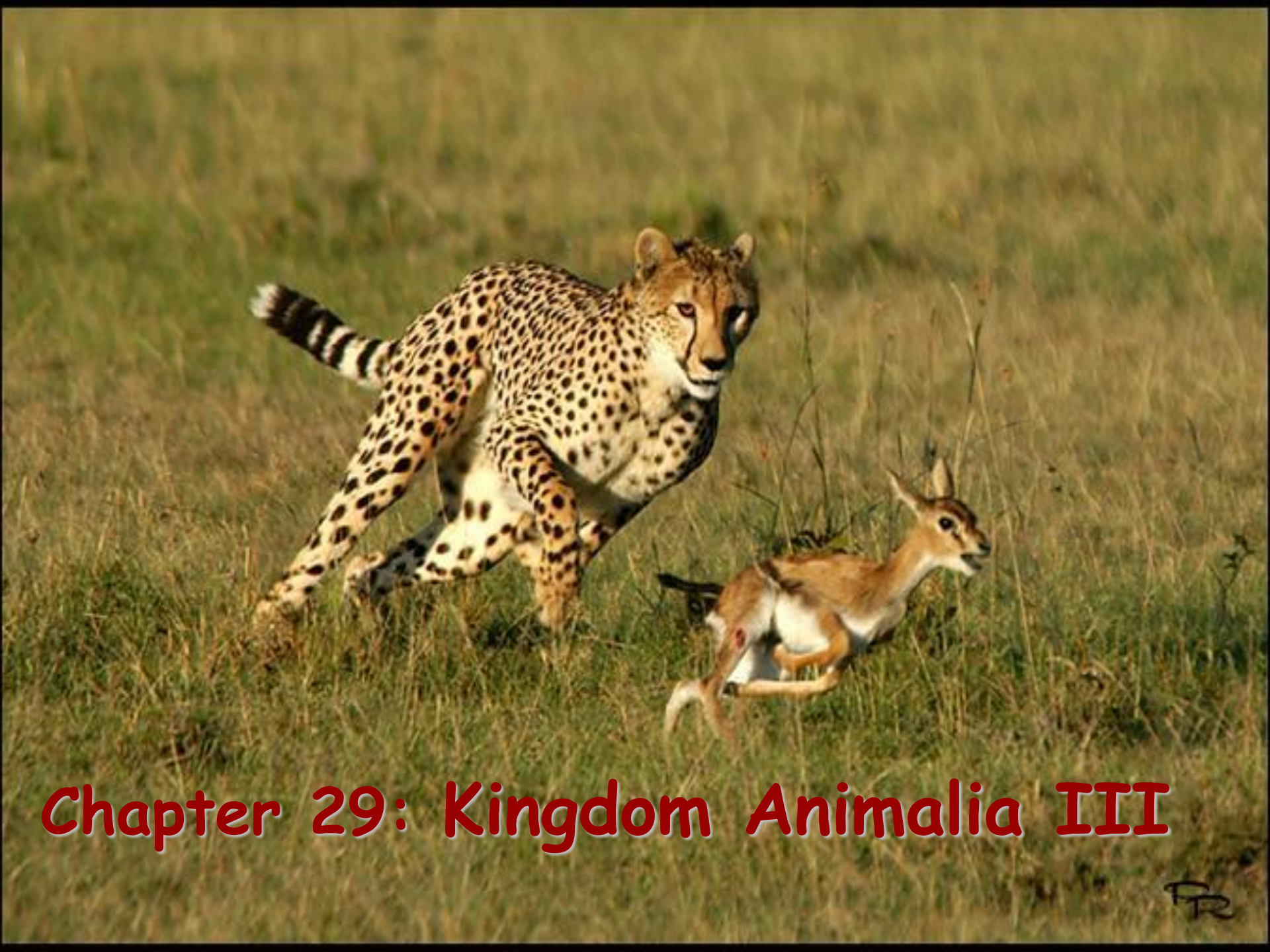
Go to the "Slide Show" shade above

Click on "Play from Beginning"

Kingdom Animalia III
Chordates

Learning CTR Online



Chapter 29: Kingdom Animalia III

WARM-UP

List the Evolutionary order of the Phyla of Animals & give an example.

Define Metamorphosis. Give the types.

Define Deuterostome. Which phyla?

WARM-UP

List the Evolutionary order of the Animals & give an example.

Porifera (*sponges*)
Coelenterates/**Cnidaria** (*hydra*)
Platyhelminthes (*flatworms, planarians*)
Nematoda (*round worms, heartworms, pinworms*)
Annelids (*segmented worms, earthworms, polychaetes, leeches*)
Echinoderms (*starfish*)
Mollusks (*gastropod: snails, bivalve: clams, cephalopod: squid*)
Arthropods *(arachnid (spiders); crustaceans (crabs); myriapods (millipeds & centipedes); insects (butterflies, Grasshoppers, lice, fleas, beetles, wasps)*
Chordates

Define Metamorphosis. Give the types.

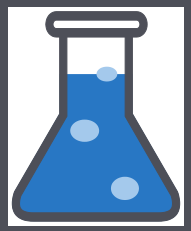
Change in form from egg to adult

Complete (4 stages); incomplete (no pupa stage)

Define Deuterostome. Which phyla?

Echinoderm & chordates ("anus first")

Lesson Objectives



By the end of this lesson, you should be able to:

- ❑ Understand and explain the general features of Chordates.
- ❑ General Features include:

  Phylum Examples of organisms Location

  Symmetry Body plan (tissue layers)

  Coelom relationship (acoelomate, pseudocoelomate, coelomate)

  Protostome or deuterostome Reproduction

  Special features

- **Science Practice:** Lab Frog Dissection

Phylum Chordata

http://somup.com/c3XVD9vAxm (5:08) Chordates

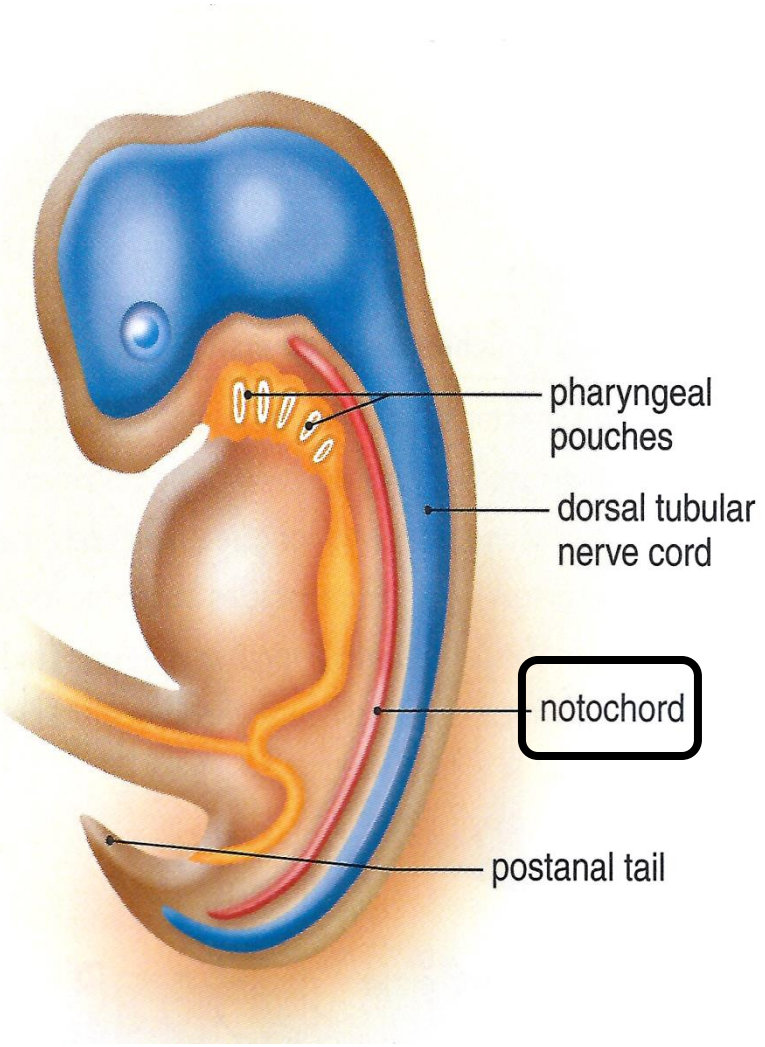
- Contains **Invertebrates** and **Vertebrates**.
- Defined by the presence of a **Notochord**.

Phylum Chordata

At some time in their life, a chordate has the following 4 characteristics:

1) **DORSAL NOTOCHORD**

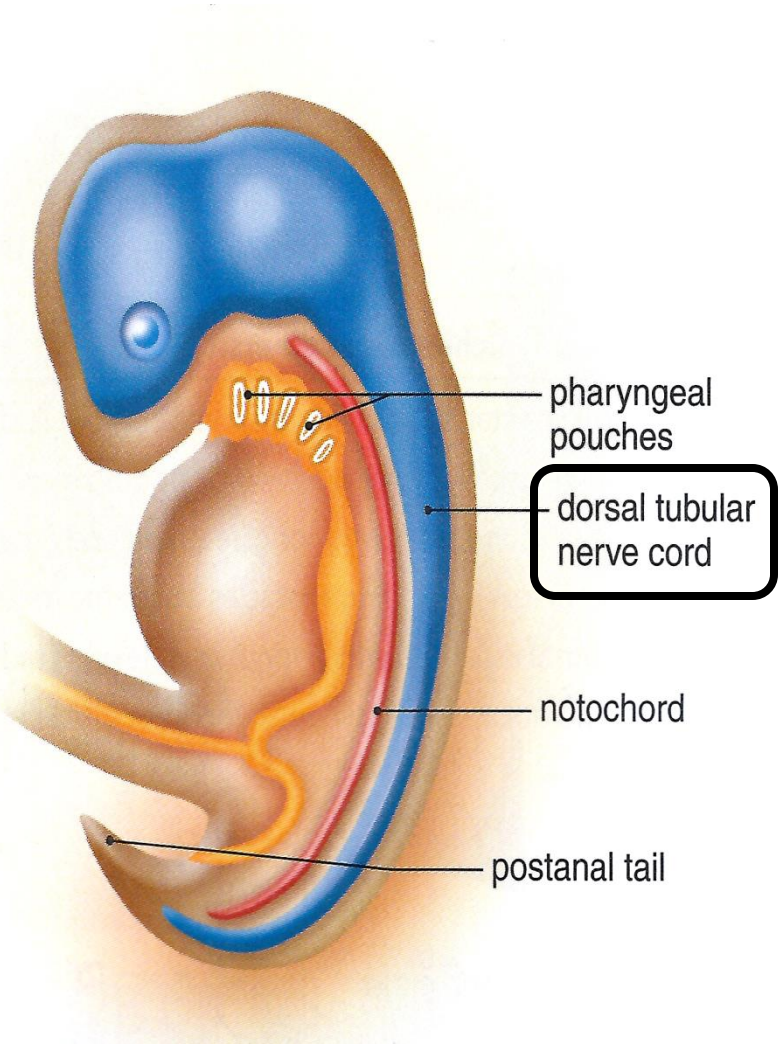
- All chordates start with a soft, flexible notochord, which in many is replaced with the vertebral column.
- Also known as the Backbone (Vertebral Column) in vertebrates.



Phylum Chordata

2) **DORSAL, TUBULAR NERVE CORD**

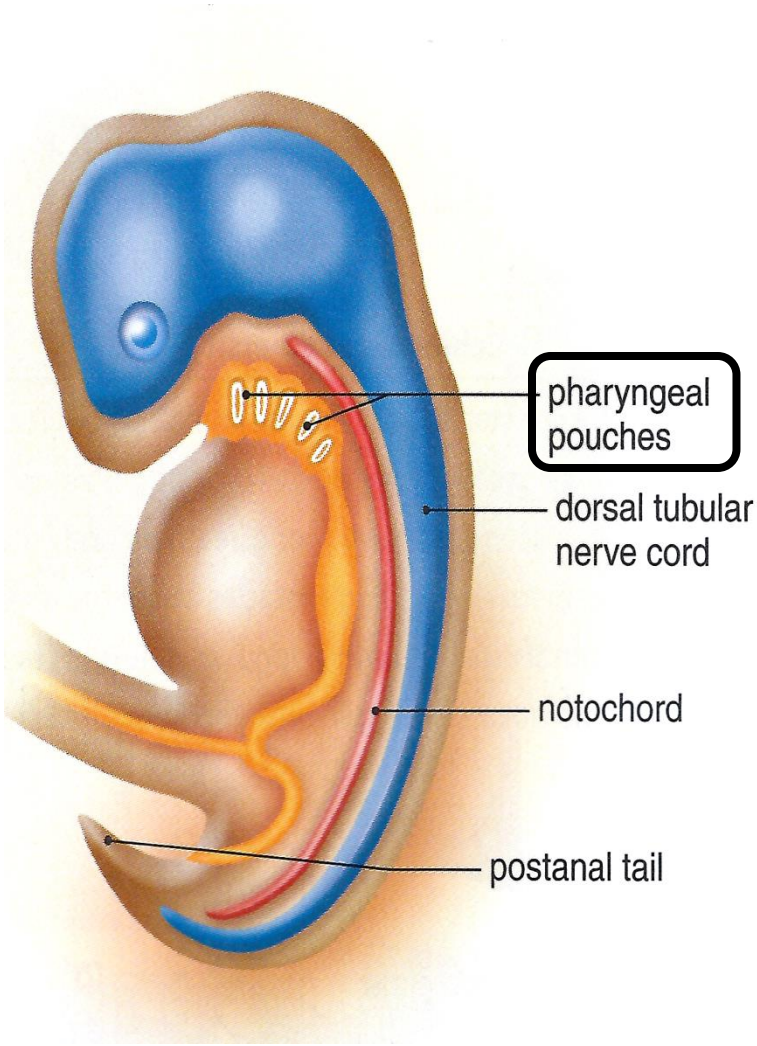
- Also called the Spinal Cord.
- Runs down the back and helps the brain communicate with the rest of the body.
- Often protected by the Vertebral Column or Notochord.



Phylum Chordata

3) **PHARYNGEAL POUCHES**

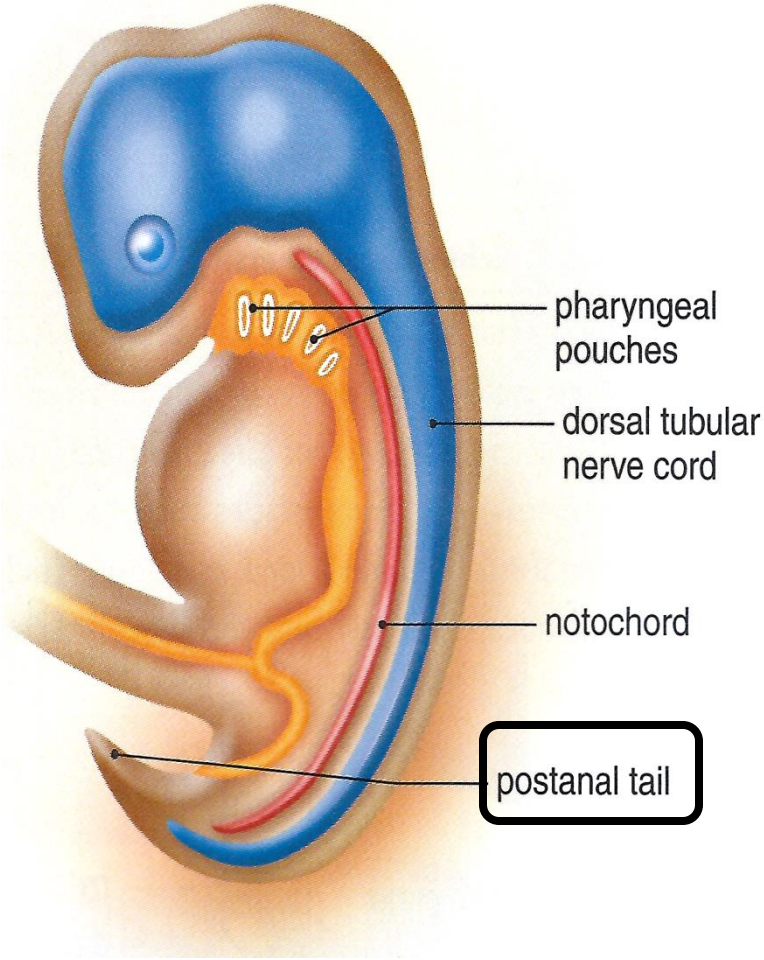
- Seen only during embryonic development in most vertebrates.
- In invertebrate chordates, fishes, & some amphibian larvae, these become functioning Gills.
- In terrestrial vertebrates that breathe with lungs, the pouches are modified for various purposes.



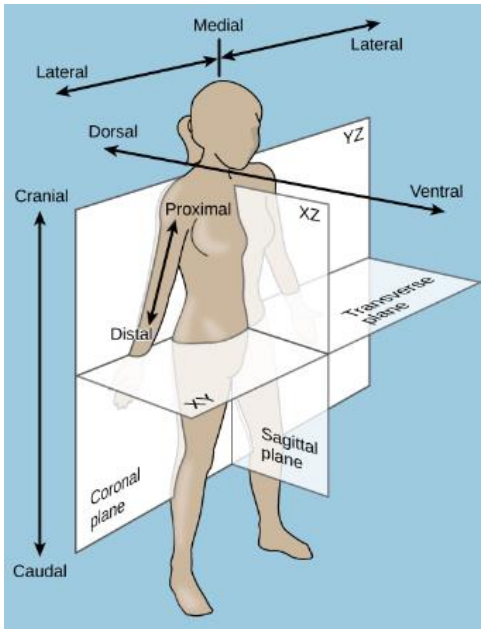
Phylum Chordata

4) **A TAIL**

- Extends beyond the anus in all chordate embryos.

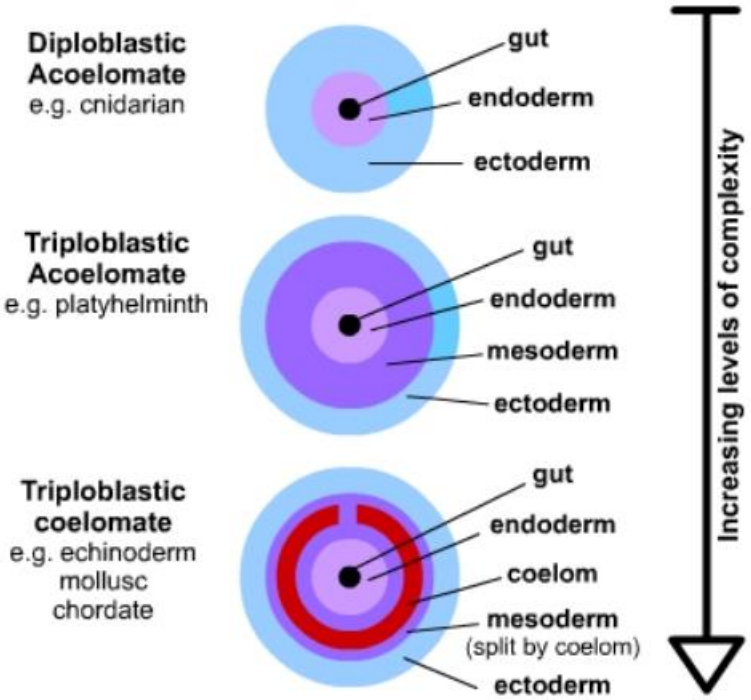


Phylum Chordata

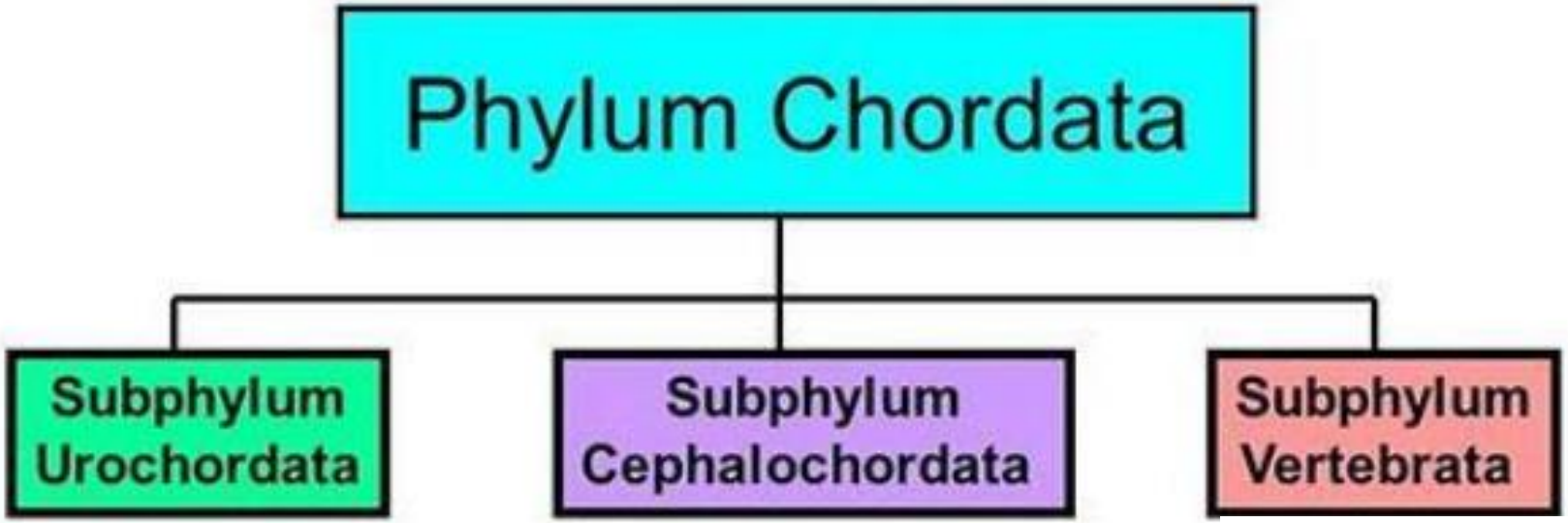


All Chordates:

- Have bilateral symmetry
- Are triploblastic
- Are Coelomates
- Are Deuterostomes (anus first development)
- Mostly Reproduce sexually

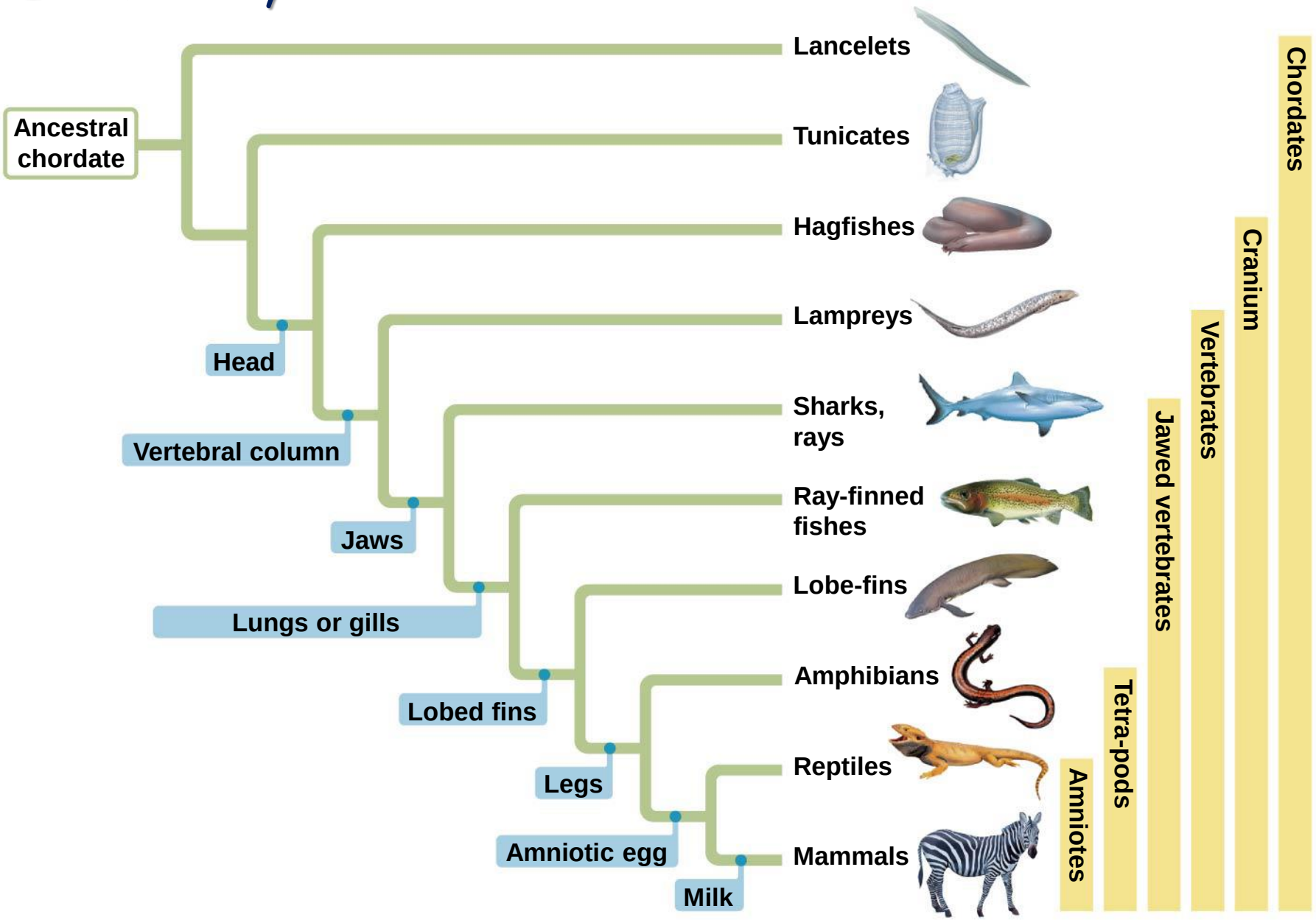


SubPhyla of Chordata



Fish (Pisces)
Reptiles
Birds (Aves)
Amphibians
Mammals

Evolutionary "Tree"



Chordate Diversity

Characteristics that distinguish each chordate group from the preceding one (arranged according to complexity):

- Tunicates & Lancelets are the simplest (no "head").
- Presence of Cranium that protects the brain [hagfish].
- Presence of Vertebrae that protects the Spinal Cord [lamprey].
- Presence of Jaws (bones that frame the entrance to the mouth) [sharks & rays].
- Presence of Gills for breathing [bony fish].
- Lungs [birds, reptiles, mammals]

Chordate Diversity

Characteristics that distinguish each chordate group from the preceding one (arranged according to complexity):

- Presence of Limbs for locomotion.
  - Birds (bipedal): vertebrates with one pair of limbs to walk, attach, grab, etc. (amniotic eggs)
  - Tetra-pods: vertebrates with two pairs of limbs that enables animals to walk on land.
    - Amphibians (lay eggs in water)
    - Amniotic Eggs
      - Reptiles, Birds,
      - Mammary glands (Mammals)

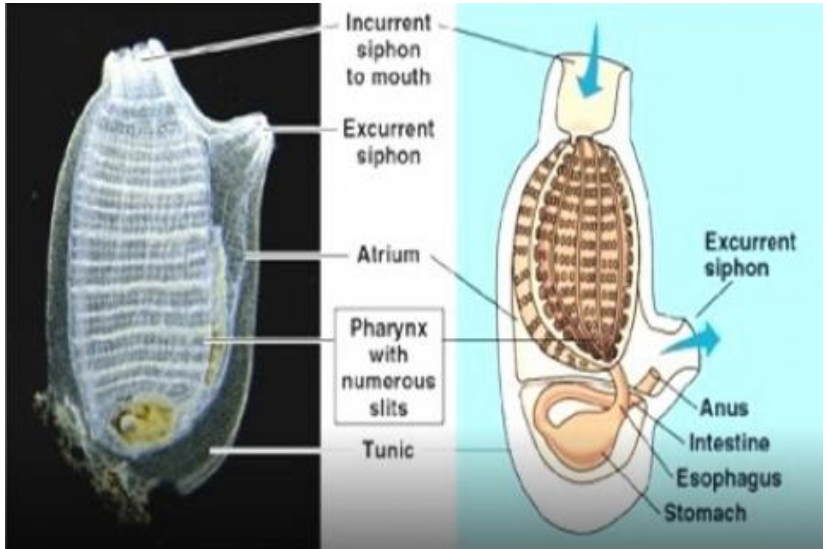
Invertebrate Chordates – no cranium

- Subphylum Urochordata
- TUNICATES (SEA SQUIRTS):
  - Sessile marine animals that resemble a bag with two siphons.
  - Only the free-swimming larva has all 4 chordate characteristics.

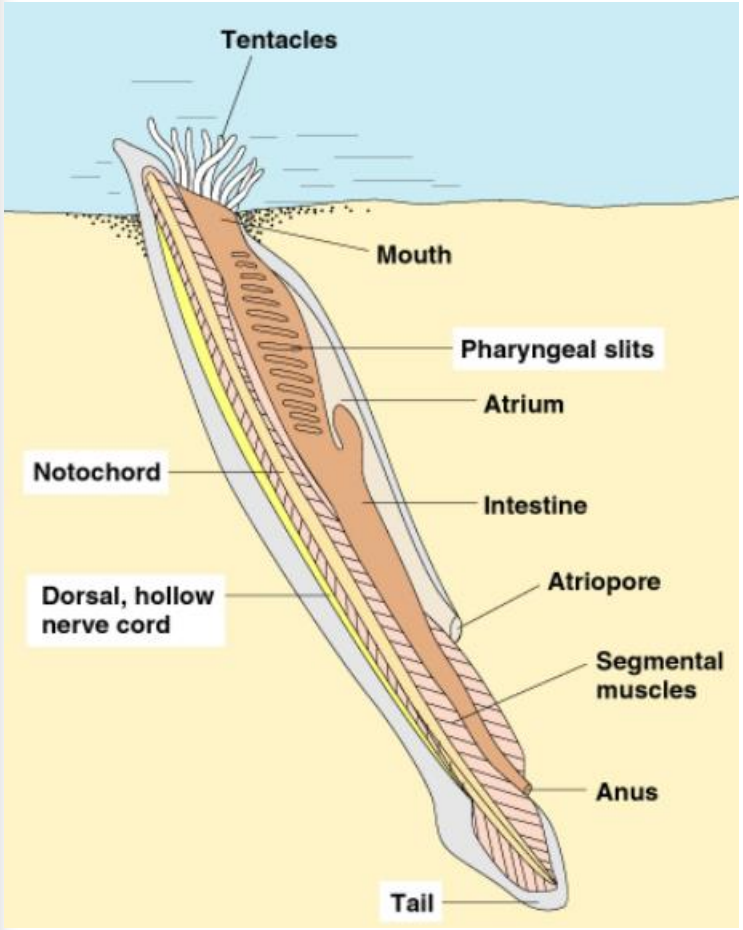
Invertebrate Chordates – no cranium

TUNICATES (SEA SQUIRTS):

- They have a shape of a bag, sessile and filter-feeding animals.
- They are found in seawater only.
- They have a nerve cord and notochord at the tail of their larvae. The Notochord is never replaced by the Vertebral Column.
- Both the nerve cord and the notochord are lost during metamorphosis.



Invertebrate Chordates – no cranium



Subphylum Cephalochordate

LANCELETS:

- Small, blade-like chordates that live in marine sands.
- Adults display all 4 major chordate characteristics.

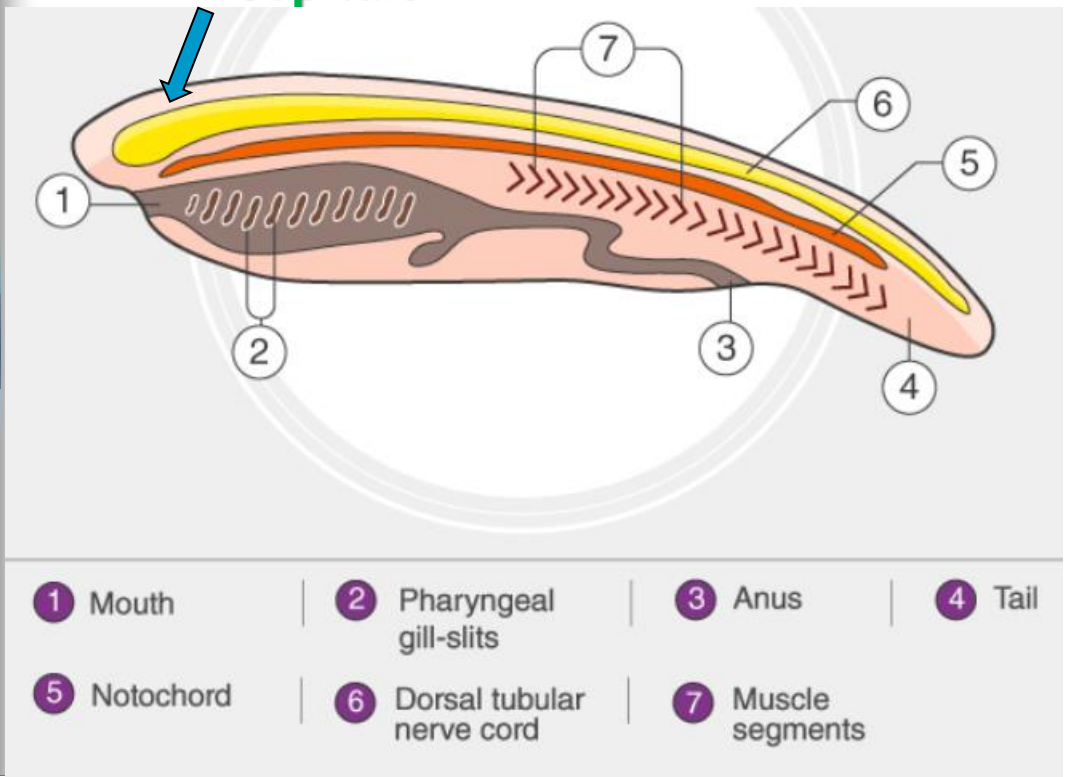
Invertebrate Chordates – no cranium

LANCELETS:

- Closed circulatory system.
- Filter feeders.
- Dorsal anterior neural tube "cephalo-"

- 5-7 cm in length.
- Separate sexes.

E.g. amphioxus



Two general types of chordates:

All chordates possess (at some time in their life):

Subphyla of invertebrates:

Protostome or Deuterostome?

QUICK CHECK

Two general types of chordates:

Invertebrate and vertebrate

All chordates possess (at some time in their life):

Dorsal Notochord; Dorsal nerve cord; pharyngeal pouches; tail

Subphyla of invertebrates:

Tunicates & Lancelets

Protostome or Deuterostome?

All chordates are deuterostome (anus first development)

QUICK CHECK

Chordate Diversity - Eggs

FISH & AMPHIBIANS lay eggs in water so they will not dry out (*or the embryo inside will die*).

REPTILES, BIRDS, & MAMMALS form **AMNIOTIC Eggs** which are water tight.

- Leathery or hard outer layer surrounds a Yolk that nourishes the developing embryo and enables it to survive outside the water.

FISH / PISCES

- Most diverse & abundant of vertebrates.
- Vary greatly in shape, size, & color.
- Occupy nearly all types of water (marine or freshwater).
- Segmented backbones, and Gills are present in this group.
- "ECTOthermic" (cold blooded).
- Scales.

FISH / PISCES

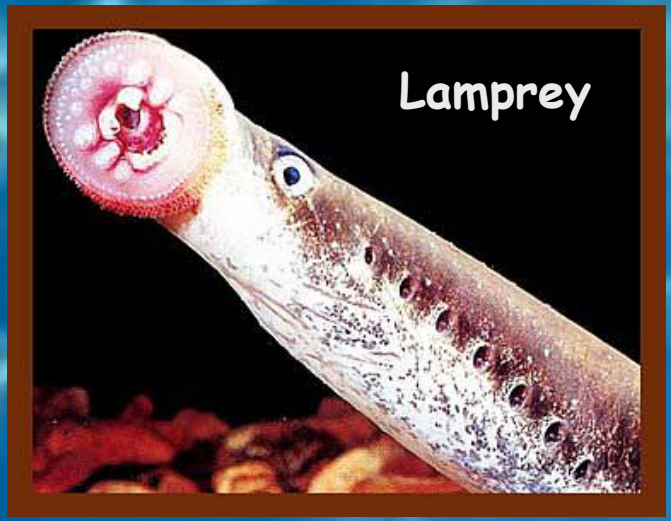
Main Groups:

- Jawless Fish
- Cartilaginous Fish
- Bony Fish
  - Ray-finned fish
  - Lobe-finned fish

"Jawless" Fish

Lampreys & Hagfish

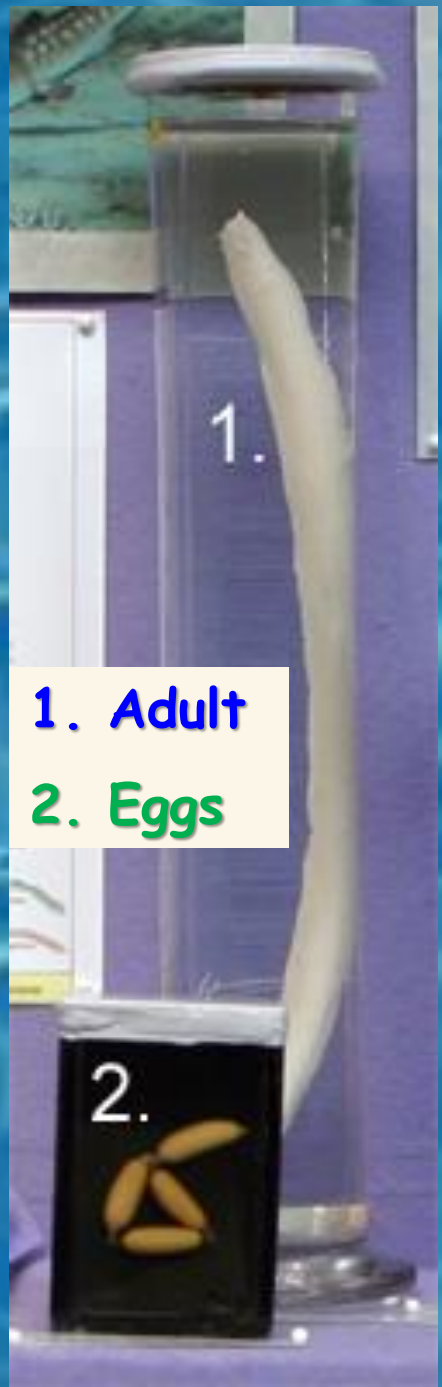
- Smooth, Scaleless skin.
- Gills present.
- NO Jaws or Fins.
- Notochord remains throughout organism's life.



"Jawless" Fish

Hagfish

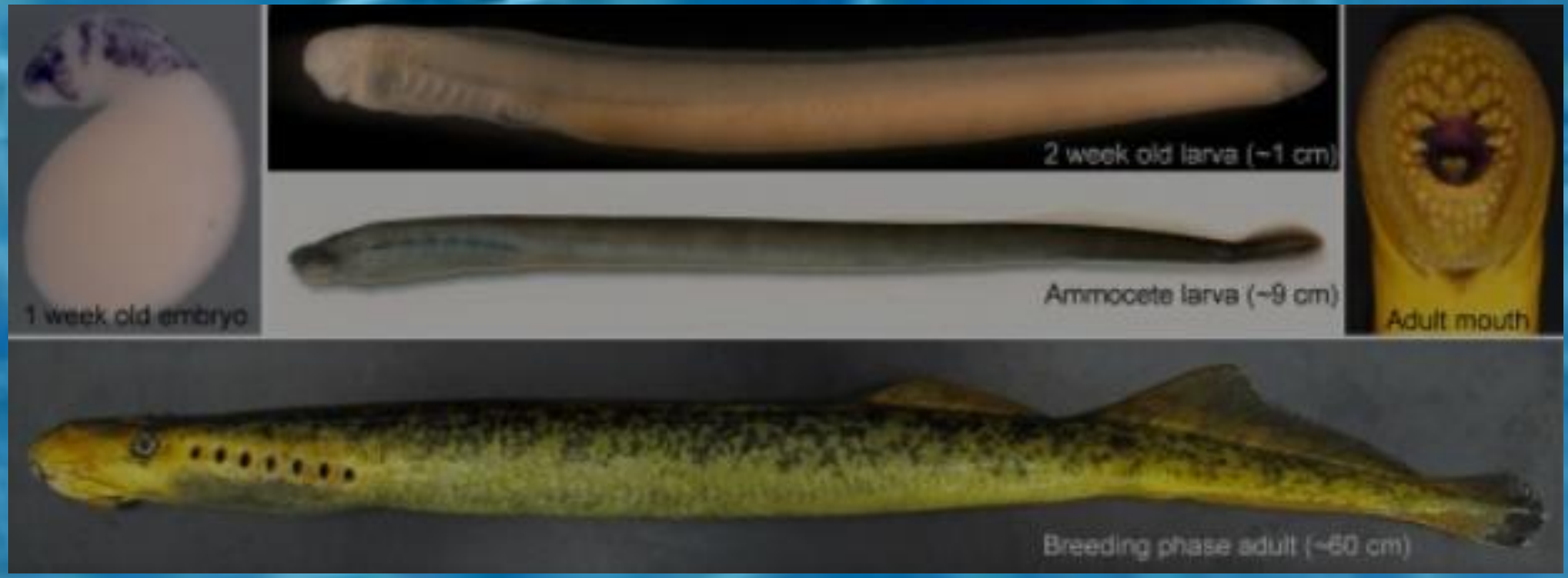
- "Agnatha"
- **Marine.**
- **Eel-like slime.**
- No vertebrae.
- **Scavengers.**
- Skull but no vertebral column.



1. **Adult**
2. **Eggs**

Lampreys "Jawless" Fish

- "Agnatha"; Live in fresh water.
- Complex eye. Adults are parasitic on other fish.
- No ossification (bones); actually have primitive vertebrae.
- Some genes help to repair human spinal tissue.
- Head



"Jawless" Fish

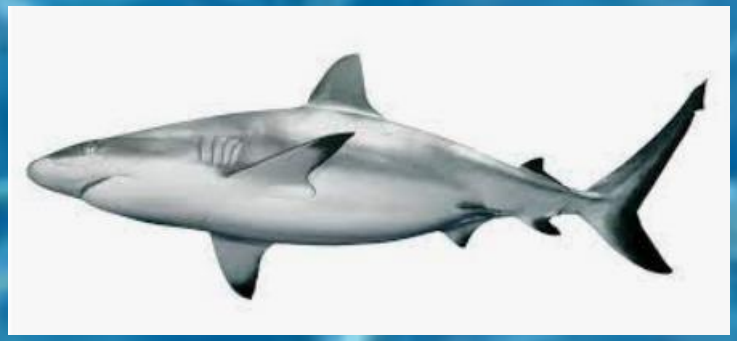
A sea lamprey on the banks of the Little Manistee River near Manistee, MI.

"Jawless" Fish

A sea lamprey
attached to the thumb.

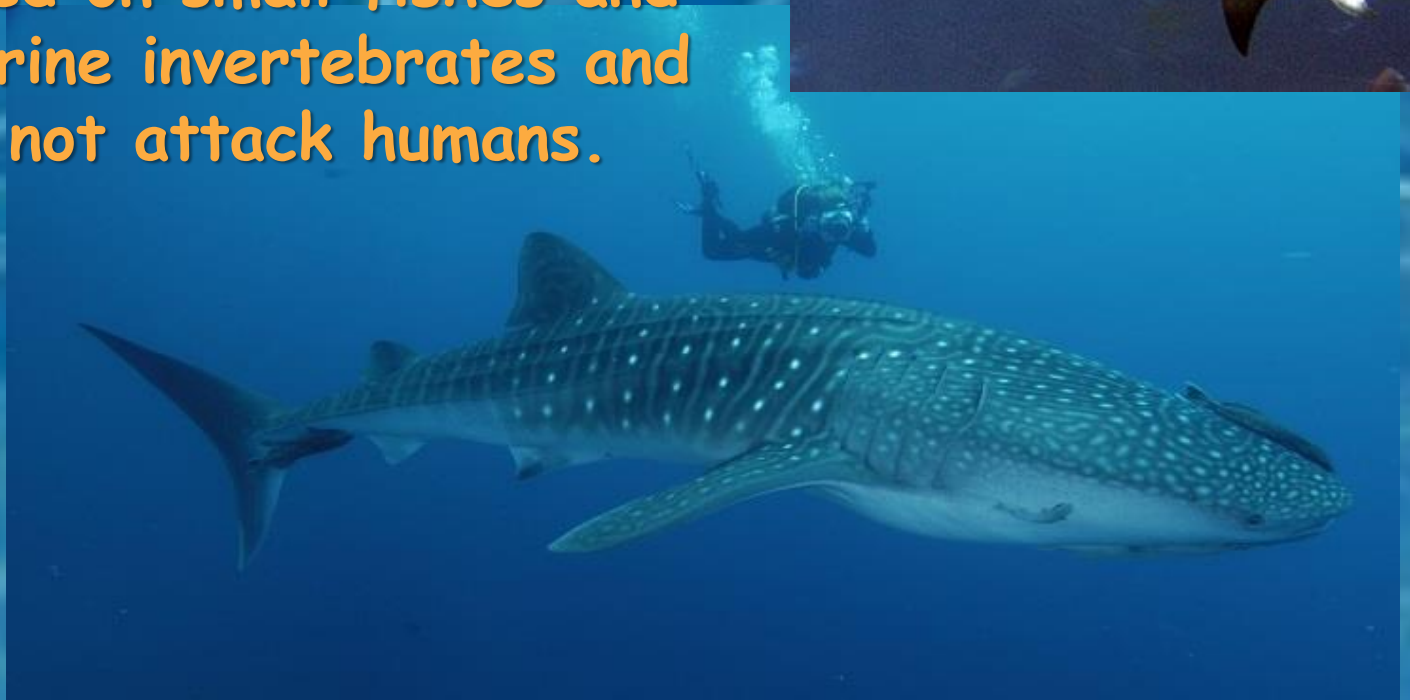
"Cartilage Fish" (Chondrichthyes)

- Sharks and Rays
- Flexible skeletons of Cartilage, not bone.
- Have movable jaws and paired fins.
- Gills present; some must swim continuously to keep water flowing over their gills.
- Rays live partially buried in the sand and feed on mussels and clams.



"Cartilage Fish" (Chondrichthyes)

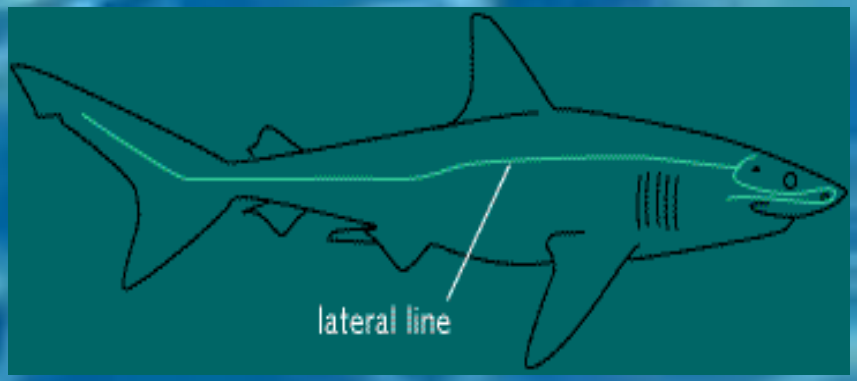
- One of the most dangerous sharks: **Hammerhead**
- Largest Sharks: **Whale Sharks**
  - Feed on small fishes and marine invertebrates and do not attack humans.



"Cartilage Fish" (Chondrichthyes)

Two well-developed senses enable these fishes to detect their prey:

1) **Lateral Line:** Sensory organ running both sides of the fish; collects information from the environment, such as vibrations & electrical currents.



2) **Keen sense of smell**
   - Part of the brain associated with smell is twice as large as the other parts.
   - Can detect 1 drop of blood in 25 gallons of water.

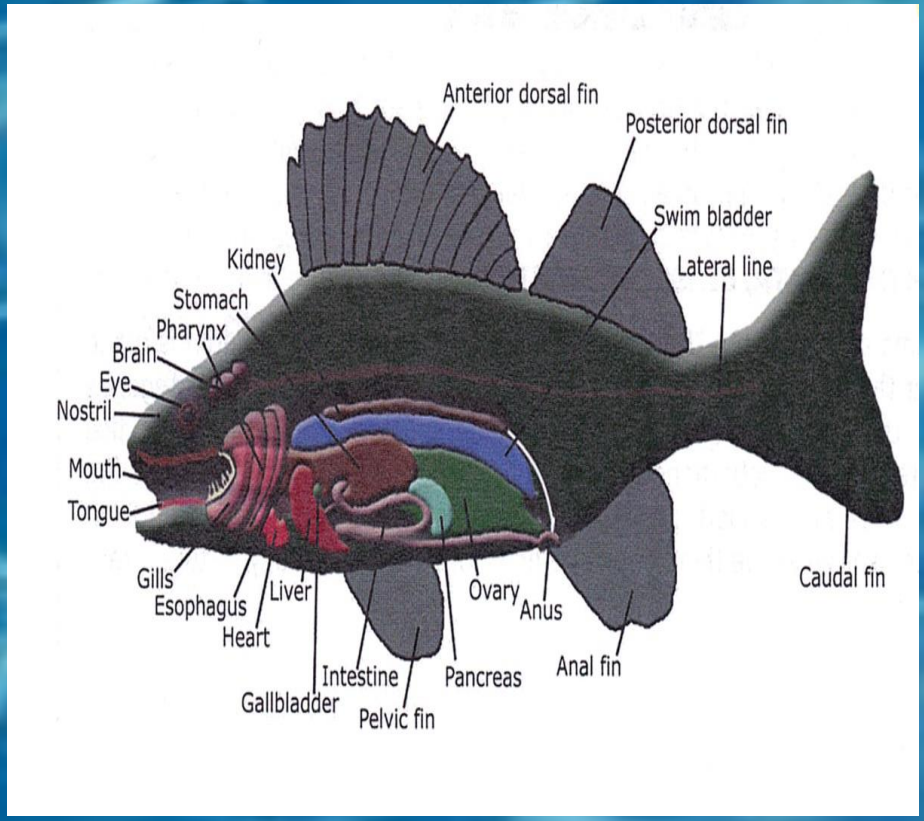
"Cartilage Fish"
(Chondrichthyes)

Sharks are SCAVENGERS that eat garbage & other waste from ships, injured fish & animals such as seals, turtles, birds, whales, crabs, & a wide range of fish.

- Multiple rows of teeth constantly replaced.
  - The shark's mouth has 6 to 20 rows of backward-pointing teeth.
  - They can detect blood from an injured animal as far as 500 miles away.
- They swim with a side-to-side motion of their asymmetric tail fins.
- Gas exchange requires constant passage of water over a shark's gills. So they must swim continually.

"Bony Fish" (Osteichthyes)

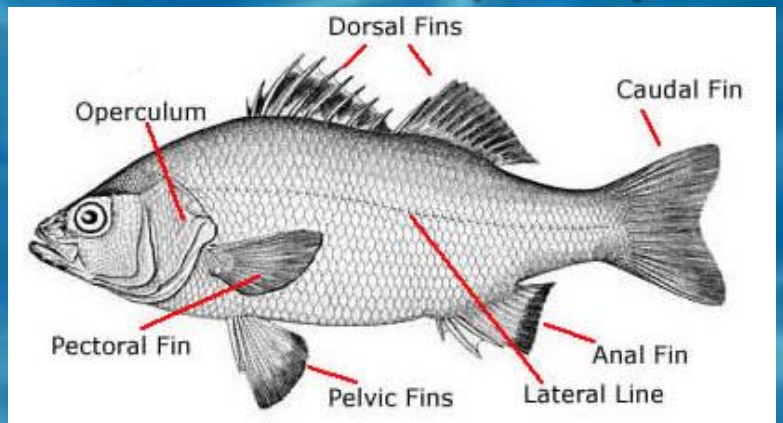
- Bony Fish are the most numerous and diverse of all vertebrates.
- Bony Skeletons.
- Well-developed organs & organ systems.
- Skin covered with Scales.
- External Fertilization



"Bony Fish" (Osteichthyes)

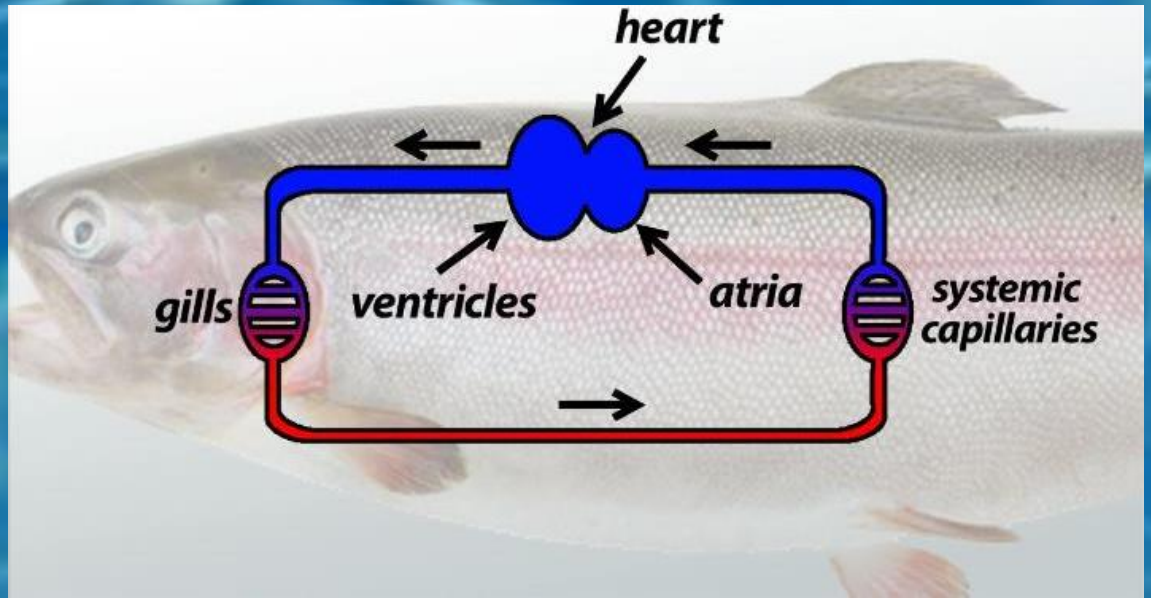
The central nervous system of Osteichthyes is **comprised of a brain (cephalization) and a spinal cord** (as in humans) **along** with distinct **Lateral Line**.

- **Possess hinged gill covering that directs water over the gills, eliminating the need for constant swimming.**
- **Gas / swim Bladder that helps fish adjust depth in the water due to buoyancy.**



"Bony Fish" (Osteichthyes)

- Fins are used in balancing and propelling the body.
- Gills are kept moist by the passage of water through the mouth and out of the gill slits.
- As water passes over the gills, oxygen is absorbed by the blood, and carbon dioxide is given off.
- Two-Chambered Heart.



Two Classes: **"Bony Fish"** (Osteichthyes)

RAY-finned Fish:

- Include: Eels, Minnows, Catfish, Trout, Tuna, Salmon, and others.

LOBE-finned Fish:

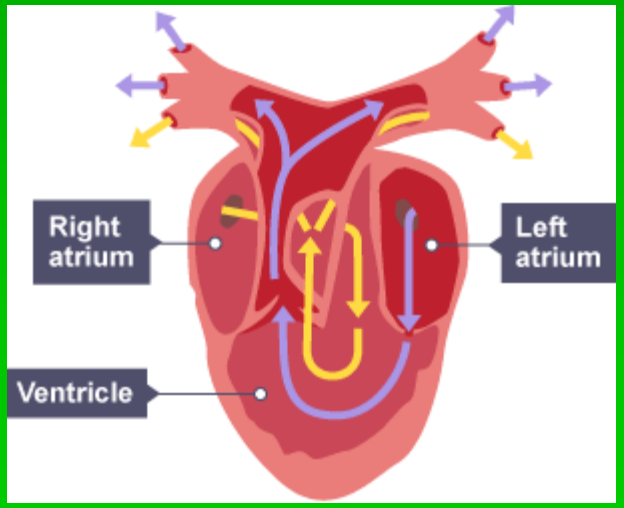
- Lungfishes: have lungs
  - During droughts it burrows into the mud beneath stagnant water.
  - Coelacanths: "Living fossils" (deep in ocean).

Amphibians

- Name means living on both: land and water.
- Represented by
  - Frogs
  - Toads
  - Newts
  - Salamanders.
- **TETRAPODS**: vertebrates with two pairs of limbs.
- Ectothermic

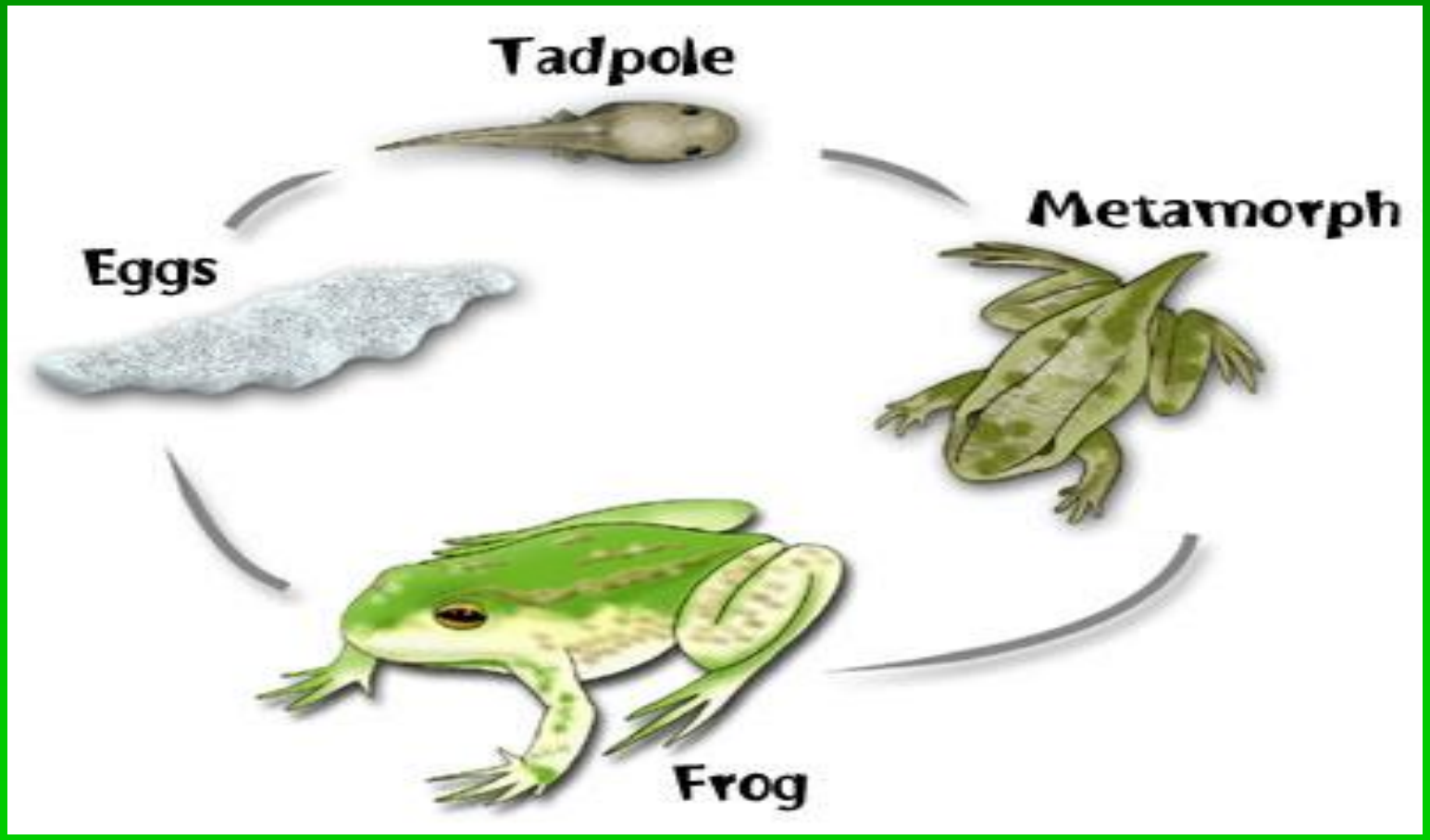
Amphibians

- Most amphibians have complex life cycles with time on land and in the water.
- Their skin must stay moist to absorb oxygen and therefore lacks scales.
  - Often have Poison Glands in their skins.
- Usually lay their eggs in water.
- Small Lungs
  - Respiration supplemented by gas exchange through their moist Skin.
- Three-Chambered Heart.



METAMORPHOSIS

Most change from an aquatic larval stage (develop legs and lungs, lose the tail, acquire carnivorous taste) to a terrestrial adult form.



External Fertilization

Frog eggs (top): a tadpole is developing in the center of each ball of jelly;

tadpole (right) undergoing metamorphosis.

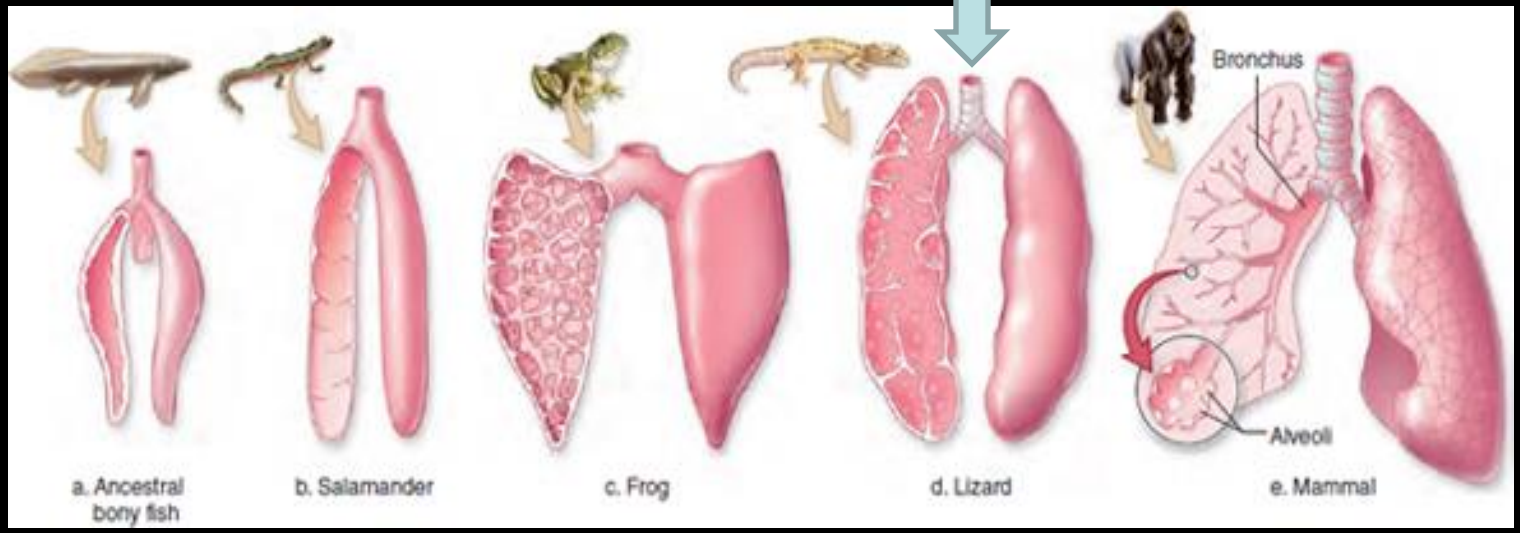
Reptiles

Living Reptiles include Turtles, Crocodilians, Snakes, Lizards.

Skin covered with Scales and waterproofed with Keratin, which protects them from dessiccation and from predators.

Reptiles

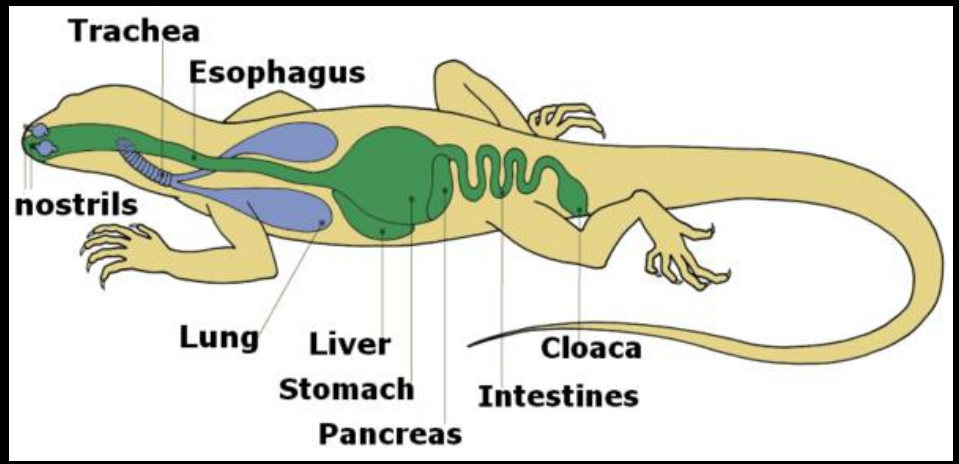
Well-developed Lungs.



Most are Ectothermic, absorbing external heat rather than generating much of their own.

Most have a 3-chambered heart, except Crocodilians (4-chambered).

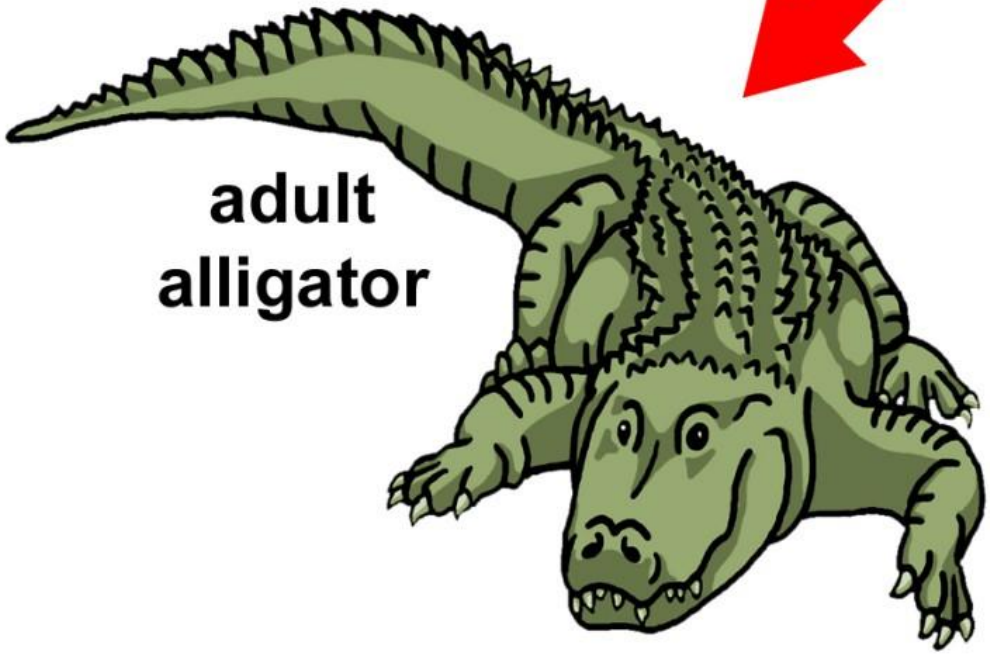
Oviparous



Most reptiles have Internal Fertilization.

alligator eggs

baby alligator



adult alligator

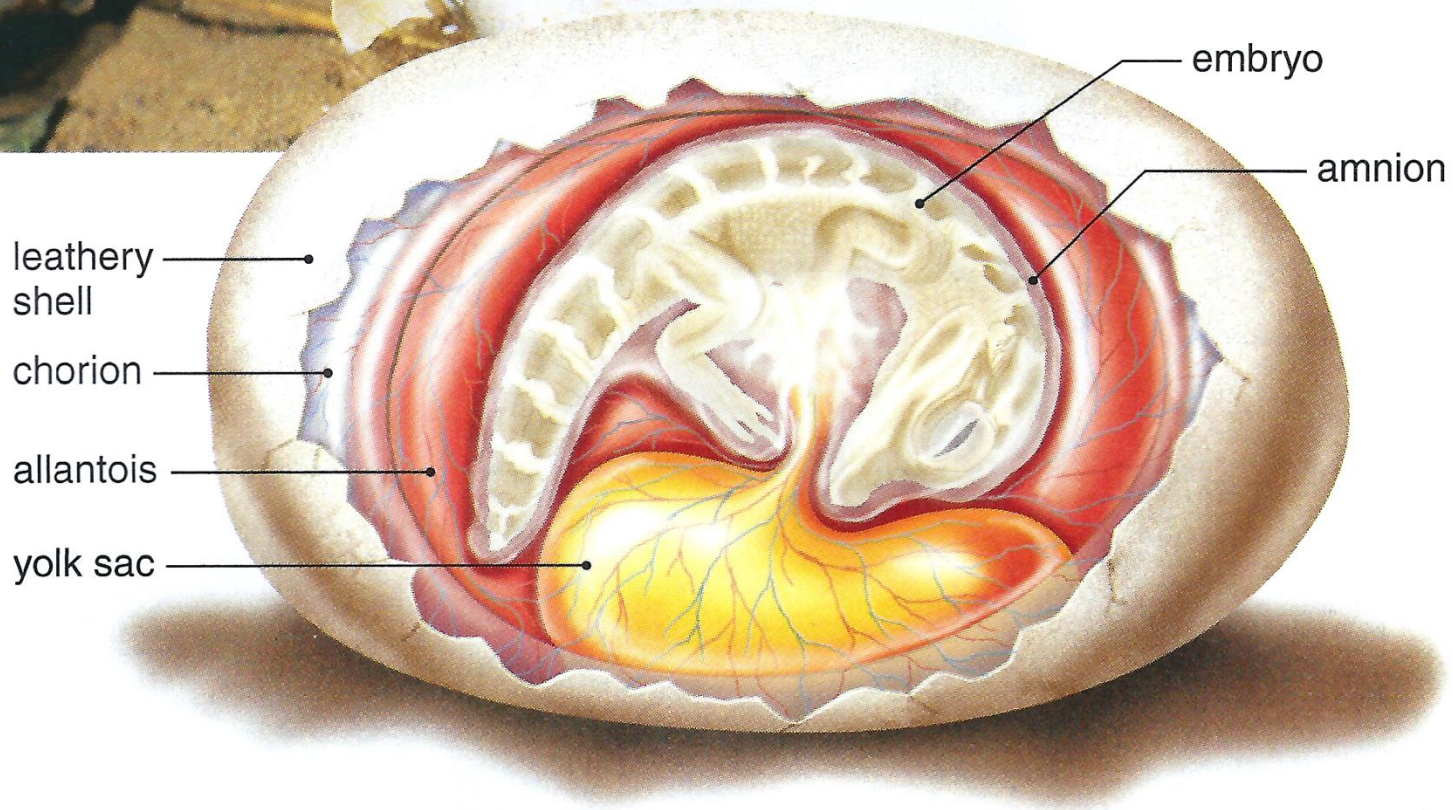
INTERNAL Fertilization – Amniotic Egg

Reptiles, Birds, and Mammals form an Amniotic Egg:

- **Inside the egg are 4 internal membranes:**

1. The **AMNION** is a fluid-filled sac surrounding the embryo.
2. The **YOLK SAC** contains a rich store of nutrients for the developing embryo.
3. The **CHORION** (and **ALLANTOIS**) enables the embryo to obtain oxygen from the air and dispose of carbon dioxide.
4. The **ALLANTOIS** also helps dispose of metabolic waste.

Amniotic Egg



The **AMNION** is a fluid-filled sac surrounding the embryo.

The **YOLK SAC** contains a rich store of nutrients for the developing embryo.

The **CHORION** (and **ALLANTOIS**) enable the embryo to obtain oxygen from the air and dispose of carbon dioxide.

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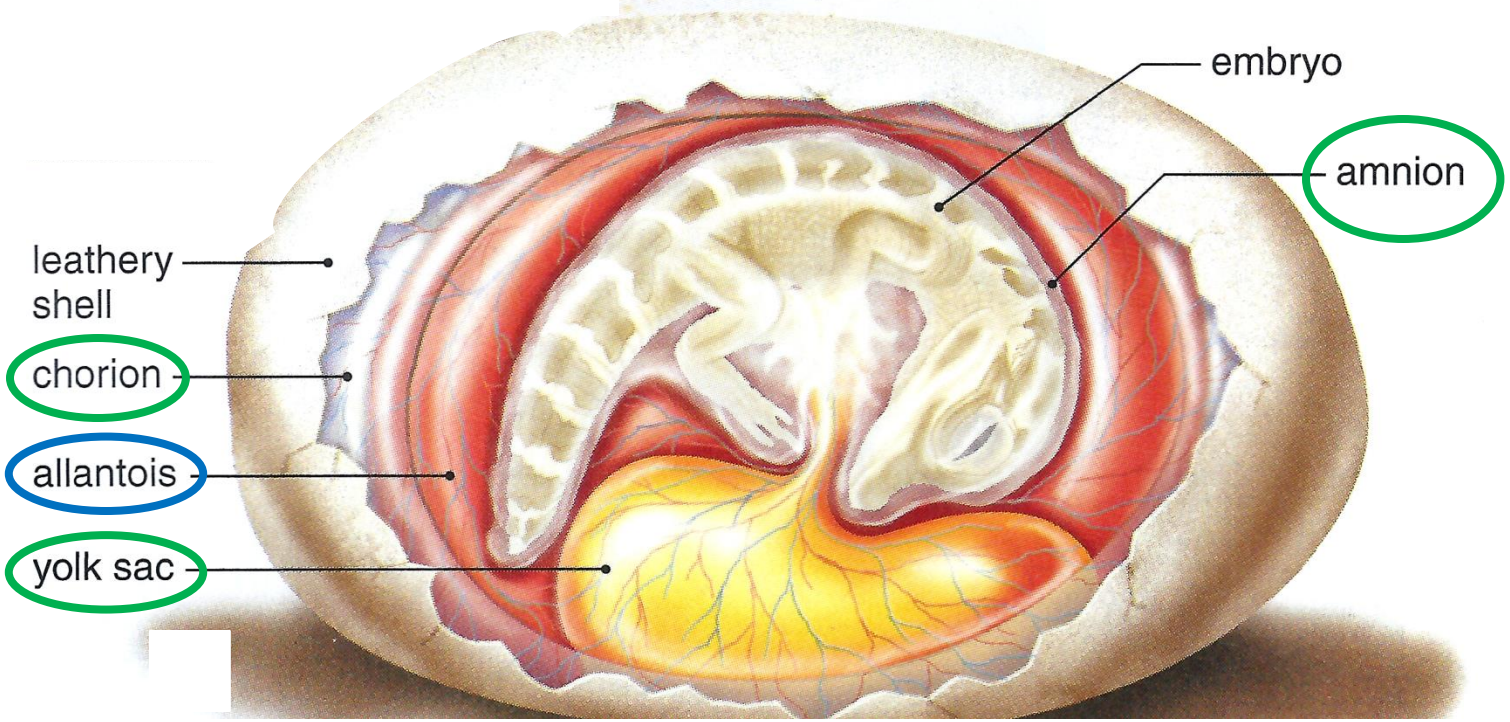


Types of Egg/Embryo Development:

Parity

Oviparity:

- Shell forms around the embryo after it is internally fertilized.
- Female DEPOSITS THE EGG containing the embryo to complete development before hatching (Birds, Reptiles).

Ovoviviparity:

- Shell forms around the embryo after it is internally fertilized.
- RETAINED IN THE FEMALE until it hatches, or just before it hatches (Sharks, Sea Horses).

Portuguese shark with developing eggs in ovaries

Parity

Viviparity

- Shell does NOT form around an embryo.
- LIVE BIRTH after gestation period (most Mammals).

Placenta

Structure through which an embryo receives its nourishment and performs gas exchange from the mother.

All chordates	Fish	Amphibians	Reptiles
These classes are all ___ (backbone).			

TRY IT

Name & define 3 types of "parity" (eggs).

What does "amniotic" mean?

All chordates	Fish	Amphibians	Reptiles
Bilateral Symmetry	Jawless	Frogs	Lizards
Triploblastic	Cartilage	Toads	Turtles
Coelomates	Bony lobed fins	Newts	Crocodilians
Reproduce Sexually	Body ray fins	Salamanders	Snakes
These classes are all vertebrates (backbone).			

TRY IT

Name & define 3 types of "parity" (eggs).

oviparity – hard shell, deposited in nest

ovoviviparity – shell within mother

viviparity – no shell, live birth

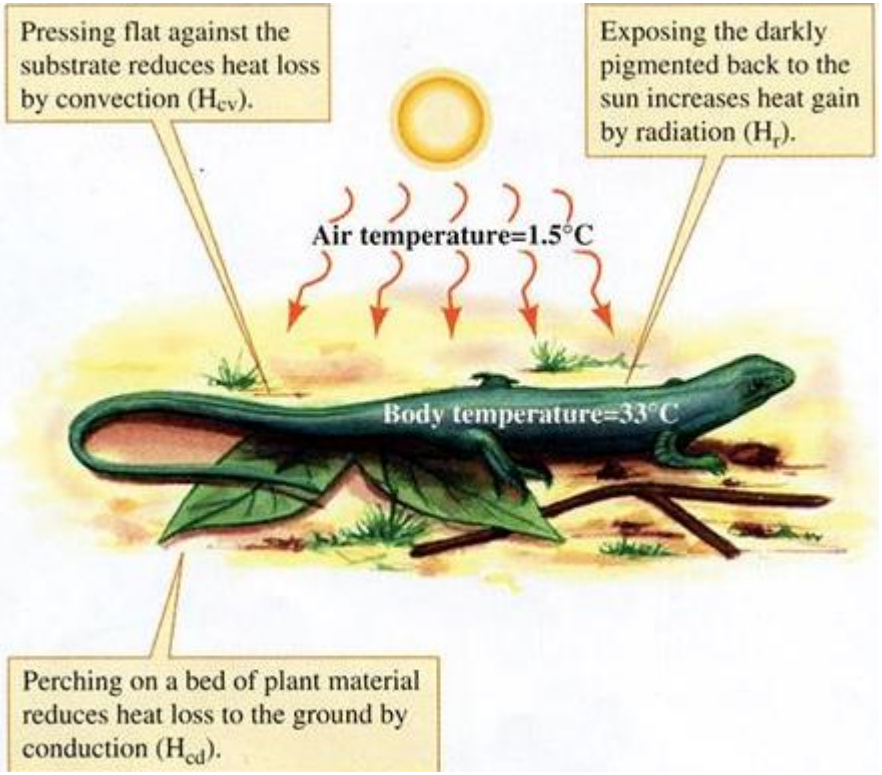
What does "amniotic" mean?

The egg (reptiles, birds, mammals) has an amnion, yolk sac, chorion, allantois.

Regulation of Body Temperature

ECTOTHERM:

- Animal whose body temperature tends to fluctuate with the environment.
- Invertebrates, fishes, amphibians, and reptiles.
- Behaviors that help adjust body temperature: basking in the sun, burrowing into the ground, etc.



Regulation of Body Temperature

ENDOTHERM:

- Animal that maintains constant INTERNAL body temperature by using heat generated by his own metabolism.
- Birds and Mammals
- Requires an enormous amount of energy and food.
- Fur, hair, and Feathers help retain heat.

Chapter 29: Kingdom Animalia IV

Birds / AVES

ORNITHOLOGY

Study of Birds

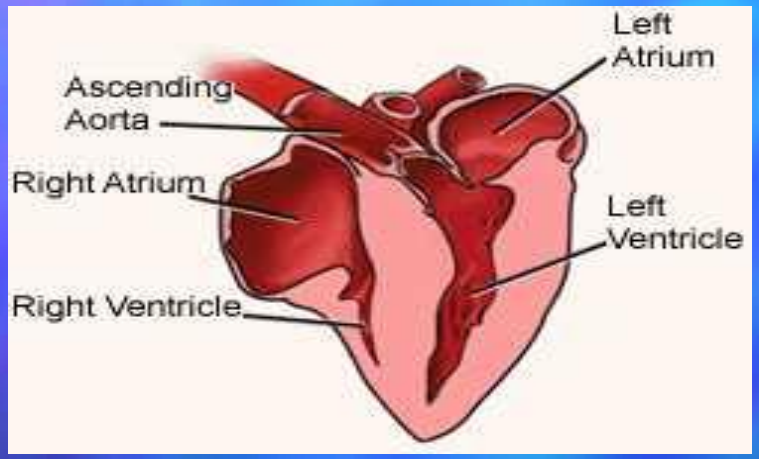
Unique Features that set Birds apart from other Vertebrates:

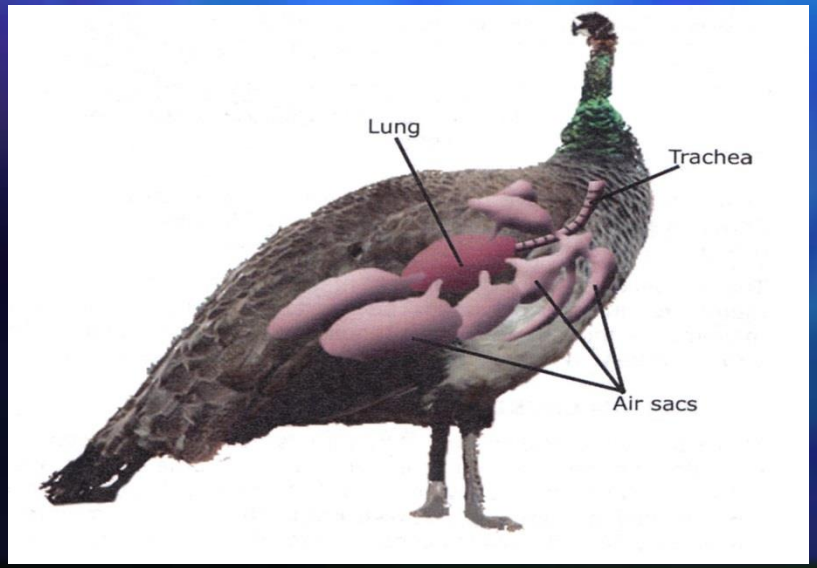
- Endothermic
- Flight

Anatomical Adaptations to Flight:

- Tapered body with a streamlined profile.
- Bones are lightweight and HOLLOW, with internal struts that add support.

Birds / Aves





Powerful 4-chambered heart

- Completely separates oxygen-rich from oxygen-poor blood.

Unique Lungs (anterior and posterior air sacs) that supply the oxygen needed for flight.

- The forelimbs function as Wings used for flight not grasping.
- Highly developed muscles power the flight.

Birds / Aves

Body covered with Feathers

- Provide insulation
- Enable a bird to fly
- Important in mating behavior
- Built of the protein Keratin

The two hind limbs with clawed toes support body.

Birds / Aves

A toothless, horny Beak is present.

No Bladder

- Metabolic Waste travels to the Cloaca, it is excreted in a semisolid, usually white mass along with undigested matter from the intestines.

Acute Vision and Well-developed Brains.

Birds / Aves

Ritualized Courtship precedes Mating.

Oviparous

High degree of Parental Care.

Most species' eggs are incubated in a Nest.

Seasonal Migration

- Navigate by day and night, whether it is sunny or cloudy, by using the sun and stars, and even the Earth's magnetic field to guide them.

Mammals


MAMMALIAN BIOLOGY RESEARCH CENTER
I'VE DISCOVERED A HERETOFORE UNKNOWN SPECIES OF MICE --- WHAT SHALL I CALL IT?
"ANONY-MOUSE"!
E-mail:BobThaves@aol.com
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3-27
THAVES

Mammals

Two Chief Characteristics:

HAIR

- Composed of Keratin.
- Provides insulation against heat loss.
- Allows mammals to be active even in cold weather.

MAMMARY GLANDS

- Produce Milk.
- Enable female to feed their young without leaving them to find food.
- Creates a bond between mother and offspring that helps ensure parental care while the young are helpless.

Mammals

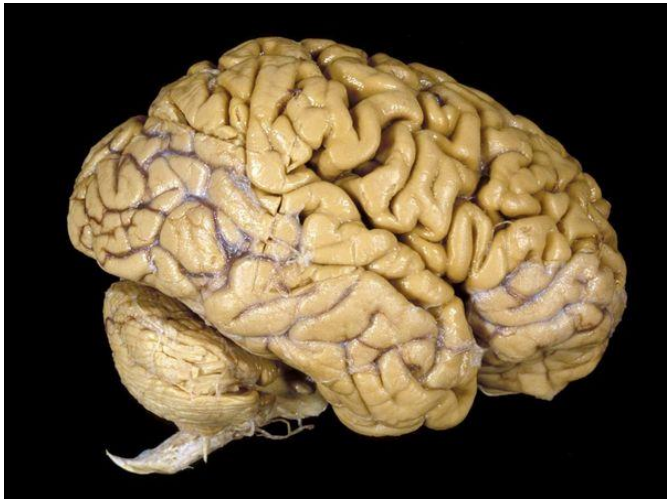
ENDOTHERMIC

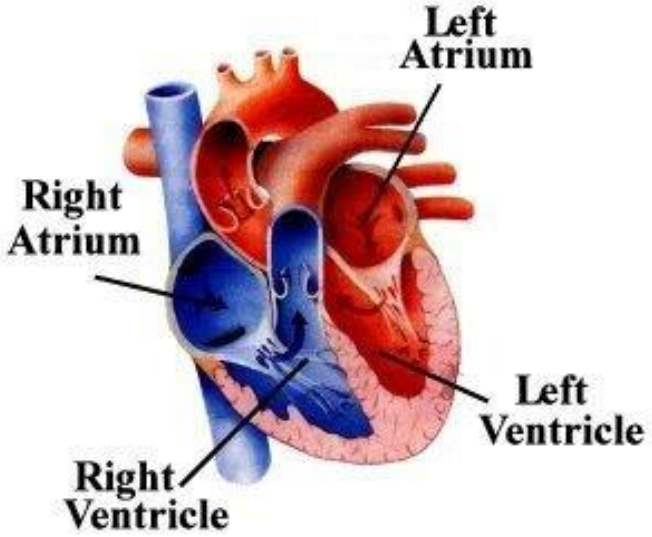
Warm blooded. Interior body temperature is regulated within a narrow range.

Brain is well-developed.

4-chambered heart.

In most mammals, the young are born alive after a period of development in the uterus (part of the female reproductive system).





Mammals

Two Main Categories:

- EGG-LAYING Mammals (MONOTREMES)
- LIVE-BEARING Mammals:
  - Two Branches:
    - MARSUPIALS
    - PLACENTAL Mammals

Monotremes

- Oviparous or Egg-Laying Mammals.
- Lay hard-shelled amniotic eggs through a cloaca.
- Duck-billed Platypus and Echidnas (Australia).

Marsupials

Marsupials give birth to tiny immature young that crawl to a pouch on the mother's belly immediately after they are born.

They attach themselves to milk secreting nipples, nursing until they are mature enough to survive outside the pouch.

Majority live in Australia.

Ex. Kangaroos, Koalas and Opossums

Virginia Opossum: Only North American Marsupial

Placental Mammals

Majority of Mammals are Placental, which carry unborn young in the uterus until young can survive in the wild.

Oxygen and Nutrients are transferred from mother's blood to baby's blood (and vice versa) through a structure called Placenta.

Gestation Period: time in which mammals develop in mother's uterus.

Grizzly Bear Are Mammals

http://somup.com/c3QtrmU7o2 (5:00)

A Friendly Look At Grizzly Bears

QUICK CHECK

No Head or jaws?	Vertebrates?	Tetrapods?	Amniotic Eggs?

Define and give terms for cold vs. warm blooded.

Why can birds fly (anatomically)?

Name the types of mammals:

QUICK CHECK

No Head or jaws	Vertebrates	Tetrapods	Amniotic Eggs
Tunicates	Fish	Amphibians	Reptiles
Lancelets	Amphibians	Reptiles	Mammals
Hagfish	Birds	Mammals	Birds
	Reptiles		
	Mammals		

Define and give terms for cold vs. warm blooded.

Ectotherm (cold blooded); Endotherm (warm blooded).

Body temperature regulation

Why can birds fly (anatomically)?

Feathers, hollow bones

Name the types of mammals:

Monotremes, marsupials, placental