make complete sentences.

1. 1. Answer the questions:



a. What does that all vertebrates share a same *organization body model* mean?

b. Do these characteristics have scientific value? Why?

c. We can use them to include all vertebrates in the same taxonomic rank. What is it?

d. Classify the animals represented in the pictures in their correspondent group:

Fish	Amphibians	Reptiles	Birds	Mammals

1.2. Listen and indicate if the sentences about vertebrates are true or false:

2. Mammals

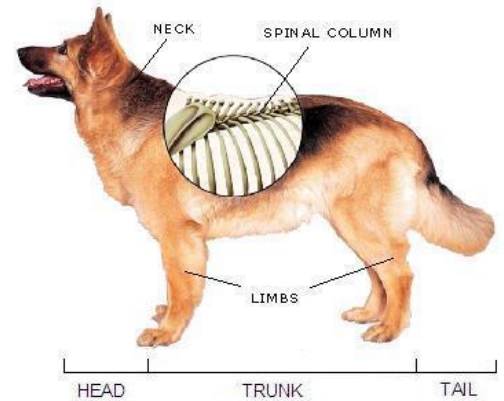
There are about 5,700 species of mammals. They appeared 200 million years ago. They evolved from a group of reptiles that developed hair and capacity for feeding their calves with milk that they selves produce.

a) Habitat

They are **terrestrial tetrapods**. Some are aquatic (e.g. dolphins) and only one group can fly (bats)

b) Morphologic characteristics

- They have **four limbs**. These extremities are adapted to different ways to move and can be wings, legs or fins.
- Their body is divided into: **head, trunk** and **tail**.
The head is joined to the trunk by the **neck**.
- Their skin is covered by **hairs**. They protect of heat loss.
- They have several types of **glands**:
sweat glands, sebaceous glands and mammary glands.



c) Vital functions:

Nutrition:

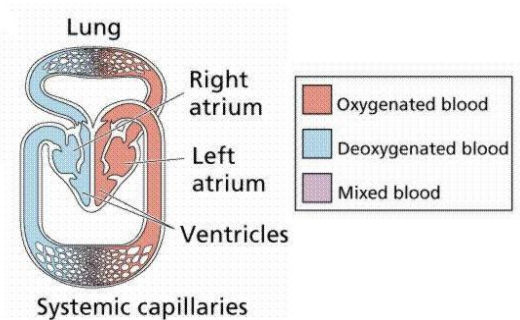
The **digestive system** is complete. They have mouth with teeth and lips (to suction). Teeth have different shape depending on the kind of feeding the animal has. Anus opens outside directly.

Mammals breathe through **lungs**.

They have **double circulation**.

This means that blood follows a double circuit:

- **Pulmonary circulation** (Heart-Lungs)
- **Systemic circulation** (Heart- Body)



Their heart has **four chambers**: two upper atriums and two lower separated ventricles, so that they have **complete circulation**. This means that oxygenated blood and deoxygenated blood don't mix.

They have two **kidneys**.

Interaction

They have a well-developed brain and sense organs: eyes (with eyelids), ears (with auricles), taste, smell and touch.

They are **homeotherms** (warm-blooded). This means that they can keep their body temperature constant.

Reproduction:

Fertilization is **internal**. They are **viviparous**. Young grow in the mother's womb (uterus). Mammals care young and females feed them with **milk** produced in their **mammary glands**.

d) Classification:

- Monotremes

They are oviparous. They have a beak without teeth.

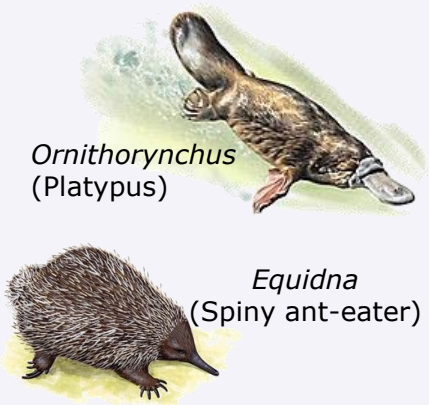
- Marsupials

They are viviparous but calves birth very immature and have to complete their development into the mother's pouch (marsupium).

- Placentals

Young develop completely into the mother's uterus. Embryo is connected to the female by the placenta.

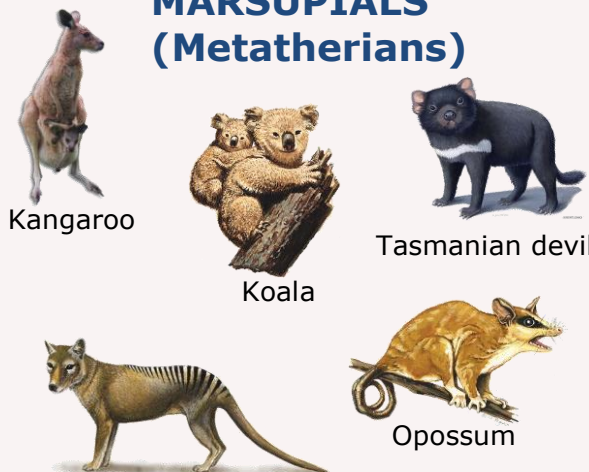
**MONOTREMES
(Prototherians)**



Ornithorynchus
(Platypus)

Equidna
(Spiny ant-eater)

**MARSUPIALS
(Metatherians)**



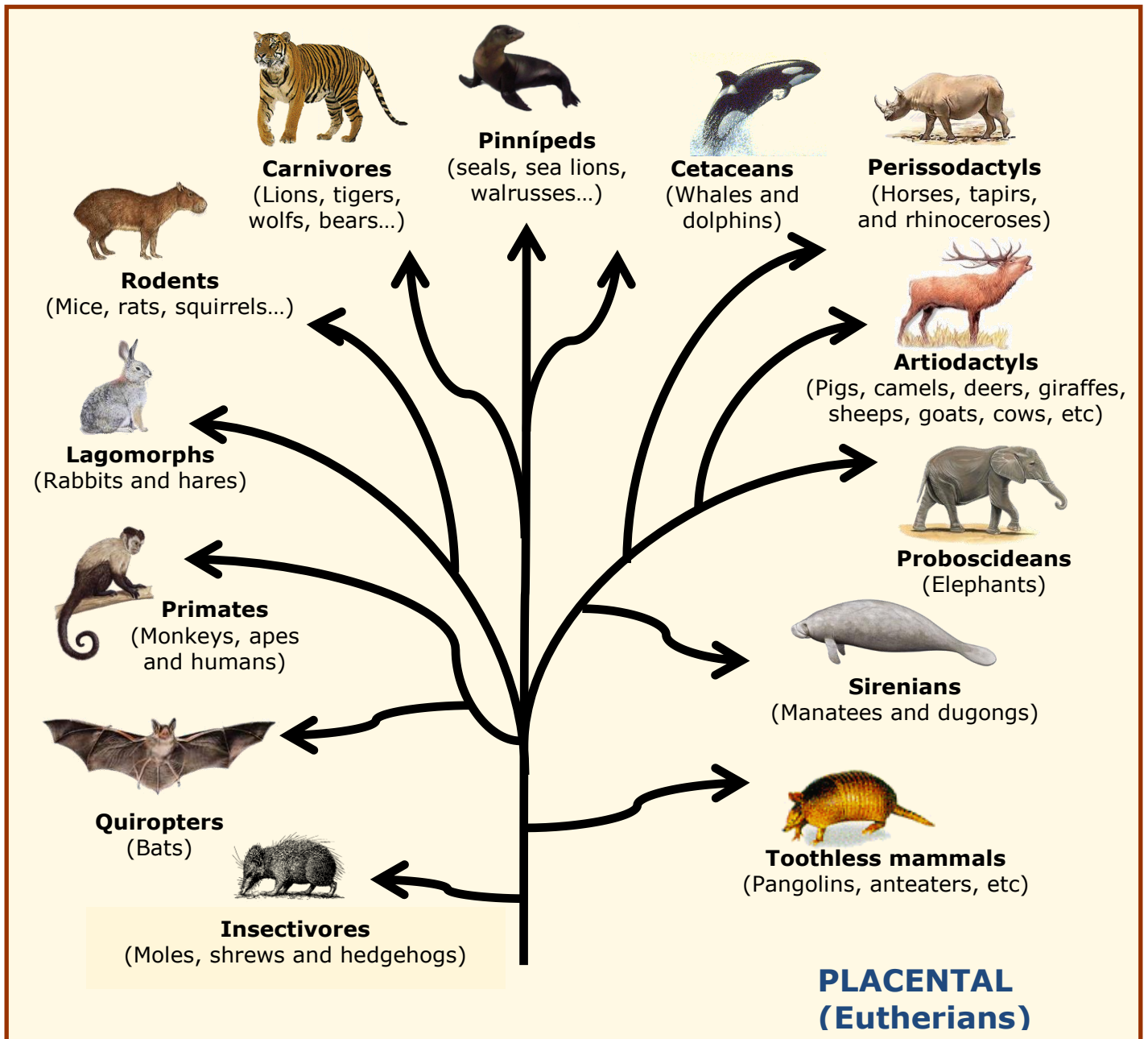
Kangaroo

Koala

Tasmanian devil

Marsupial wolf

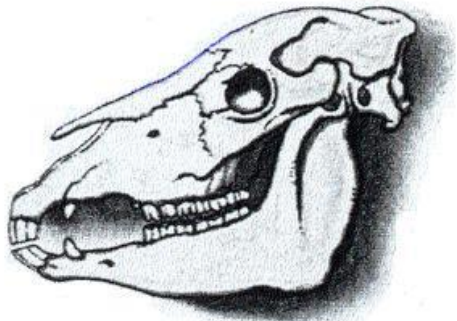
Opossum



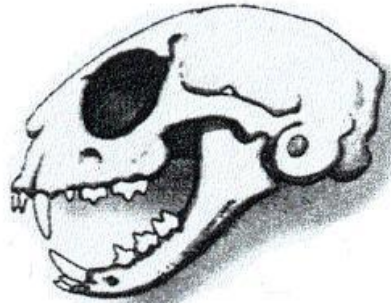
READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:

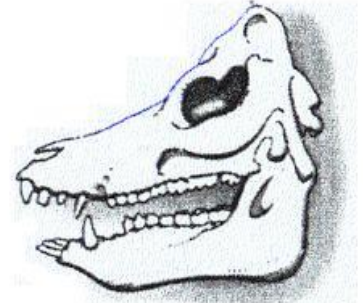
Remember: you must make complete sentences.

2.1. Answer the questions about mammal jaws:

1



2



3

a. Indicate, in each picture, the different types of teeth:

- *Incisors* (colour them in yellow)
- *Canines* (colour them in red)
- *Molars* (colour them in blue).

b. What type of tooth is more developed in every case?

c. We can deduce by the type of dentition, what kind of food they take. Try to identify what of the skulls belong to a *carnivorous*, to a *herbivorous* and to an *omnivorous*.

2.2. Listen and indicate if the described characteristic belongs to:

- a. Placentals
- b. Marsupials
- c. Monotremes

3. Birds

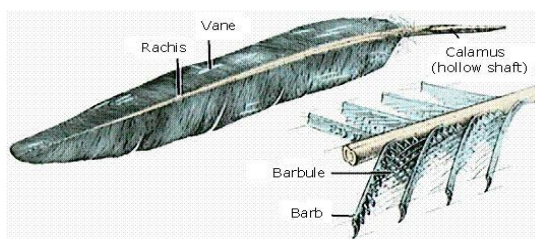
There are about 10,000 species of birds. Birds appeared 160 million years ago. They evolved from reptiles related to dinosaurs that developed feathers and capacity for flying.

a) Habitat

Birds are **terrestrial tetrapods**, although some of them are adapted to pass a lot of time on water (e.g. penguin). Most are flying animals but some have lost this capacity (e.g. ostrich)

b) Morphologic characteristics

- They have **four limbs**. The forelimbs are **wings** and the hind limbs are legs.
- Their body is divided into: **head, trunk** and **tail**.
- Their skin is covered by **feathers**. They protect the bird of heat loss and are the sustentation surface for flying.



c) Vital functions:

Nutrition:

The **digestive system** is complete. They have a mouth covered by a **beak** without teeth, a very muscular stomach, intestine and anus. It opens outside by the **cloaca**, a common opening to digestive, reproductive and excretal systems. Their feeding is very diverse and the shape of beak is adapted to.

They need a lot of energy for flying, so that they have many adaptations to increase the amount of oxygen that arrives to muscles.

Birds breathe through **lungs**. They have special organs called **air sacs** attached to their lungs that increase the amount of oxygen that a bird can take.

They have **double circulation**. Their heart has **four chambers**: two upper atriums and two lower separated ventricles, so that they have **complete circulation**.

They have two **kidneys**.

Interaction

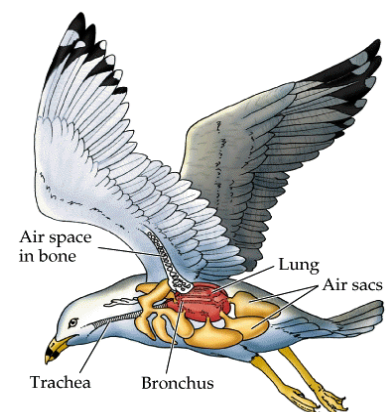
They have a well-developed brain and sense organs: eyes (with eyelids) ears (without auricles), taste and touch.

They are **homeotherms** (warm-blooded).

Bird skeleton is compact and strong. They have some **fused bones** (some of the vertebrae, ribs and hip bones). This makes the skeleton more rigid than in other vertebrates and allows move wings more efficiently.

They have **hollow bones** that reduce the weight of bird, making easier fly.

They have **keel**, a prolongation of the breastbone (sternum) that provides of a good attached for the powerful flight muscles.



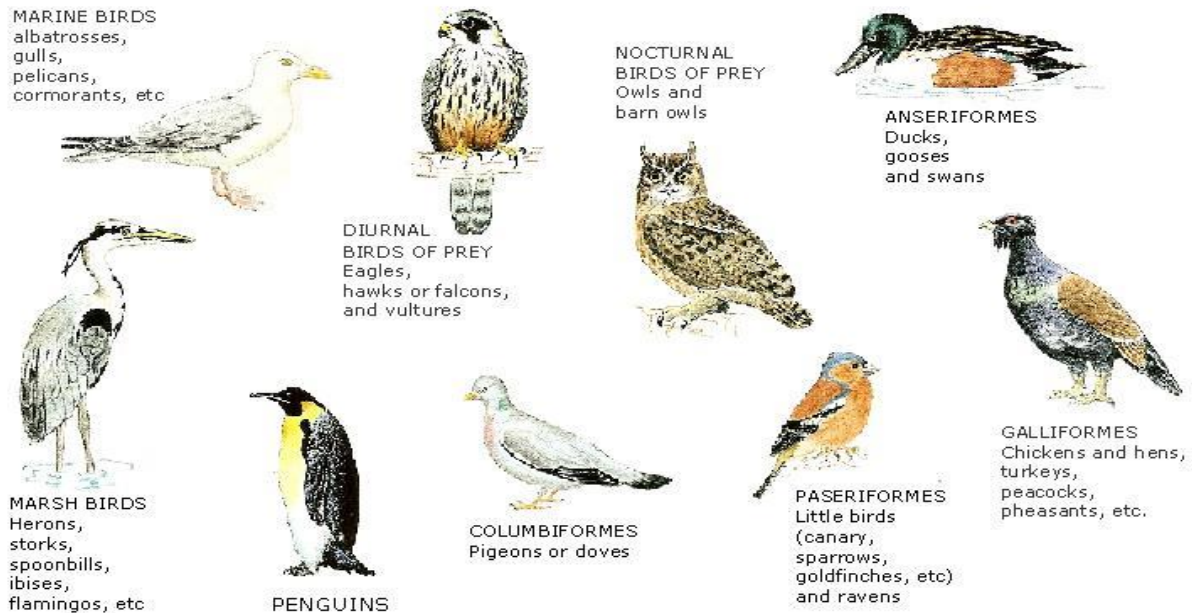
Reproduction:

Fertilization is internal. They are **oviparous**, this is the embryo develops inside an egg. This egg has a hard and rigid shell and an internal impermeable membrane (amnion). They incubate the eggs and take care of their young (chicks).

d) Classification:

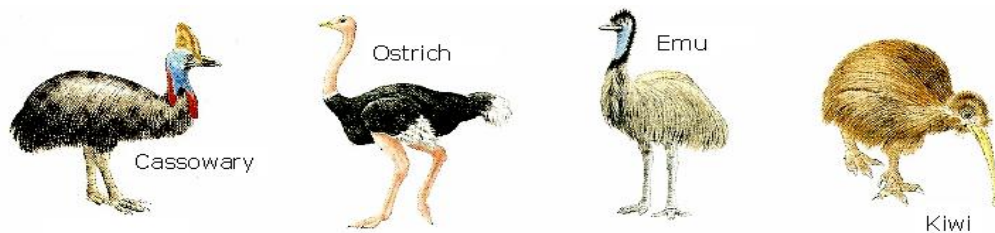
- **Carinatae** (flying birds)

They have keel. It is the most numerous group.



- **Ratites** (non-flying birds)

They don't have keel and are adapted to running. Their wings are atrophied and reduced.



READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:

Remember: you must make complete sentences.

3.1. The shape of the beak of Birds is an adaptation to the type of feeding. Can you relate every picture on the right with its correspondent way of feeding?

- a. They use it to make holes in wood looking for insects.
- b. They use it to break seeds.
- c. They use like a harpoon to fish.
- d. They use it to tear meat.
- e. They use it to sweep water surface to catch molluscs and insects.



3.2. Listen and indicate which of these characteristics are adaptations for flying.

4. Reptiles

It is estimated that there are about 8,200 species of reptiles.

Reptiles appeared more than 310 million years ago.

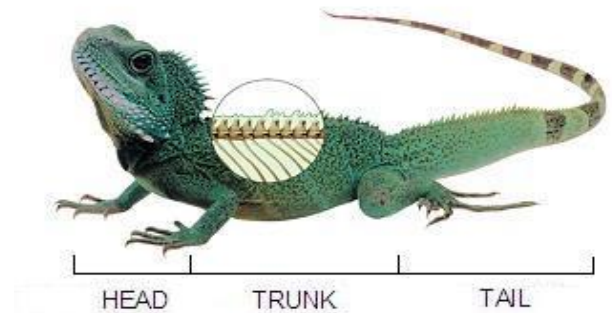
They evolved from a group of amphibians that developed impermeable skin without glands, and eggs with shell that allowed them leave wet environments.

a) Habitat

Reptiles are terrestrial tetrapods. Most reptiles live in very dry environments, although some of them spend a lot of time in water (e.g. crocodiles) and some are marines (e.g. marine tortoises).

b) Morphologic characteristics

- They have **four limbs**, except snakes that do not have legs.
- Their body is divided into: **head, trunk** and **tail**.
- Their skin is thick and is covered by hard **scales** and does not have glands. It protects them from water loss. Lizards and snakes shed their skin and tortoises have a hard shell called *carapace*.



c) Vital functions:

Nutrition:

The **digestive system** is complete. They have a mouth, stomach, intestine and anus. It opens outside by the **cloaca**. Most are carnivorous. They have teeth to capture preys. Turtles do not have teeth but have beak. Many snakes have poisonous gland connected to fangs.

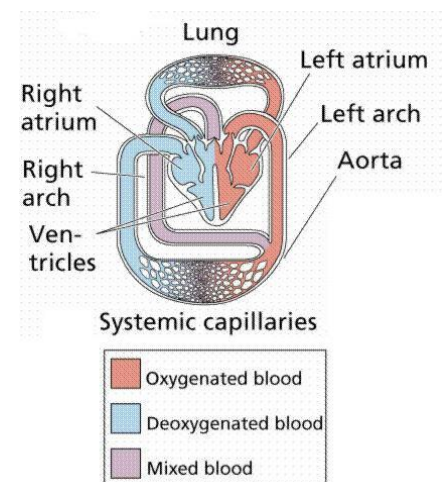
Reptiles breathe through **lungs**.

They have **double circulation**.

Their heart has **four chambers**:

two upper atriums and two lower connected ventricles, so that they have **incomplete circulation**. This means that oxygenated blood and deoxygenated blood mix.

They have two **kidneys**.



Interaction

They have a well-developed brain and sense organs: eyes (with eyelids), ears (without auricles) and taste, smell and touch.

They are **poikilotherms** (cold-blooded). That means that they can not keep their body temperature constant. They adapt it to the environment temperature.

Reproduction:

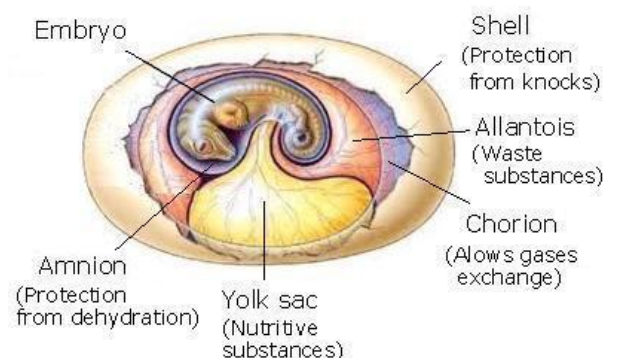
Fertilization can be **external** or **internal**.

Most of them are **oviparous**.

Some snakes are **ovoviviparous**, this is the embryo develops inside an egg that remains inside the female until hatching.

They lay eggs with a flexible shell and an internal impermeable membrane (amnion) that protect the embryo and allows laying them out of water.

Usually, they do not incubate the eggs or take care of their young.



d) Classification:

- **Chelonians** (Turtles and tortoises)

Their body is covered by a carapace.
They don't have teeth, but a beak.
Adults are mainly terrestrial and some are aquatic (fresh water and marines)



- **Crocodylians** (Crocodiles, alligators and gavials)

Their body is elongated and large.
They live in aquatic environments (swamps and rivers)
All of them are carnivorous.

- **Squamata**

They live terrestrial environments.
All of them are carnivorous.

- **Saurians** (Lizards).
They have four limbs

- **Serpents** (Snakes).
They do not have limbs.



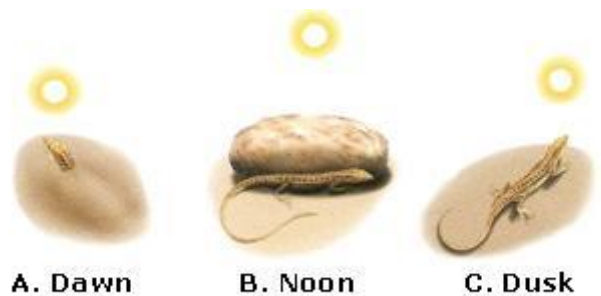
READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:
Remember: you must make complete sentences.

4.1. Reptiles are *poikilotherms* or cold-blooded animals.

a. What does it mean?

b. In spite of this, many of them can control their body temperature keeping it, higher or lower than the environment, with their behaviour. Pictures represent a desert lizard in different day moments. Describe its behaviour in each moment and explain what consequences can it has in its body temperature.



- A. *At dawn, the lizard, as a result*
- B.
- C.

4.2. Listen and relate each sentence with the group of Reptiles it belongs to:

- a. Chelonians
- b. Crocodylians
- c. Saurians
- d. Serpentes

5. Amphibians

It is estimated that there are about 7,000 species of amphibians.

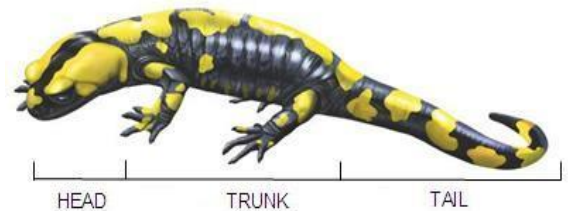
Amphibians appeared more than 360 million years ago. They are the oldest group of tetrapods. They evolved from a group of fish that developed legs and primitive lungs.

a) Habitat

"Amphibians" means "double life". All amphibians begin life in water, but adults are terrestrial animals although they have to live in wet places, near fresh water.

b) Morphologic characteristics

- They have **four limbs**.
- Their body is divided into: **head, trunk** and **tail**.
- Their **skin** is very thin and is not covered by any protective structure. They have glands that produce mucus and keep the skin moist.



c) Vital functions:

Nutrition:

The **digestive system** is complete. They have a mouth without teeth, a stomach, an intestine and an anus.

It opens outside by the **cloaca**.

Young usually are herbivorous and adults carnivorous.

Young breathe by **gills**, and adults breathe by **lungs** and **skin**.

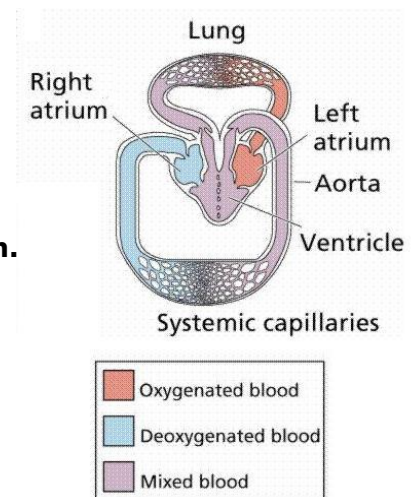
Amphibians have **double circulation**.

Their heart has only **three chambers**:

two upper atriums and a lower ventricle.

They have **incomplete circulation**.

They have two **kidneys**.



Interaction

They have a well-developed brain and sense organs: eyes (with eyelids), ears (without auricles), taste, smell and touch.

Many of them have poisonous glands.

They are **poikilotherms** (cold-blooded).

Reproduction:

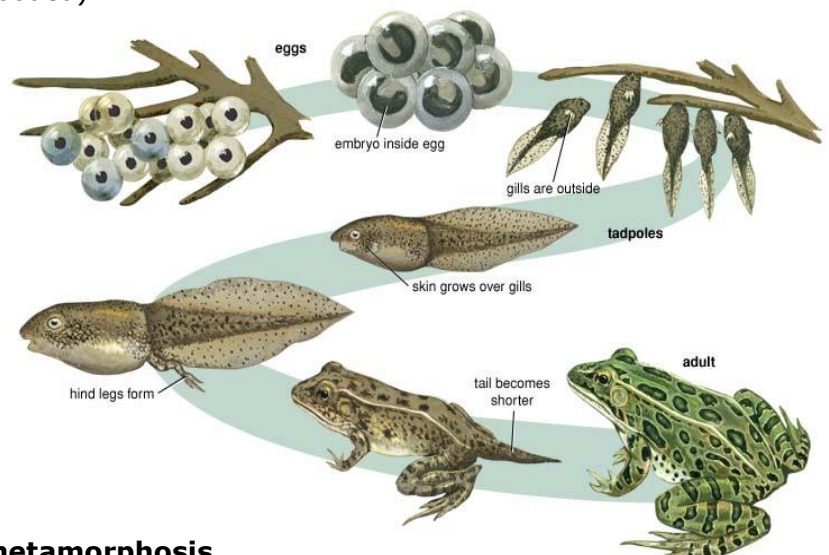
Fertilization can be **external** or **internal**.

They are **oviparous**, except salamanders that are **ovoviviparous**.

They have to lay eggs into water, because they do not have impermeable shell.

Usually, they do not care the eggs or young.

Young (tadpoles) have to change to become adult. They undergo **metamorphosis**.



d) Classification:**- Anurans** E. g. Frogs and toads.

Their body is compact.
They don't have tail.
Their hind limbs are longer and stronger than the forelimbs
Adults are mainly terrestrial.

**- Urodeles** E.g. Salamanders and newts

Their body is elongated.
They have tail.
Their hind limbs and forelimbs are similar
Adults are mainly aquatic.

READING ACTIVITIES

After reading the text, copy and answer the following questions into your notebook:

Remember: you must make complete sentences.

5.1. The following sequence of pictures represents the metamorphosis of a frog.

- a. Cut out them and glue on the right order on your notebook. Do the same with the labels. Relate every phase with its description

Female frog lays eggs on water and male frog fertilizes them

One tadpole hatches from every egg. It has gills and tail and lives on water.

Gills and tail disappear and tadpole develops legs.

Adult frog can live out of water. It has lungs and four legs.

- b. Why do they have to lay eggs in water?
- c. What phases have gill breathing?
- d. What differences are there between tadpole and adult frog feeding?

5.2. Listen and relate each sentence with a characteristic of Amphibians:

- Metamorphosis
- Pulmonary and cutaneous respiration
- Tetrapods
- Poikilotherms (cold-blooded)
- Naked skin with mucuous glands

6. Fish

This is the most numerous group of Vertebrates.

It is estimated that there are more than 25,000 species of fish.

Fossil evidence indicates that fish appeared about 500 million years ago.

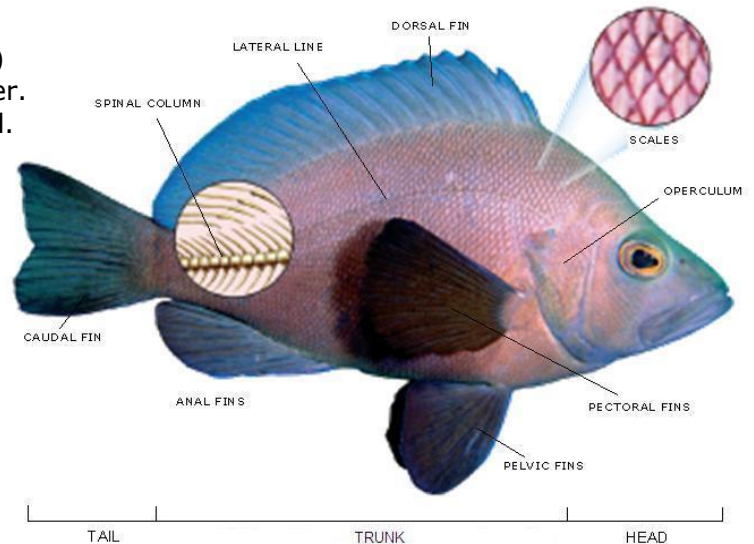
a) Habitat

All fish are **aquatic** vertebrates.

We can find them in **fresh water**, living in lakes or rivers, but the most part of them are **marines**.

b) Morphologic characteristics

- Their body is **spindle-shape** (fusiform) to make them easier to move into water. It is divided into: **head, trunk** and **tail**.
- Their limbs are modified into **fins** for swimming.
- Their skin is covered with **scales**, which protect the body and reduce the friction with water.
- Most of them have **swim bladder**. It is a balloon-like organ filled with gases which help to float.



c) Vital functions:

Nutrition:

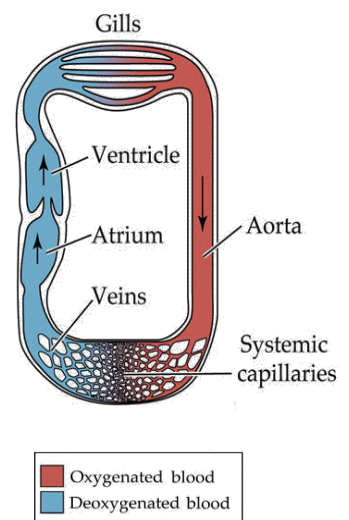
The **digestive system** is complete. They have a mouth with teeth, a stomach, an intestine and an anus. It opens outside by the **cloaca**. Their type of feeding is very diverse.

They breathe through **gills**.

Fish have **simple circulation**. This means that blood follows a single circuit: heart-gills-body-heart.

Their heart has only **two chambers**: an upper atrium and a lower ventricle. Only blood without oxygen flows through it.

They have two primitive **kidneys**.



Interaction

They have a well-developed brain and sense organs: eyes (without eyelids), ears (without auricles), taste, smell and touch. In addition they have an exclusive sense organ, the **lateral line**. It is row of sensorial receptors along each side of the body and the head. This system detects water vibrations.

They are **poikilotherms** (cold-blooded).

Reproduction:

Most of them have **external fertilization**. The female lays eggs in the water and the male drops sperm on them.

They are **oviparous** and usually do not care the eggs or young.

d) Classification:

- Bony fish

They are the most numerous group of fish (95 %).
 Their skeleton is made of **bone**.
 The skin is covered by **scales**.
 They have protected the **gill openings** by an operculum.
 They have a very diverse feeding kind.



Sole



Tuna



Goldfish



Sea horse

- Cartilaginous fish

Their skeleton is made of **cartilage** (no bone)
 The skin is covered by **dermal denticles** (no scales). It is similar to sandpaper.
 They do not have protected the **gill openings** by an operculum.
 They do not have swim bladder.
 They are mainly predators.



Sharks



Rays

READING ACTIVITIES

After read the text, copy and answer the following questions on your notebook:

Remember: you must make complete sentences.

6.1. Answer the following questions:

- a. Which organ allows fish to breathe into water?
- b. What is the swim bladder?
- c. Which morphologic characteristics allow fish to move into water?

6.2. Complete the comparative chart cartilaginous fish and bony fish.

	Bony Fish	Cartilaginous Fish
Operculum		
Skeleton made of...		
Skin covered by...		
Swim bladder		
Examples		

6.3. Listen and identify which characteristic of fish is described:

- a. Spindle-shape body (fusiform)
- b. Scales
- c. Fins
- d. Gills
- e. Swim bladder
- f. Lateral line