



Aakash

+ BYJU'S NOTES

Animal Kingdom





Key Takeaway

Characteristics of animals

1

Levels of organisation

Symmetry

Germ layer organisation

Coelom

Segmentation

Notochord

Circulatory system

Digestive system

2

Classification of animals

3

Phylum Porifera



Key Takeaway





Key Takeaway

12

Phylum Hemichordata

13

Phylum Chordata

Subphylum Vertebrata

Class Cyclostomata

Class Chondrichthyes

Class Osteichthyes

Class Amphibia

Class Reptilia

Class Aves

Class Mammalia

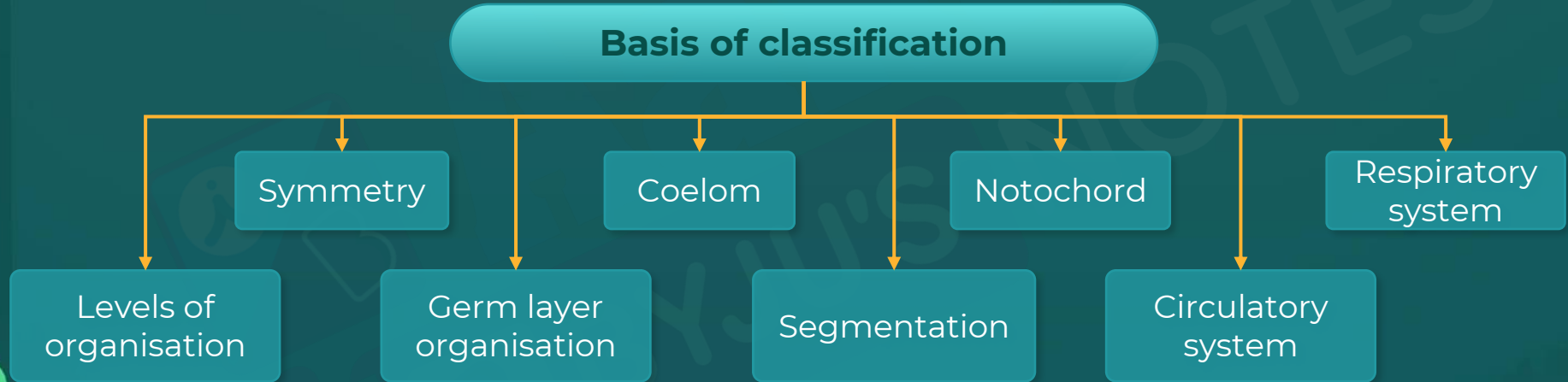
Summary



Classification of Animals



- Classification of animals is important as the **diversity of animals is huge**.
- It also helps in assigning a systematic position to newly discovered species.



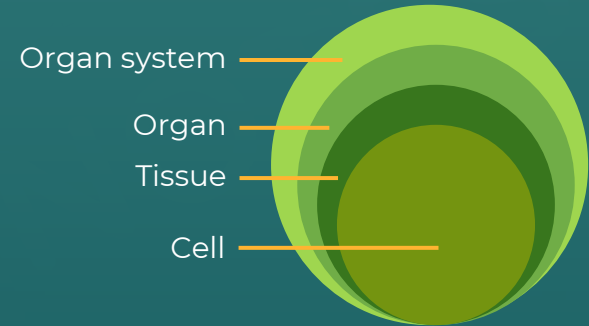


Levels of Organisation



- **Cellular level of organisation:** In lower animals such as sponges, cells aggregate together to exhibit cellular level of organisation.
- **Tissue level of organisation:** Cells which perform similar functions are grouped together to form tissues (E.g. - Coelenterates).
- **Organ level of organisation:** Several tissues together form the organ (E.g. - members of Platyhelminthes)
- **Organ system level of organisation:** Several organs combine to form the organ system (E.g. - humans).

Levels of organisation





Symmetry



Symmetry refers to a correspondence of body parts, in size, shape and relative position, on opposite sides of a dividing line or distributed around a central point or axis.

Radial



- Body can be divided into **two identical halves in any plane** passing through the centre.
- E.g., starfish.

Bilateral



- Body can be divided into identical **two halves in only one plane**.
- E.g., goat.

Asymmetry



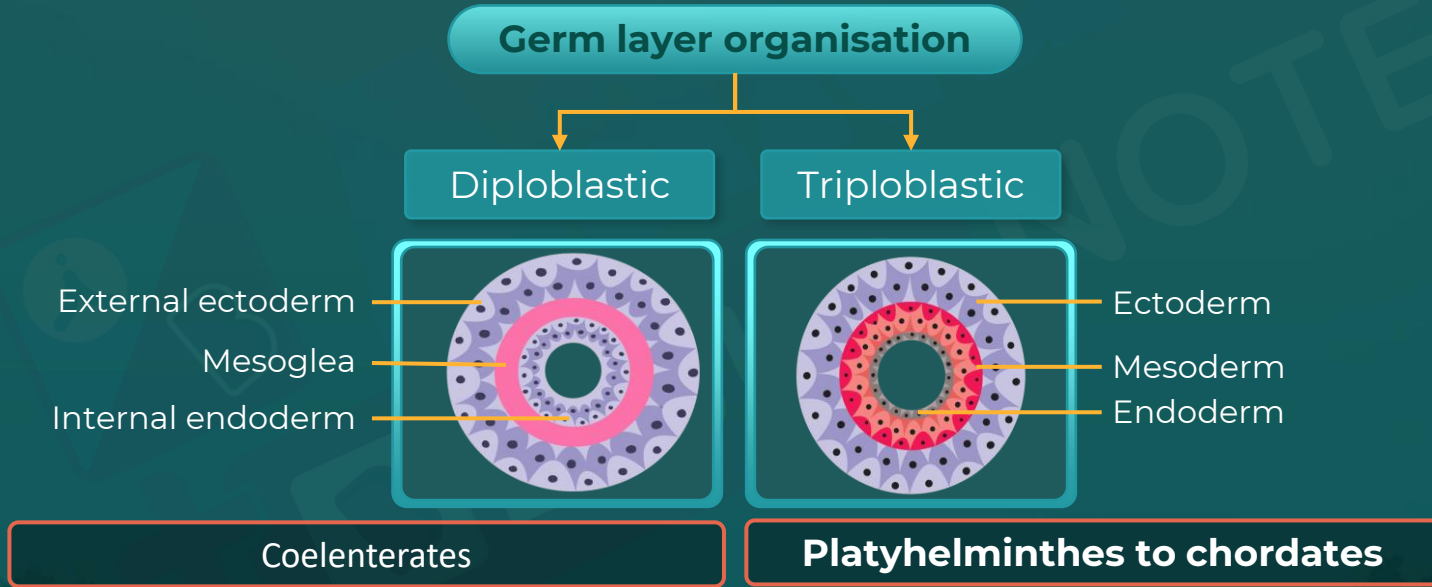
- Body **cannot be divided** into two equal halves in any plane.
- E.g., sponges (irregular).



Germ Layer Organisation



- Germ layer is a **layer of cells in an embryo**.
- It contributes to the **formation of all organs and tissues**.



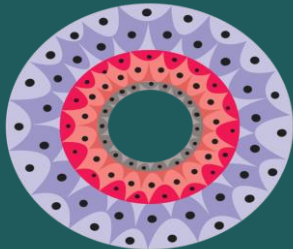


Coelom



- A **body cavity** present between the alimentary canal and body wall.
- The cavity is lined externally by mesoderm.

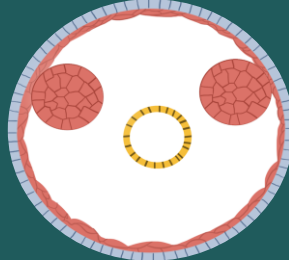
Acoelomate



Platyhelminthes

- Organisms that **do not have coelom**
- For e.g. - Flatworms

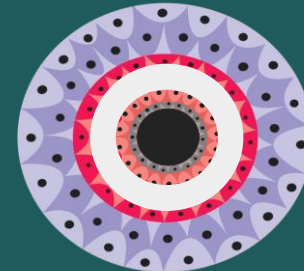
Pseudocoelomate



Aschelminthes

- Organisms which have a cavity, but it is **not lined by the mesoderm**
- For e.g. - Roundworms

Eucoelomate



Annelida to chordata

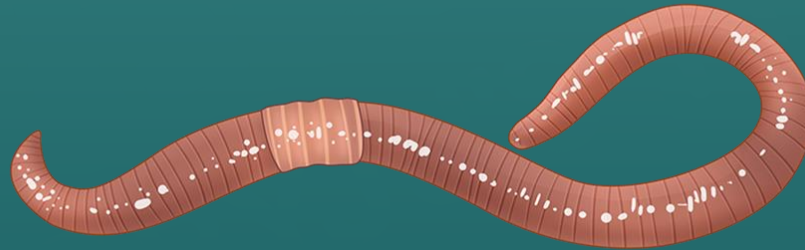
- Organisms that **have coelom**
- For e.g. - Human beings



Segmentation



- Based on the absence or presence of segments in their body, the organisms are classified into- **segmented** and **unsegmented**.
- In organisms like earthworm, the body is divided into segments with serial repetition of some organs. This type of segmentation is known as **metameric segmentation**.



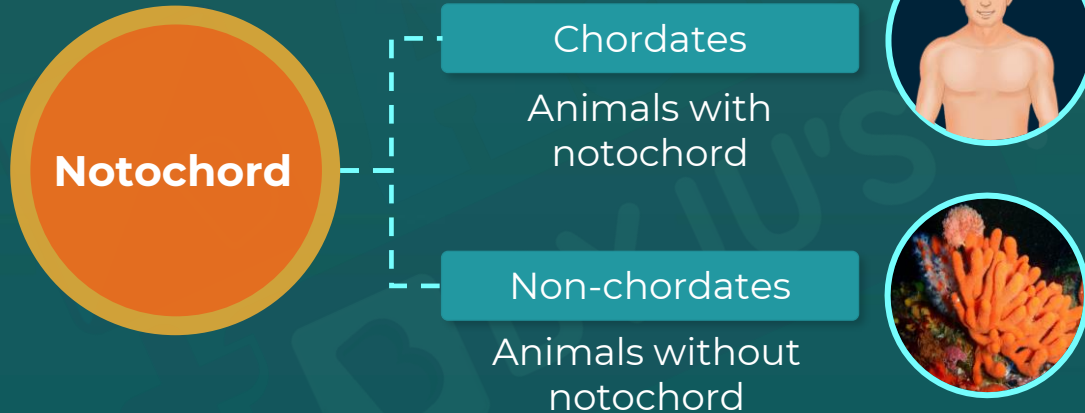
Metameric segmentation in earthworm



Notochord



- Derived from the **mesoderm**
- **Rod-like structure** on the posterior side of the embryo
- Found during embryonic development





Circulatory and Digestive System



Based on the number of openings, digestive system is classified as:

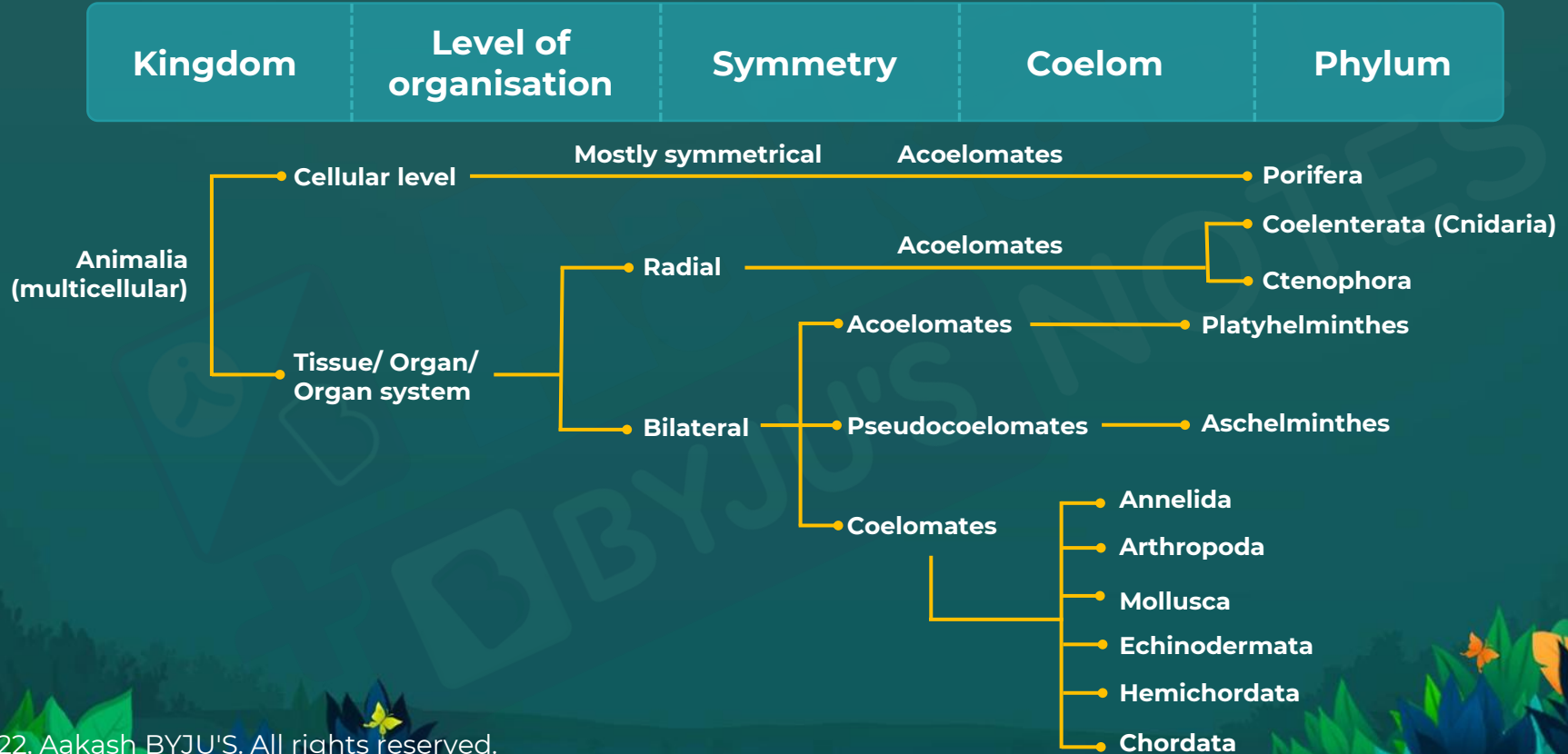
- **Complete digestive system:** Separate opening for mouth and anus
E.g. - Aschelminthes to chordates.
- **Incomplete digestive system:** One common opening for mouth and anus
E.g. - Platyhelminthes.

Based on the presence and absence of blood vessels, circulatory system is classified into:

- **Open circulatory system:** Blood pumped from heart directly bathes cell and tissues
- **Closed circulatory system:** Blood flows through definite vessels throughout



Classification of Animals



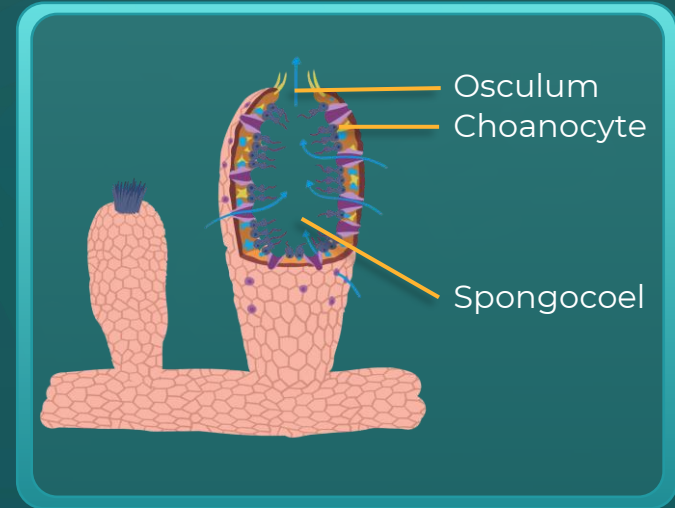


Phylum Porifera



Characteristic features

- Mostly marine (*Sycon*), some freshwater (*Spongilla*) forms are also present
- Sedentary and asymmetrical
- Primitive and show cellular level of organisation
- Water enters through minute pores (**ostia**) in the body wall into a central cavity, **spongocoel**, from where it goes out through the **osculum**
- **Water canal system**- to feed, respire and remove waste
- **Choanocytes** or **collar cells** line the spongocoel and the canals
- Digestion is intracellular
- Presence of **spicules** and **spongin** fibres to support and protect itself





Phylum Porifera



Asexual
Fragmentation

Sexual
Formation of gametes

- Sexes are not separate (**hermaphrodite**)
- Fertilisation is internal
- Development - indirect having a **larval stage** which is **morphologically distinct** from the adult
- Examples: *Sycon* (Scypha), *Spongilla* (Freshwater sponge) and *Euspongia* (Bath sponge)



Phylum Coelenterata



Characteristic features

- Aquatic- mostly marine
- Sessile or free swimming
- Radially symmetrical
- Stinging capsules called **cnidocytes** are present on the tentacles and the body
 - Used for anchorage, defense and for the capturing prey
- Tissue level of organisation and diploblastic
- They have a central gastrovascular cavity with a single opening, mouth on **hypostome**
- Digestion : Extracellular and intracellular
- Some of the cnidarians, e.g., corals have a **skeleton composed of calcium carbonate**



Phylum Coelenterata



Basic body forms

Polyp



Sessile,
cylindrical form
E.g.- *Hydra*,
Adamsia

Medusa



Umbrella shaped
and free swimming
E.g. - *Aurelia*

Alternation of generation

- **Cnidarians** which exist in both forms exhibit alternation of generation.
 - It is also known as **metagenesis**.
- In *Obelia*
 - **Polyps** produce medusae asexually.
 - **Medusae** form the polyps sexually.
- Examples: *Physalia* (Portuguese man-of-war), *Adamsia* (Sea anemone), *Pennatula* (Sea-pen), *Gorgonia* (Sea-fan) and *Meandrina* (Brain coral)

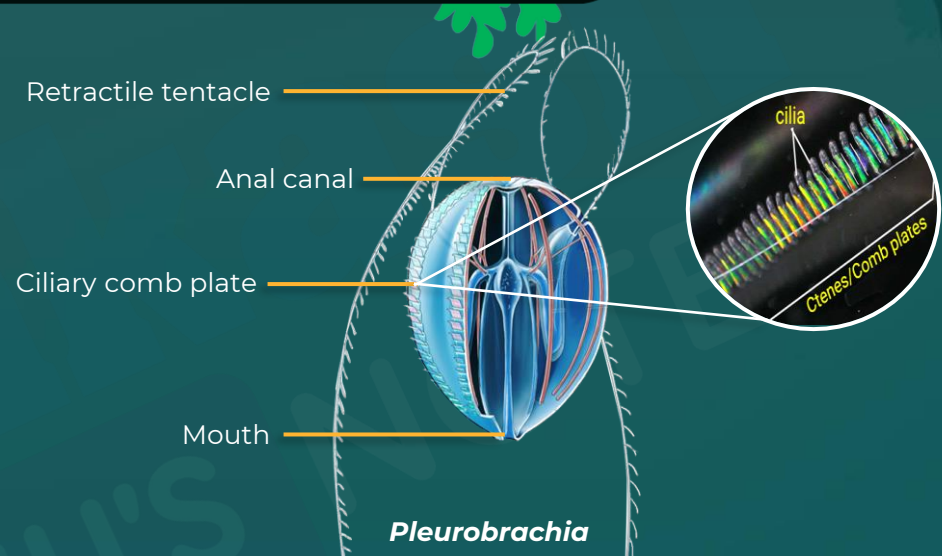


Phylum Ctenophora



Characteristic features

- Exclusively marine, also known as **sea walnuts or comb jellies**
- Radially symmetrical, diploblastic, tissue level of organisation
- **Digestion:** Extracellular and intracellular
- **Bioluminescence:** Property of a living organism to emit light
- **Hermaphrodites:** Sexes are not separate
- Only sexual reproduction
- External fertilization with indirect development
- **8 external rows** of ciliated comb plates used for locomotion
 - Hence, they are also called **comb jellies**



Pleurobrachia and *Ctenoplana*
Bioluminescent comb jellies

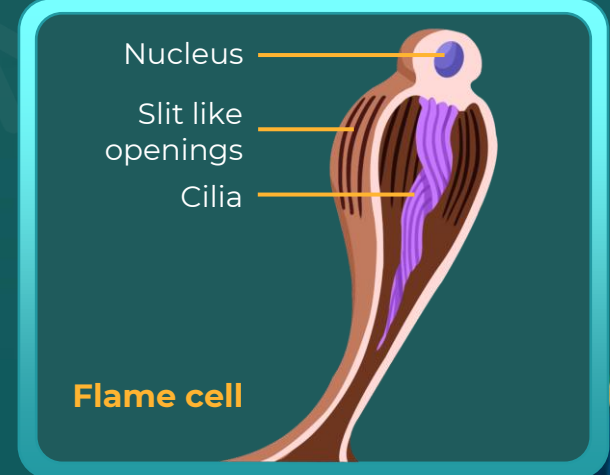
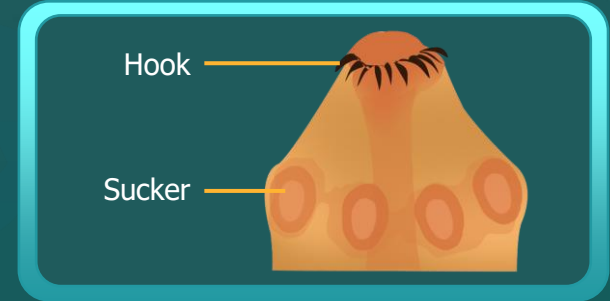


Phylum Platyhelminthes



Characteristic features

- They have dorsoventrally flattened body: Flatworms
- Mostly **endoparasites**, only a few are free living
- Bilaterally symmetrical, triploblastic, acoelomates
- Organ level of organisation
- **Hooks** and **suckers** are present in the parasitic forms
- **Flame cells**: specialized excretory cells which help in **osmoregulation** and **excretion**
- Sexes are not separate
- Fertilisation - internal
- Development is through many larval stages
- Some members like *Planaria* possess **high regeneration capacity**
- Examples: *Taenia* (Tapeworm), *Fasciola* (Liver fluke)





Phylum Aschelminthes



Characteristic features

- Commonly known as **roundworms**
- **Habitat:** Terrestrial and Aquatic (both freshwater or marine)
- Either **parasitic** or **free-living**
- Organ system level of organisation
- Triploblastic and pseudocoelomate
- Bilaterally symmetrical
- **Digestive system:** Complete alimentary canal with a **muscular pharynx**
- Have excretory tube
- They are **dioecious**: Separate sexes; females longer than males, exhibit internal fertilization
- Development - direct (young ones look same as adults) or indirect (through a larval stage)



Ascaris

Examples : *Ascaris* (Roundworm), *Wuchereria* (Filaria worm), *Ancylostoma* (Hookworm).



Phylum Annelida



Characteristic features

- Metamerically segmented worms
- **Habitat:**
 - Terrestrial (Earthworm)
 - Aquatic
 - Freshwater - Leech
 - Marine – *Nereis*
- **Lifestyle:**
 - Parasitic (Leech)
 - Free-living (*Nereis*)
 - Bilaterally symmetrical and triploblastic
 - True coelomates
 - Examples: *Nereis*, *Pheretima* (Earthworm) and *Hirudinaria* (Blood sucking leech)



***Nereis* (Free-living)**



***Hirudinaria* (Leech)
(Parasitic)**

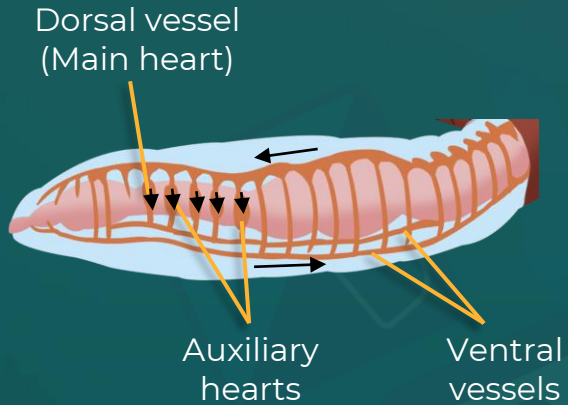


Phylum Annelida



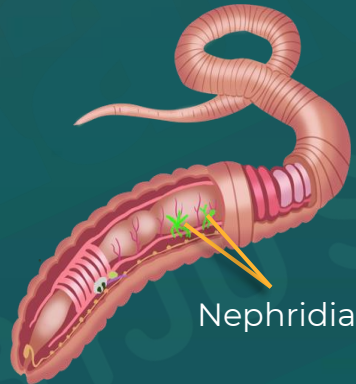
- Organ-system level of organisation

Circulatory system



Closed circulatory system

Excretory system



Nephridia help in osmoregulation and excretion

Nervous system



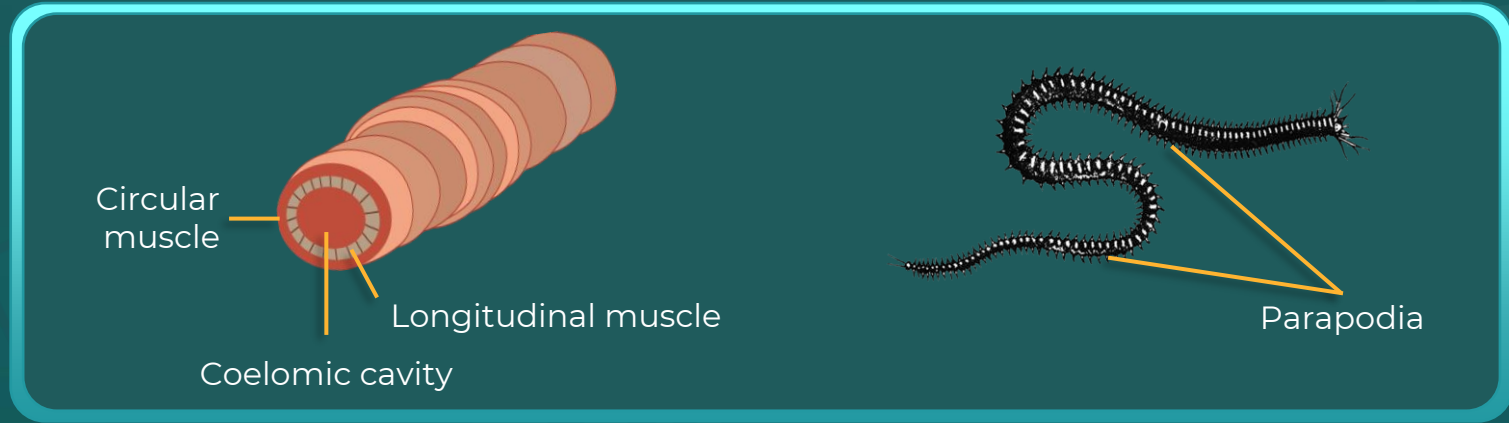
Consists of paired ganglia connected by lateral nerves to a double ventral nerve cord



Phylum Annelida



- **Locomotion:** Longitudinal and circular muscles (Eg., Earthworm)
- **Swimming:** Parapodia (Eg., *Nereis*)



- **Sexual reproduction**
 - Monoecious - Both sexes together (hermaphrodites)
E.g., Earthworms, Leeches.
 - Dioecious - Separate sexes, E.g., *Nereis*.

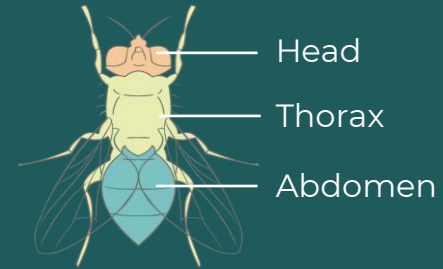


Phylum Arthropoda

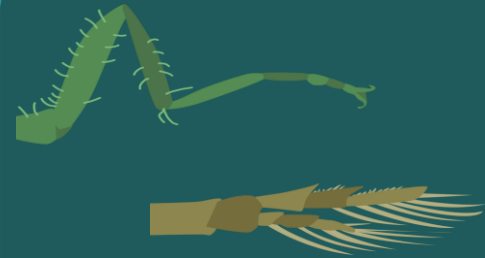


Characteristic features

- **Largest phylum**, includes insects
- Segmented body, bilateral symmetry, triploblastic, coelomate
- **Chitinous exoskeleton**: Skeleton outside the body
- **Body divisions**: Head, thorax and abdomen
- **Jointed appendages** (arthros- joint and poda- appendages)
- Organ system level of organisation
- Open circulatory system
- **Sensory organs**:
 - Antennae
 - Eyes (compound and simple)
 - Statocysts or balancing organs are present



Body divisions



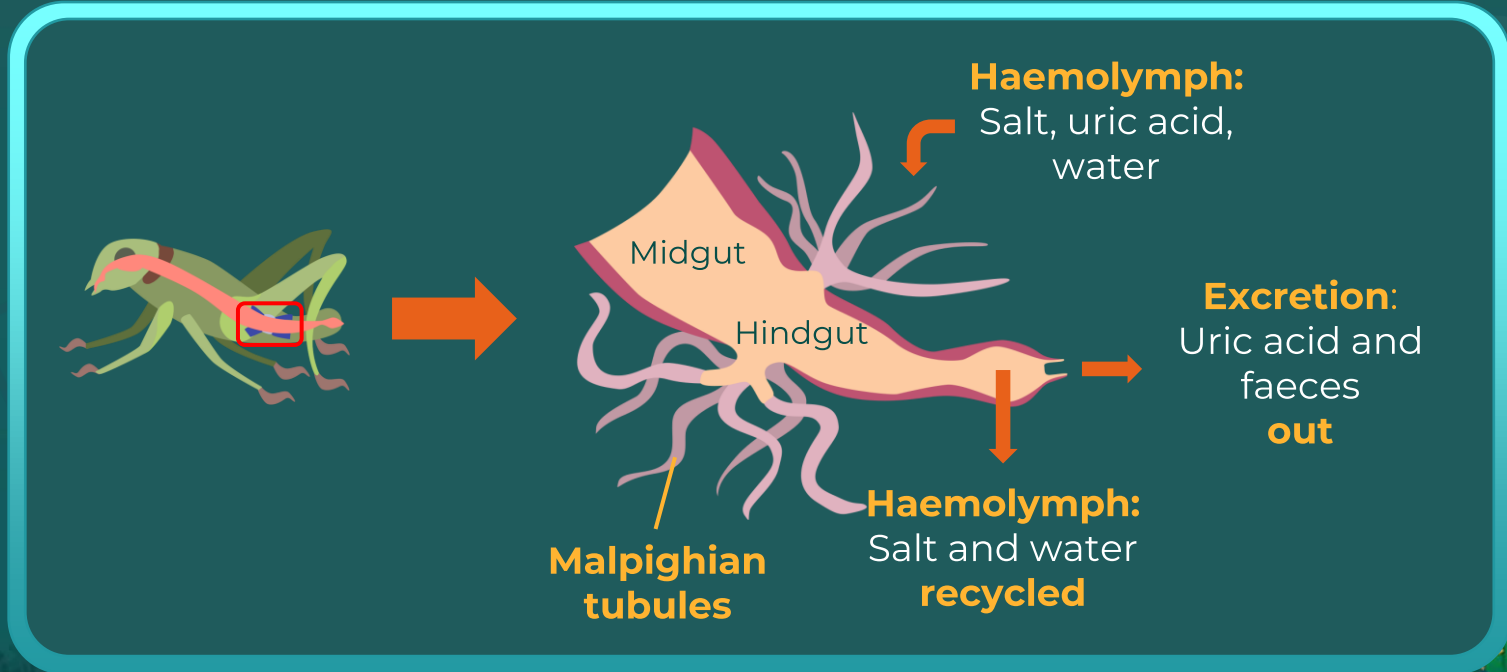
Jointed appendages



Phylum Arthropoda



- **Excretory system:** Malpighian tubules





Phylum Arthropoda



- Mostly **dioecious**
- Fertilization is usually internal
- Mostly oviparous
- Development maybe direct or indirect
- Examples:
 - **Economically important Arthropods-** *Apis* (Honey bee), *Bombyx mori* (Silkworm), *Laccifer lacca* (Lac insect)
 - **Vectors-** *Anopheles*, *Culex* and *Aedes* (Mosquitoes)
 - **Gregarious pest-** *Locusta* (Locust)
 - **Living fossil-** *Limulus* (King crab)



Bombyx mori
(Silk worm)



Laccifer lacca
(Lac insect)



Honey bee



Phylum Mollusca



Characteristic features

- **Second largest** animal phylum
- **Habitat:**
 - Terrestrial
 - Aquatic- Freshwater, Marine
- Bilateral symmetry, triploblastic and coelomate
- Organ system level of organisation
- Unsegmented body covered with **calcareous shell** (**Exception-** Octopus)
- Usually dioecious and oviparous with indirect development
- Examples: *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Sepia* (Cuttlefish), *Loligo* (Squid), *Octopus* (Devil fish), *Aplysia* (Sea-hare), *Dentalium* (Tusk shell) and *Chaetopleura* (Chiton)



***Pila* (Apple snail)**



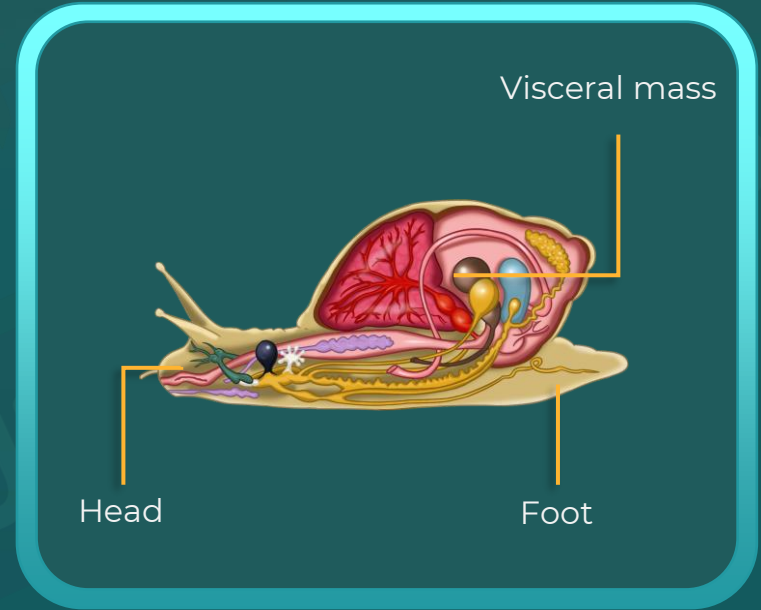
***Octopus* (Devil fish)**



Phylum Mollusca



- **Distinct body:** Head, muscular foot and visceral hump (visceral mass)
- **Mantle:** Spongy layer covering the visceral hump
- **Mantle cavity:** Space between hump and mantle in which feather like gills are present
- The anterior head region has **sensory tentacles**
- **Mouth:** Contains a file-like rasping organ for feeding called **radula**





Phylum Echinodermata



Characteristic features

- Marine
- Endoskeleton of **calcareous ossicles**; spiny bodied
- Symmetry
 - Adults: Radial
 - Larvae: Bilaterally.
- Organ system level of organisation, triploblastic, coelomates
- **Water vascular system:** Helps in locomotion, capture and transport of food and respiration
- Excretory system: Absent
- **Digestive system:** Complete with mouth on ventral and anus on the dorsal side
- Sexual reproduction, separate sexes
- Fertilisation is usually external and indirect development with free-swimming larva
- **Examples:** *Asterias* (Star fish), *Echinus* (Sea urchin), *Antedon* (Sea lily), *Cucumaria* (Sea cucumber) and *Ophiura* (Brittle star)



Asterias (Starfish)



Phylum Hemichordata

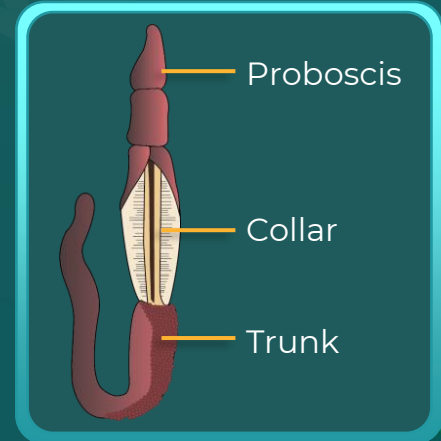


Characteristic features

- They have a rudimentary structure in the collar region called **stomochord** which resembles a notochord
- **Worm-like** marine animals
- Organ-system level of organisation
- Bilaterally symmetrical, triploblastic and coelomate
- Cylindrical body with anterior proboscis, a collar and a long trunk
- Circulatory system: Open type
- Respiration: Through gills
- Excretory organ: **proboscis gland**
- Sexes are separate
- Fertilisation is external
- Development is indirect
- Examples: *Balanoglossus* and *Saccoglossus*.



Saccoglossus



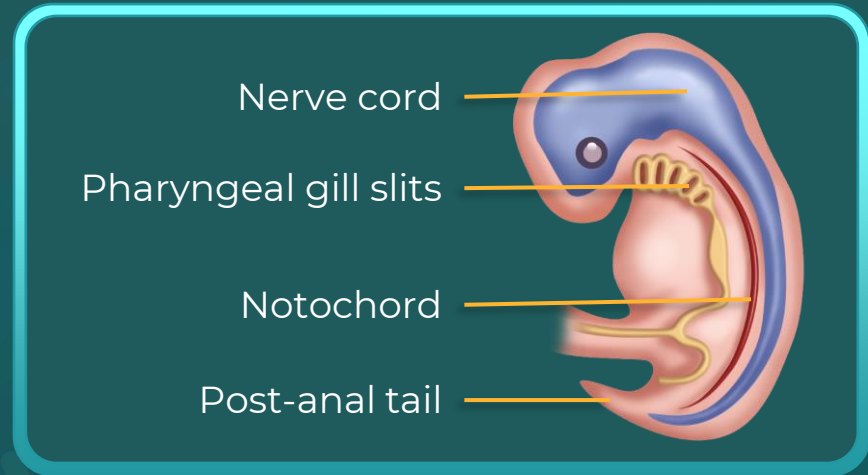


Phylum Chordata



Characteristic features

- Characterised by the **presence of notochord**, a dorsal **hollow nerve cord** and **paired pharyngeal gill slits**
- Bilaterally symmetrical, triploblastic and coelomat
- Organ system level organisation.
- Show **presence of post anal tail**
- Circulatory system: Closed





Phylum Chordata



Chordates

Notochord present

Central nervous system is dorsal, hollow and single

Pharynx perforated by gill slits

Heart is ventral

Post-anal tail present

Non-chordates

Notochord absent

Central nervous system is ventral, solid and double

Gill slits are absent

Heart is dorsal (if present)

Post-anal tail absent



Phylum Chordata



Phylum chordata is divided into three subphyla

Urochordata/Tunicata

- Exclusively marine
- Notochord is present in **the larval tail**
- Eg: *Ascidia*, *Salpa*, *Doliolum*

Cephalochordata

- Exclusively marine
- Notochord extends from **head to tail** region, and is persistent **throughout their life**
- Eg: *Branchiostoma*

Vertebrata

- Notochord present during **embryonic development** later replaced by bony **vertebral column** in adults
- Have a ventral muscular heart (2, 3 or 4 chambers)
- Kidneys for excretion and osmoregulation
- Paired appendages- fins or limbs

Protochordates

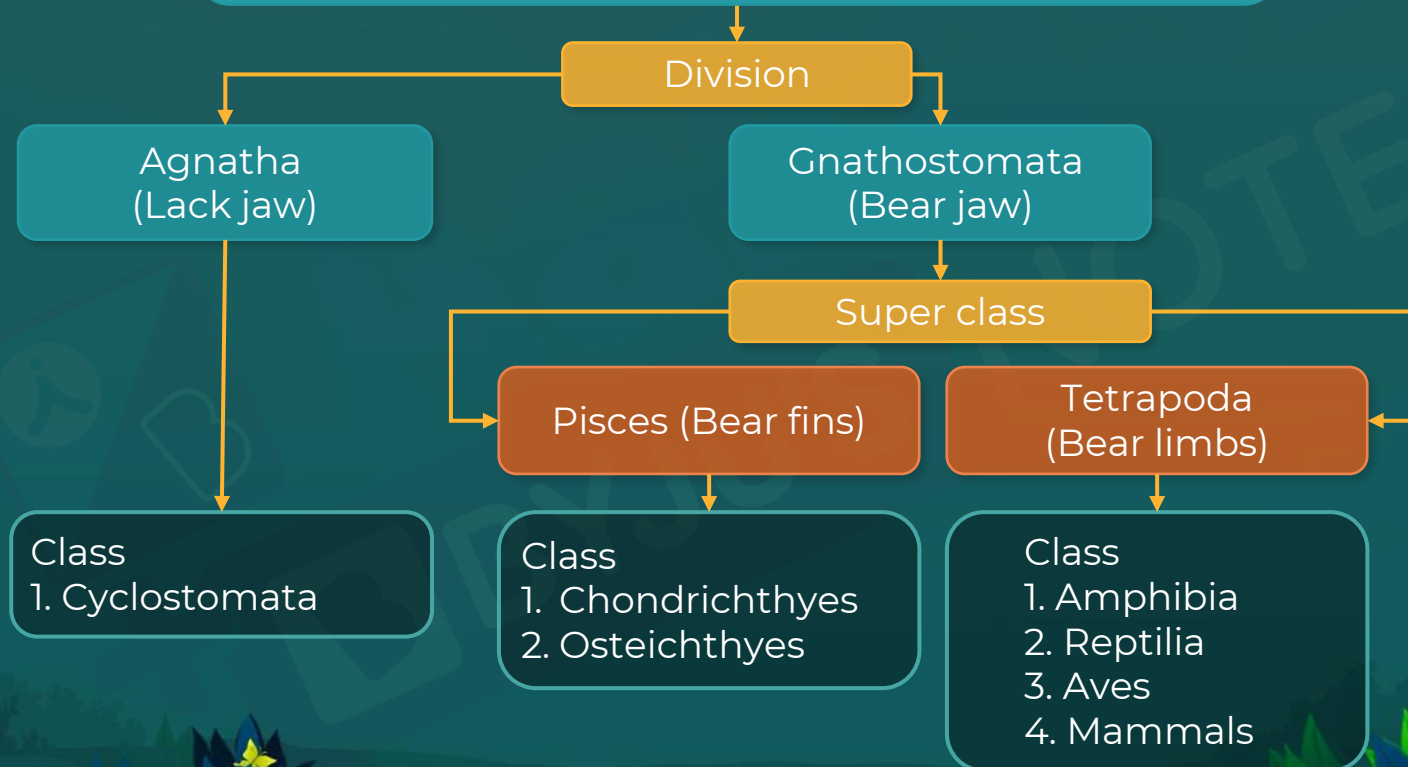
All vertebrates are chordates but all chordates are not vertebrates



Subphylum Vertebrata



Classification of vertebrata





Class Cyclostomata



Characteristic features

- Elongated body is **devoid of scales** and **paired fins**
- Have **6-15 pairs of gill slits** for respiration
- **Ectoparasites** on some fishes
- Have sucking and circular mouth **without jaws**
- **Cranium** and **vertebral column** are cartilaginous
- Circulatory system: Closed type
- Marine but migrate for spawning to fresh water, die after few days
- Their larvae, after **metamorphosis**, return to the ocean
- Examples: *Petromyzon* (Lamprey) and *Myxine* (Hagfish)



Petromyzon (Lamprey)



Class Chondrichthyes

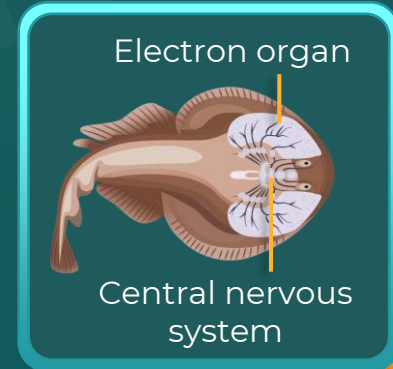


Characteristic features

- Marine, streamlined body with cartilaginous endoskeleton
- Notochord persistent throughout life
- Separate gill slits **without operculum**
- Tough skin with minute **placoid scales**
- Ventrally located mouth; Teeth are modified placoid scales
- Predaceous animals with **powerful jaws**
- **Swim constantly** to avoid sinking as air bladder is absent
- Two chambered heart; **Poikilothermous** (cold-blooded)
- Separate sexes, internal fertilisation, many are viviparous
- In males, pelvic fins bear claspers
- Some of them have **electric organs** (*Torpedo*) and some possess **poison sting** (*Trygon*)
- Examples: *Scoliodon* (Dog fish), *Pristis* (Saw fish), *Carcharodon* (Great white shark), *Trygon* (Stingray).



Carcharodon
(The great white shark)



Torpedo



Class Osteichthyes



Characteristic features

- Both marine and freshwater fishes
- Bony endoskeleton and a streamlined body
- Terminal mouth
- Have 4 pairs of gills **with an operculum** on each side
- Skin is covered with **cycloid/ctenoid scales**
- **Air bladder** regulates buoyancy
- Heart is two-chambered; **Poikilothermous** (cold-blooded)
- Sexes are separate, external fertilisation
- Mostly oviparous and development is direct
- Examples:
 - Marine– *Exocoetus* (Flying fish), *Hippocampus* (Sea horse)
 - Freshwater– *Labeo* (Rohu), *Catla* (Katla), *Clarias* (Magur)
 - Aquarium– *Betta* (Fighting fish), *Pterophyllum* (Angel fish)



Labeo (Rohu)



Gills covered by operculum



Class Amphibia



Characteristic features

- Amphibians can live in aquatic and terrestrial habitats (**dual life**)
- Most of them have two pairs of limbs
- **Body division:** Head and trunk (Tail may be present in some)
- **Moist skin** (without scales)
- Eyes with eyelids
- **Tympanum** represents the ear
- Alimentary canal, urinary and reproductive tracts open into a common chamber called **cloaca** which opens to the exterior
- **Respiration:** Gills, lungs and through skin.
- Heart: 3-chambered (two auricles and one ventricle)
- **Poikilotherms** (cold-blooded)
- Sexes are separate, external fertilisation
- Oviparous and development is indirect
- Examples: *Bufo* (Toad), *Rana* (Frog), *Hyla* (Tree frog), *Salamandra* (Salamander), *Ichthyophis* (Limbless amphibia)



Frog



Class Reptilia



Characteristic features

- Mostly terrestrial
- Body is covered by **dry and cornified skin**, epidermal **scales** or **scutes**
- No external ear openings, tympanum represents ear
- 2 pairs of limbs (if present)
- **Heart**: Usually three-chambered, but four-chambered in crocodiles.
- Poikilotherms
- Snakes and lizards shed their scales as skin cast
- **Mode of locomotion**: Creeping or crawling
- Sexes are separate, internal fertilisation
- Oviparous and development is direct
- Examples:
 - *Chelone* (Turtle), *Testudo* (Tortoise), *Chameleon* (Tree lizard), *Calotes* (Garden lizard), *Crocodylus* (Crocodile), *Alligator* (Alligator)
 - *Hemidactylus* (Wall lizard)
 - Poisonous snakes– *Naja* (Cobra), *Bangarus* (Krait), *Vipera* (Viper)



***Chelone* (Turtle)**



Class Aves



Characteristic features

- Mostly they fly due to the **presence of feathers** (Exceptions- Ostrich, Kiwi) and **possess beak**
- **Forelimbs:** Modified into wings
- **Hind limbs:** Have scales and are modified for walking, swimming or clasp the tree branches
- **Skin:** Dry without glands except the oil gland at the base of the tail
- **Endoskeleton:** Fully ossified (bony) and the long bones are hollow with air cavities (pneumatic)
- **Digestive tract:** crop and gizzard (additional chambers)
- **Heart:** Four-chambered, homoiothermous (warm-blooded)



Digestive tract



Oil glands



Class Aves



- Respiration through lungs
 - **Air sacs** connected to lungs supplement respiration
- Sexes are separate
- Fertilisation is internal
- Oviparous and development is direct
- Examples : *Corvus* (Crow), *Columba* (Pigeon), *Psittacula* (Parrot), *Struthio* (Ostrich), *Pavo* (Peacock), *Aptenodytes* (Penguin), *Neophron* (Vulture)



Air pockets

Air cavities



Class Mammalia



Characteristic features

- **Habitats**– Polar ice caps, deserts, mountains, forests, grasslands and dark caves (some of them have adapted to fly or live in water)
- Unique mammalian characteristic- Presence of milk producing glands (**mammary glands**) for the nourishment of young ones
- **Two pairs of limbs**- Adapted for walking, running, climbing, burrowing, swimming or flying.
- **Skin**- Possesses hair
- External ears or pinnae are present
- Different **types of teeth** are present in the jaw.
- **Heart**- Four-chambered
- **Homoiothermous** (warm-blooded)





Class Mammalia



- Respiration- Through lungs
- Sexes are separate, internal fertilisation
- Viviparous with few exceptions and development is direct
- Examples:
 - **Oviparous-** *Ornithorhynchus* (Platypus)
 - **Viviparous-** *Macropus* (Kangaroo), *Pteropus* (Flying fox), *Camelus* (Camel), *Macaca* (Monkey), *Rattus* (Rat), *Canis* (Dog), *Felis* (Cat), *Elephas* (Elephant), *Equus* (Horse), *Delphinus* (Common dolphin), *Balaenoptera* (Blue whale), *Panthera tigris* (Tiger), *Panthera leo* (Lion)



Platypus
(*Ornithorhynchus*)



Kangaroo
(*Macropus*)



Monkey
(*Macaca*)



Summary



Phylum	Level of organisation	Symmetry	Coelom	Segmentation	Digestive system	Circulatory system	Respiratory system	Distinctive features
Porifera	Cellular	Many	Absent	Absent	Absent	Absent	Absent	Body with pores and canal in walls
Coelenterata (Cnidaria)	Tissue	Radial	Absent	Absent	Incomplete	Absent	Absent	Cnidoblasts present
Ctenophora	Tissue	Radial	Absent	Absent	Incomplete	Absent	Absent	Comb plates for locomotion
Platyhelminthes	Organ & organ system	Bilateral	Absent	Absent	Incomplete	Absent	Absent	Fat body, suckers
Aschelminthes	Organ system	Bilateral	Pseudo	Absent	Complete	Absent	Absent	Often worm shaped, elongated



Summary



Phylum	Level of organisation	Symmetry	Coelom	Segmentation	Digestive system	Circulatory system	Respiratory system	Distinctive features
Annelida	Organ system	Bilateral	Coelomate	Present	Complete	Present	Absent	Body segmentation like rings
Arthropoda	Organ system	Bilateral	Coelomate	Present	Complete	Present	Present	Exoskeleton of cuticle, jointed appendage
Mollusca	Organ system	Bilateral	Coelomate	Absent	Complete	Present	Present	External skeleton shell usually present
Echinodermata	Organ system	Radial (adults)	Coelomate	Absent	Complete	Present	Present	Water vascular system, radial symmetry
Hemichordata	Organ system	Bilateral	Coelomate	Absent	Complete	Present	Present	Worm-like with proboscis, collar and trunk



Summary



Chordates

Notochord present

Central nervous system is dorsal, hollow and single

Pharynx perforated by gill slits

Heart is ventral

Post-anal tail present

Non-chordates

Notochord absent

Central nervous system is ventral, solid and double

Gill slits are absent

Heart is dorsal (if present)

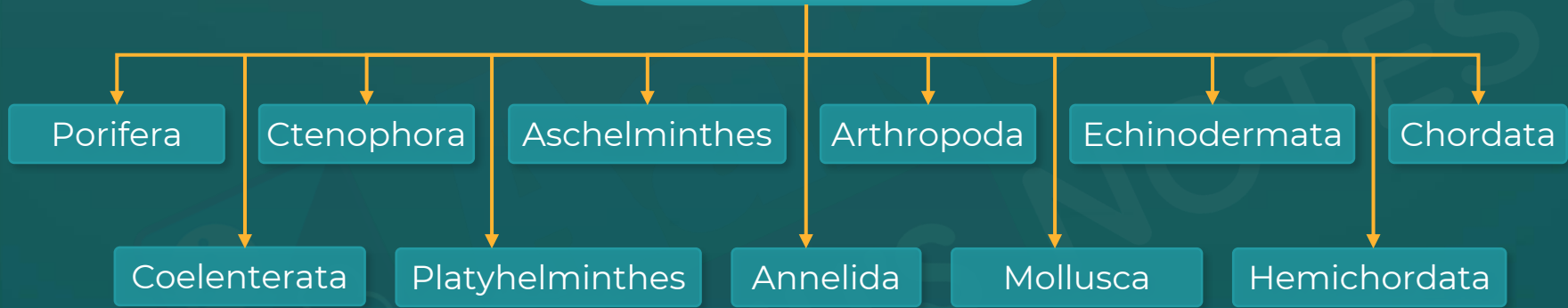
Post-anal tail absent



Summary



Kingdom animalia





Summary



Classification of vertebrata

