Animal Kingdom

Basis of classification for Kingdom Animalia

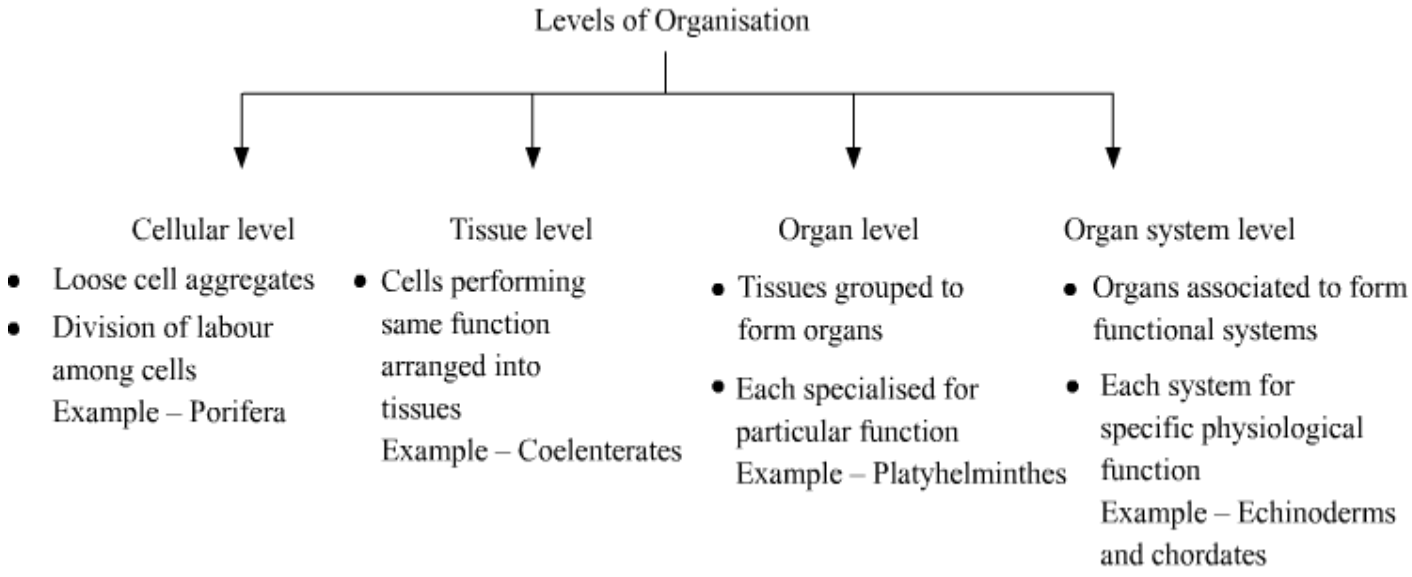
Basis of Classification

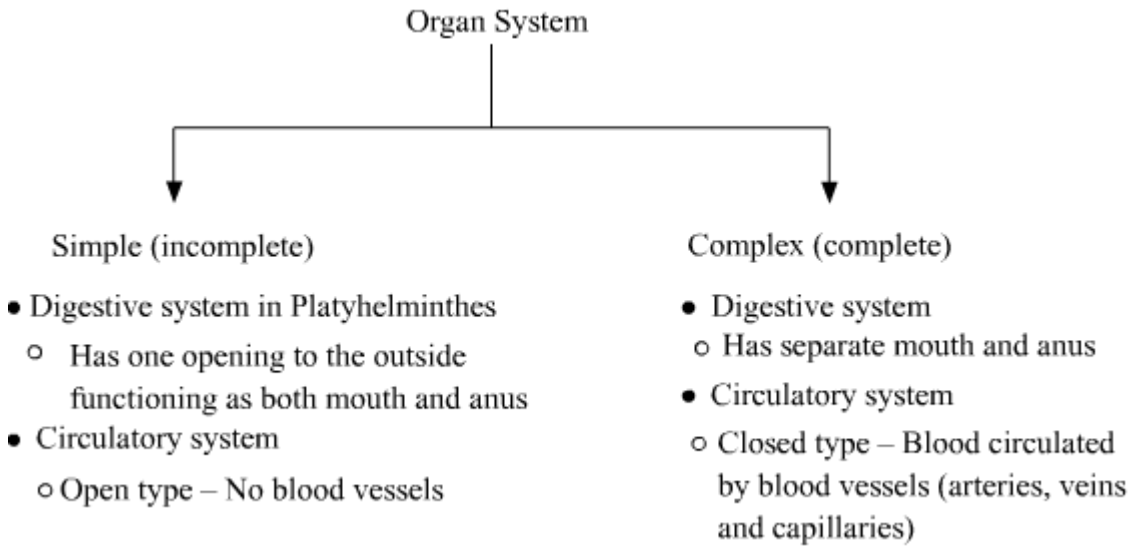
There are some features which are used to classify animals like

- Arrangement of cells (levels of organisation)
- Body symmetry
- Nature of coelom
- Patterns of digestive, circulatory, or reproductive systems

Levels of Organisation

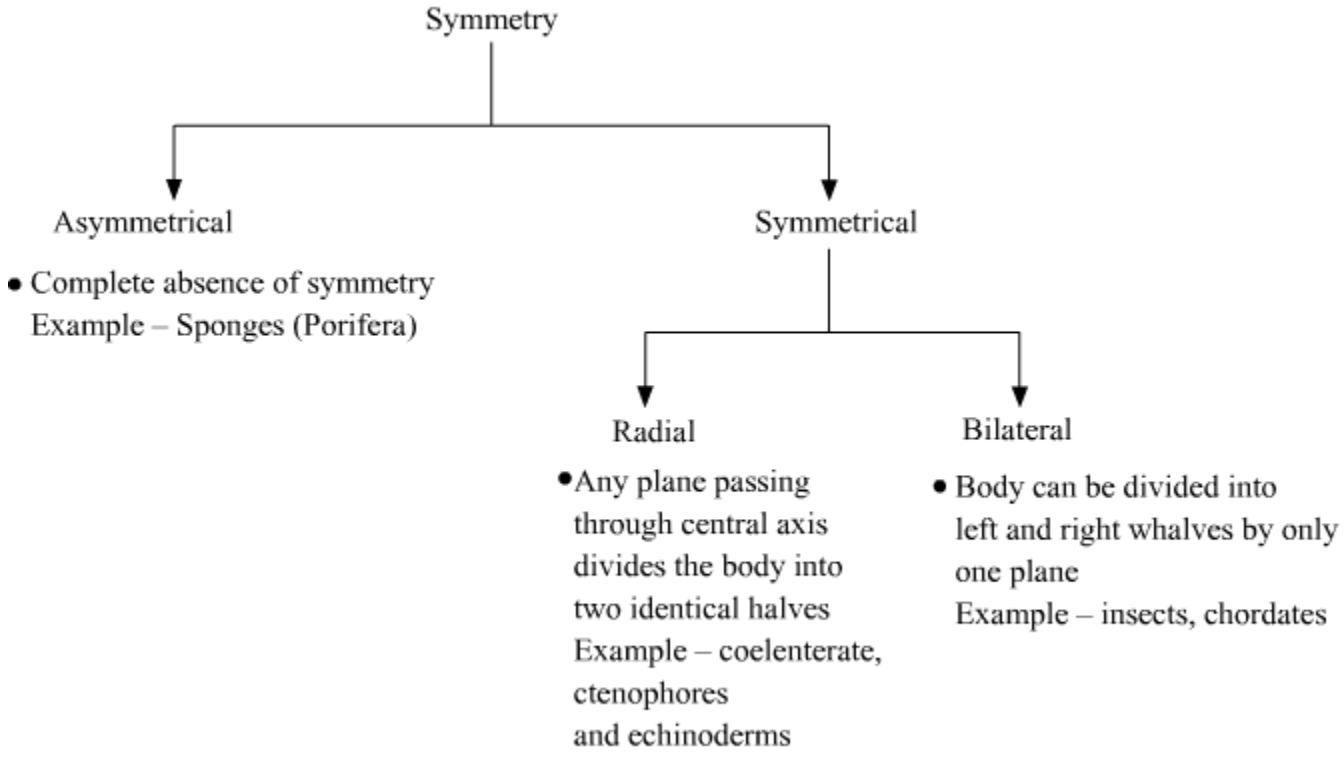
- All members of Animalia are multicellular, but exhibit different levels of organisation.





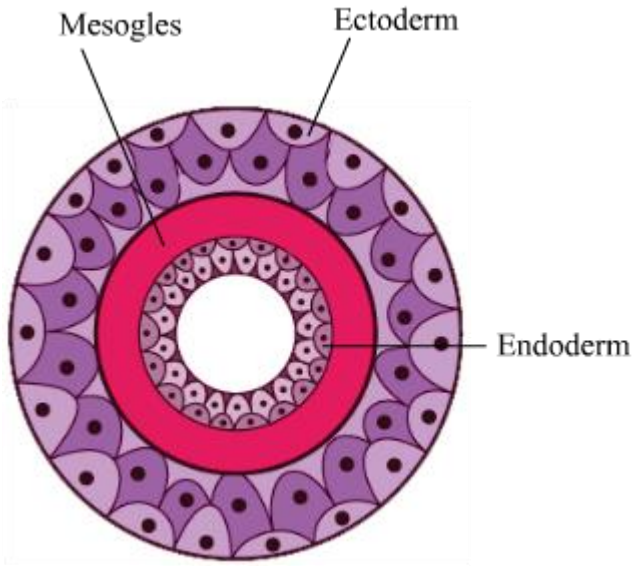
Symmetry

- Planes passing through the body dividing it into equal halves



Diploblastic and Triploblastic Organisation

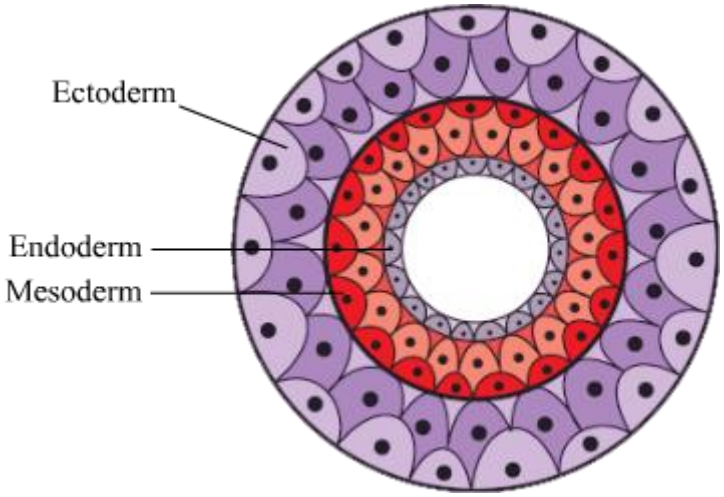
Diploblastic Organisation



- Cell arranged in two embryonic layers:
- Ectoderm (external)
- Endoderm (internal)
- Presence of an undifferentiated layer, i.e. mesoglea, in between two embryonic layers
- Example – coelenterates

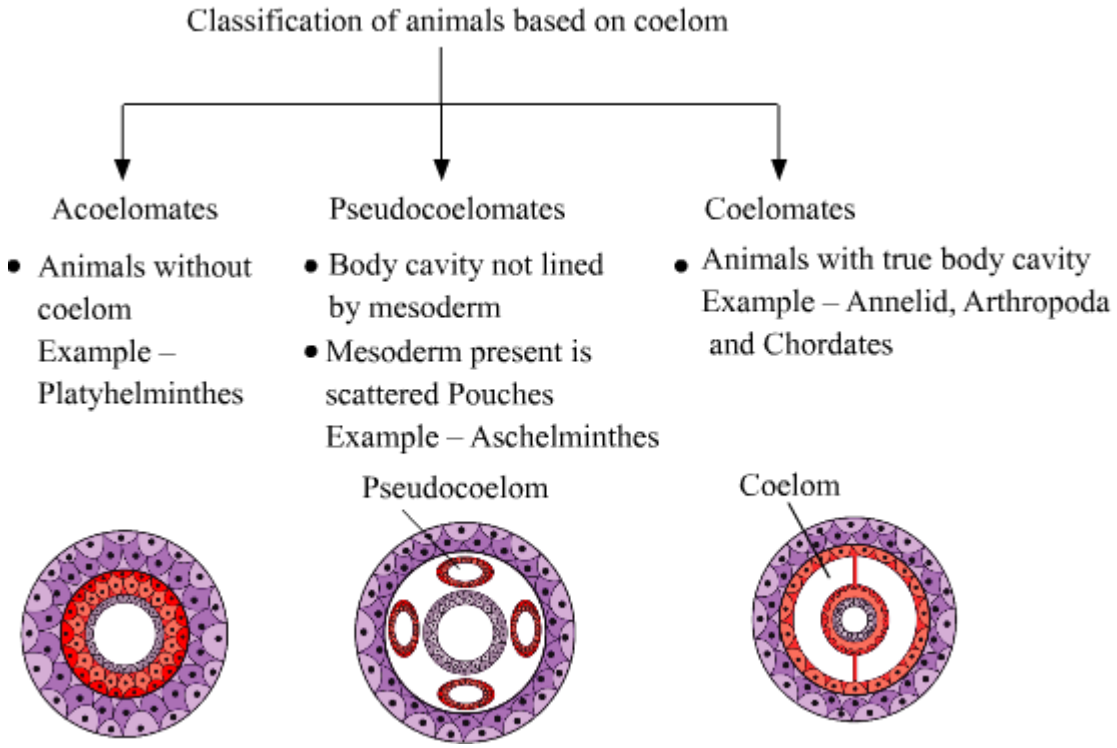
Triploblastic Organisation

- Cells arranged in three embryonic layers:
- Ectoderm (external)
- Mesoderm (middle)
- Endoderm (internal)
- Example – Platyhelminthes and chordates



Coelom

- Coelom – Mesoderm-lined body cavity present in between body wall and gut wall



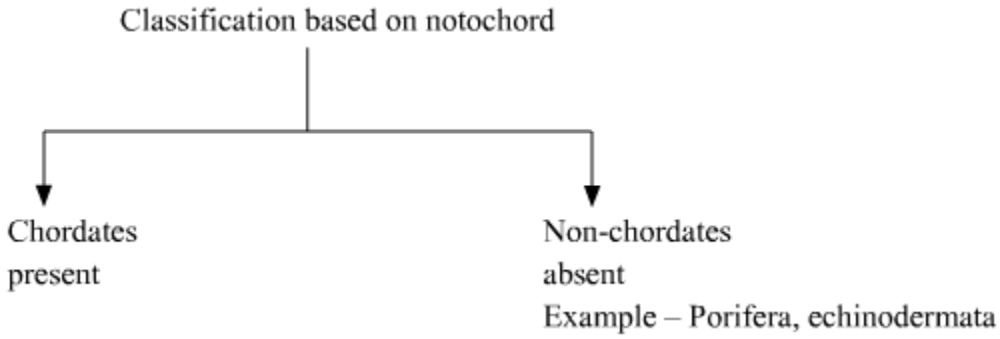
Segmentation

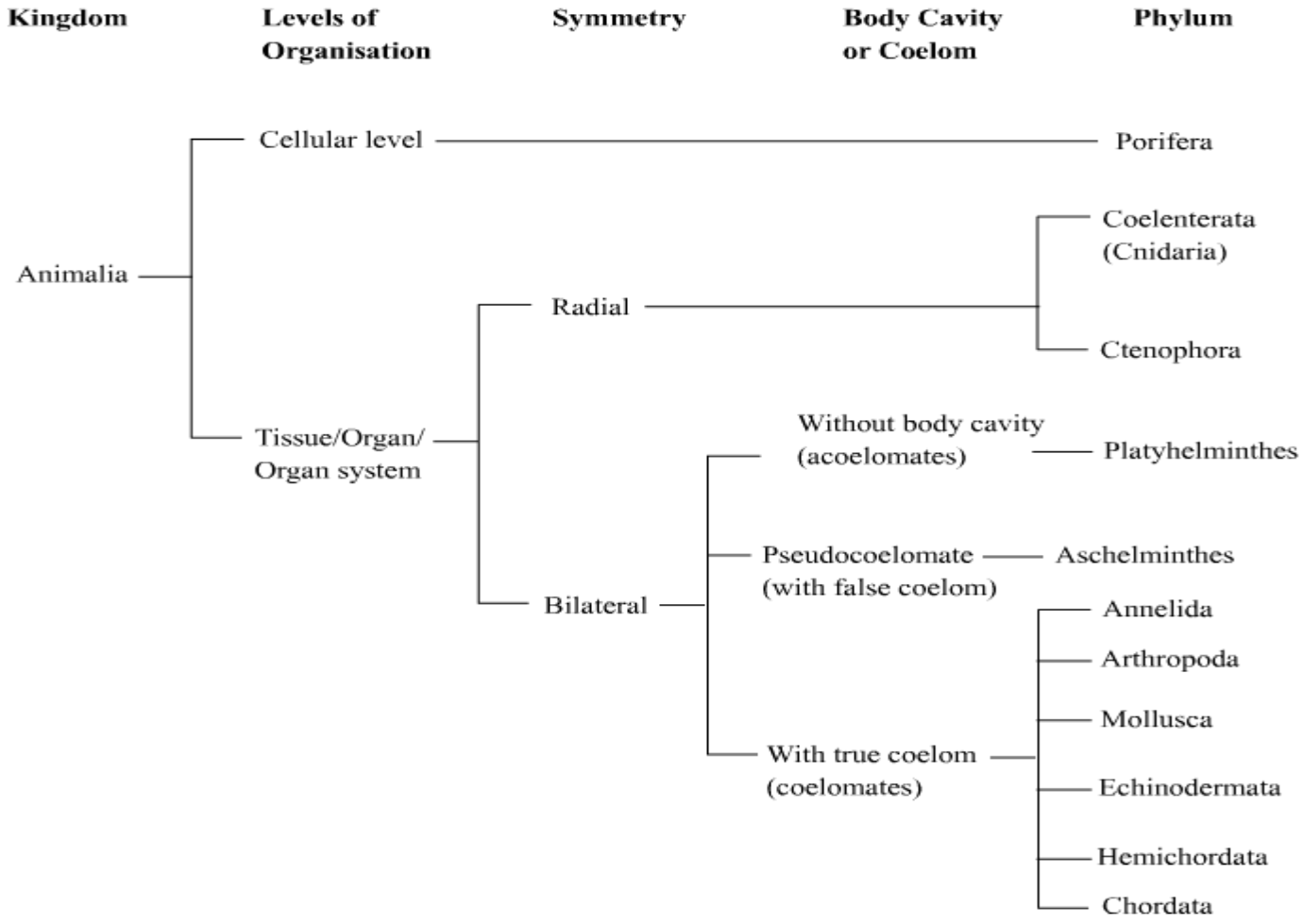
- In some animals, body is externally and internally divided into segments with certain organs repeated serially.
- Example: Earthworm

The phenomenon of division of body of the earthworm into metameric segments is known as metamerism.

Notochord

- It is a mesoderm derived rod-like structure, which is formed dorsally in some animals during embryonic development.

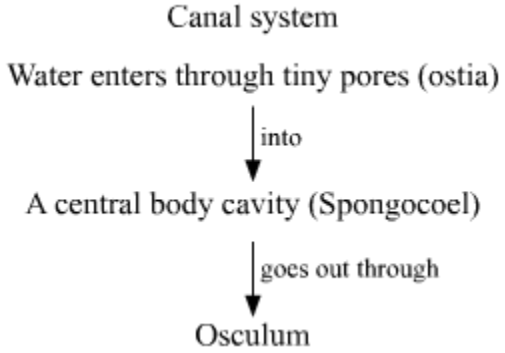




Characteristics Features of Different Phyla

Phylum – Porifera

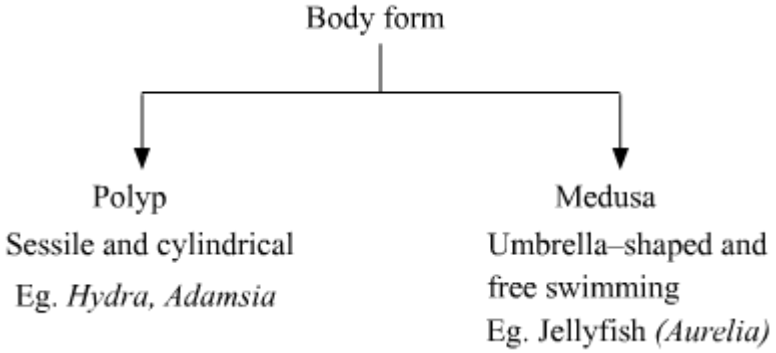
- Members commonly known as sponges are generally marine.
- They are primitive, multicellular, asymmetrical, and have cellular level of organization.
- They have a water transport system or canal system.



- Canal system is helpful in gathering food, exchange of respiratory gases, and excretion of waste.
- The spongocoel and canals are lined by collar cells (choanocytes).
- Digestion – Intracellular
- Skeletal system – Skeleton consists of spicules or spongin fibres.
- Reproduction:
- Asexual (by fragmentation) or sexual (by gamete formation)
- Sponges are hermaphrodite.
- Fertilization - Internal
- Development - Indirect (have morphologically distinct larval stage)
- Examples of sponges – *Sycon* (Scypha), *Spongilla* (fresh water sponge), and *Euspongia* (Bath sponge)

Phylum – Coelentrata (Cnidaria)

- Name cnidaria is derived from cnidoblasts or cnidocytes, which are used for anchorage, defense and capture of prey.
- Coelenterates are aquatic (mostly marine), sessile, or free swimming.
- Radially symmetrical
- Diploblastic and have tissue level of organization
- Digestion can be extracellular and intracellular.
- Skeletal system - Skeleton is composed of calcium carbonate in case of corals.



- Alternation of generation (metagenesis) is exhibited by those occurring in both forms. In this: Polyps →medusae (asexually) and medusae →polyps (sexually) (Example – *Obelia)*
- Examples of coelenterates – *Physalia* (*Portuguese* man-of-war), *Adamsia* (Sea anemone), etc.

Phylum – Ctenophora

- Common name - Sea walnuts and comb jellies
- Exclusively marine
- Radially symmetrical
- Diploblastic and have tissue level of organization
- Digestion - Both extracellular and intracellular
- Locomotory organ - Eight rows of ciliated comb plates located externally
- Reproduction - Sexual only

- Fertilization - external
- Development - indirect
- Exhibit the property of bioluminescence (emit light)
- Examples of ctenophores – *Pleurobrachia* and *Ctenoplana*

Phylum Platyhelminthes and Phylum Aschelminthes

Phylum – Platyhelminthes

- Called flatworms since they have **dorso-ventrally flattened bodies**
- Members are bilaterally symmetrical.
- Triploblastic and acoelomate with organ level of organisation
- Nutrition **–** Parasitic (endoparasites on animals and humans)
  Parasitic forms may have hooks and suckers present on their bodies or some forms may suck nutrients directly from their host.
- Excretion **–** Flame cells control osmoregulation and excretion.
- Reproduction
- Platyhelminthes are hermaphrodites.
- Fertilization **–** Internal
- Development **–** consists of several larval stages
- Some have high regeneration capacity.
- Examples of Platyhelminthes **–** *Taenia* (Tapeworm), *Fasciola* (Liver fluke)

Phylum –Aschelminthes

- Known as roundworms since their bodies are circular in cross-section
- Have bilateral symmetry
- Are triploblastic, pseudocoelomate, and have organ system level of body organisation

- Nutrition – May be free living or parasitic on plants and animals
  Alimentary canal is complete with well-developed pharynx.

- Excretion – Excretory tube removes waste through the excretory pore.

- Reproduction – Aschelminthes are dioecious (sexes separate). Females are often longer than males.

- Fertilization – Internal

- Development – Direct (young ones resemble adult) or indirect

- Examples of Aschelminthes – *Ascaris* (Round worm), *Wuchereria* (Filaria worm), *Ancylostoma* (Hookworm).

Phylum Annelida and Phylum Arthropoda

Phylum – Annelida

- May be aquatic (marine and freshwater) or terrestrial

- Members have bilateral symmetry.

- Have organ-system level of organisation, are triplobastic, coleomate, and have **metamerically segmented** bodies

- Locomotory organs - Longitudinal and circular muscles; parapodia in aquatic forms (help in swimming)

- Circulatory system - Closed

- Excretory organ - Nephridia

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

- Reproduction

- Strictly sexual

- Some forms are dioecious (*Nereis*) but some are hermaphrodites (earthworm and leech).

- Examples of annelids – *Nereis*, *Pheretima* (Earthworm) and *Hirudinaria* (Blood sucking leech)

Phylum – Arthropoda

- This is the largest phylum in Animalia and consists of insects. Over two-thirds of known species belong to Arthropoda.
- Members have bilateral symmetry.
- These have organ-system level of organisation and are triploblastic and coelomate.
- Body is covered by a chitinous exoskeleton and has distinct **head**, **thorax,** and **abdomen.**
- Have **jointed appendages** (*arthros* – joint, *poda*- appendages)
- Respiratory organs - May have gills/book gills (aquatic)/ book lungs/tracheal system (terrestrial)
- Circulatory system - Open
- Excretory organs - Malpighian tubules
- Sensory organs - Have eyes (compound and simple), antennae, statocysts (balance organs)
- Reproduction
- Mostly dioecious
- Fertilization is internal and development direct or indirect.
- Examples of arthropods
- Honey bee, silkworm (economically important)
- Mosquito, housefly (vectors)
- Cockroach, locust (Pests)

Phyla: Mollusca and Echinodermata

Phylum Mollusca

- Second largest phylum in Animalia
- Habitat: Terrestrial or aquatic (freshwater or marine)

- Members have bilateral symmetry
- Have organ system level of organisation; are triploblastic and coelomate
- Body covered by calcareous shell, and has a distinct head, a muscular foot and a visceral hump
- A soft, spongy layer of skin forms a mantle over the visceral hump.
- Space between the hump and the mantle is known as mantle cavity; gills are present in this cavity
- Gills have both respiratory and excretory functions.
- Sensory organs: Tentacles present on head
- Feeding organ: Radula (file-like)
- Reproduction:
- Molluscs are dioecious and oviparous.
- Development is indirect
- Examples: *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Octopus* (Devil fish).

Phylum Echinodermata

- Echinodermata means spiny-bodied. They are called so because of the presence of an endoskeleton of calcareous ossicles.
- Habitat: Marine
- Adults have radial symmetry but the larvae have bilateral symmetry
- Have organ system level of organisation; are triploblastic, coelomate; digestive system – complete with mouth (on ventral/ lower side) and anus (on dorsal/ upper side)
- Presence of water vascular system: Distinct feature of this phylum
- Water vascular system helps in locomotion, capture and transport of food, and in respiration.
- Reproduction:

- Sexual
- External fertilisation
- Development is indirect, with the presence of freely swimming larva stage
- Examples: *Asterias* (Star fish), *Echinus* (Sea urchin), *Cucumaria* (Sea cucumber)

Phyla:Hemichordata and Chordata

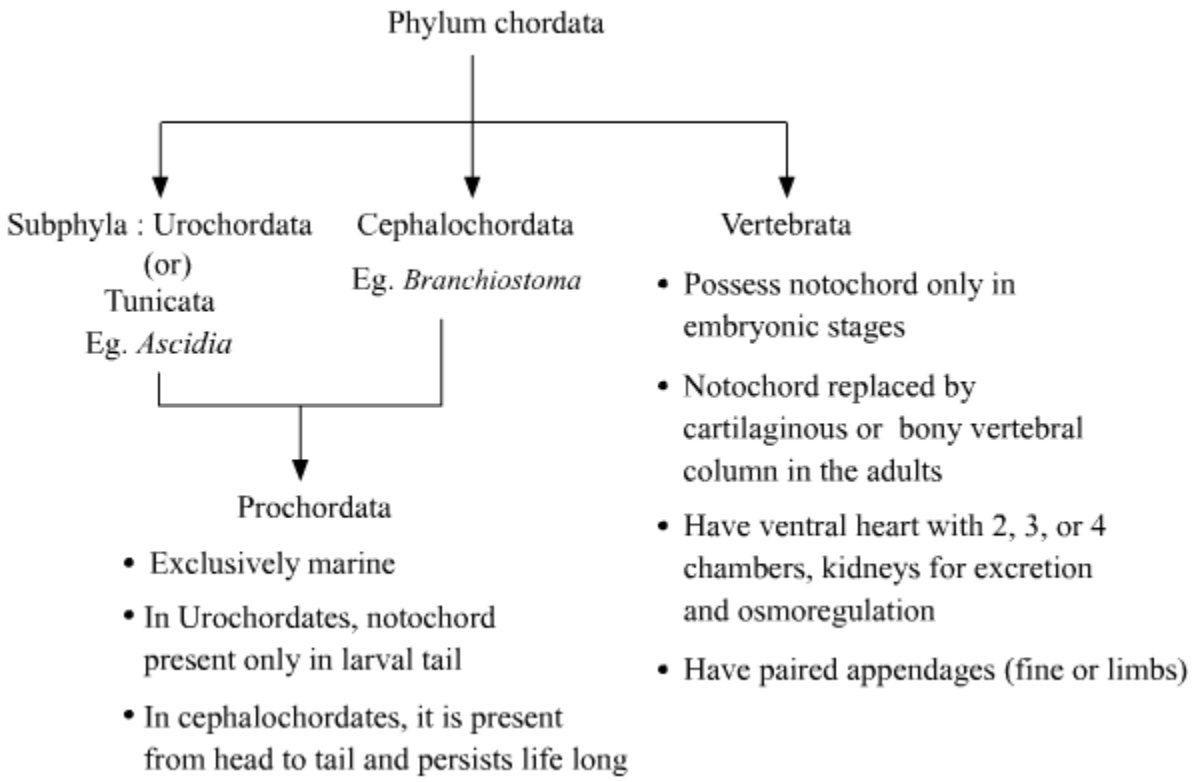
Phylum – Hemichordata

- Earlier placed as a sub-phylum of chordata
- Consists of a small group of worm-like marine animals
- Members have bilateral symmetry.
- Have organ-system level of organization, are triploblastic and coelomate
- Body is cylindrical and composed of anterior proboscis, collar, and a long trunk.
- Circulatory system – Open
- Respiratory organs – Gills
- Excretory organ – Proboscis gland
- Reproduction:
- Sexes are separate.
- Fertilization – external
- Development – indirect
- Examples of hemichordates – *Balanoglossus and Saccoglossus*

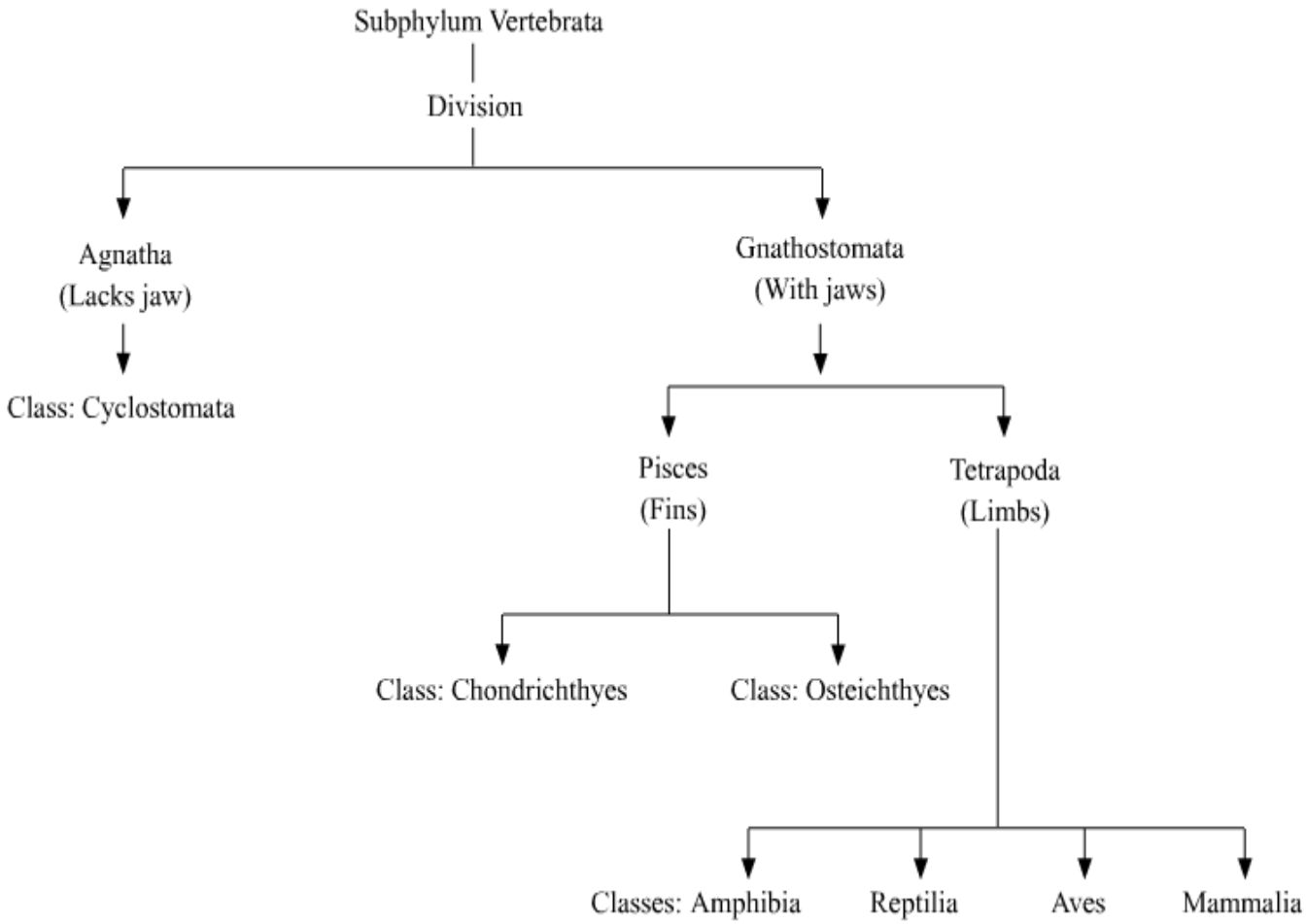
Phylum Chordata

- Characterized by the presence of
- notochord

- dorsal hollow nerve cord
- paired pharyngeal gill slits
- bilateral symmetry, triploblastic organization, and coelom
- organ system level
- post anal tail
- closed circulatory system



Subphylum Vertebrata



Class – Cyclostomata

- All members have sucking circular mouth without jaws.
- Habitat – marine, migrate to fresh waters for spawning
  They die after spawning, and larvae return to their marine habitat after metamorphosis.
- Nutrition – Ectoparasitic (on some fishes)
- Respiratory organs – 6-15 pairs of gill slits
- Body is devoid of scales and paired fins.
- Cranium and vertebral column are cartilaginous.
- Examples of cyclostomes – *Petromyzon* (Lamprey), *Myxine* (Hagfish)

Class – Chondrichthyes

- Habitat – Marine
- Members have cartilaginous endoskeleton and streamlined body.
- Their skin is tough and contains small placoid scales.
- Nutrition – Members of this class are predaceous with strong jaws. The mouth is located ventrally while the teeth, which are actually the modified placoid scales, are backwardly directed.
- Respiratory organs – Gills (Gills slits separated without operculum or gill cover)
- Have to swim continuously to avoid sinking due to the absence of air bladder
- Heart is two-chambered (one auricle and one ventricle).
- Some have electric organs (Example – *Torpedo*) and some have poisonous sting (Example – Stingray).
- They are poikilothermous (cold-blooded).
- Reproduction:
- Sexes are separate (dioecious).
- In males, pelvic fins bear claspers.
- Fertilization – Internal
- Many members are viviparous.
- Examples of Chondrichthyes: *Scoliodon* (Dog fish)

Class – Osteichthyes

- Habitat – Both marine and fresh water
- Members have bony endoskeleton and streamlined body with mouth terminally placed.
- Body covered by cycloid or ctenoid scales
- Respiratory organ – Four pairs of gills covered by operculum; presence of air bladder provides buoyancy

- Heart – two-chambered
- They are also poikilothermous.
- Reproduction:
- Sexes are separate.
- Fertilization – External
- Mostly oviparous
- Development – Direct
- Example of Osteichthyes: Marine – *Hippocampus* (Sea horse), Freshwater – *Labeo* (Rohu)

Class – Amphibia

- Can live both in water and on land
- Body divisible into head and trunk with two pairs of limbs; tail may be present in some
- Alimentary canal, excretory and reproductive tracts open into common opening called cloaca on the exterior.
- Skin is moist without scales.
- Eyes have eyelids and ear is represented by tympanum.
- Respiration can be by gills, lungs, and skin.
- Heart is three-chambered (two auricles and one ventricle).
- Poikilothermous
- Reproduction:
- Sexes are separate.
- Fertilization – External
- They are oviparous.
- Development – Indirect

- Examples of amphibians – *Bufo* (Toad), *Rana* (Frog), *Salamandra* (Salamander)

Class – Reptilia

- Characterized by creeping or crawling mode of locomotion
- Habitat – Mostly terrestrial
- Body covered by dry cornified skin, epidermal scales or scutes
- Do not have external ears, tympanum present
- Two pairs of limbs, when present
- Heart is three-chambered, but it is four-chambered in crocodiles.
- Poikilothermous
- Snakes and lizards shed their scales as skin cast.
- Reproduction:
- Sexes are separate.
- Fertilization is internal. Reptiles are oviparous.
- Development – Direct

Examples of reptiles – *Chameleon* (Tree lizard), *Crocodilus* (Crocodile), *Testudo* (Tortoise)

Class – Aves (Birds)

- Characterized by the presence of wings and ability to fly with exception of flightless birds
- They have beaks.
- Forelimbs modified into wings and hind limbs generally have scales; used for walking, swimming, or clasping the tree branches
- Skin is dry with oil glands present only at the base of the tail.
- Skeletal system – Endoskeleton is ossified and long bones are hollow (pneumatic).

- Respiratory organ – Lungs; air sacs connected to lungs supplement respiration
- Digestive system – Has two additional chambers: crop and gizzard
- Heart is four-chambered.
- Homoiothermous (warm-blooded)
- Reproduction:
- Fertilization – Internal; they are oviparous
- Development – Direct
- Sexes are separate.
- Example – *Corvus* (Crow), *Columba* (Pigeon), *Psittacula* (Parrot)

Class – Mammalia

- Habitat – Variety of habitats (polar ice caps, deserts, mountains, forests, grasslands, etc)
- Show adaptations that enable them to fly, to swim, or to walk
- Presence of mammary glands (produce milk for young ones) – unique characteristic of mammals
- Respiratory organ – Lungs
- Have two pairs of limbs
- Skin is covered by hair (Present only in mammals).
- External ears are present.
- Heart is four-chambered. These are homoiothermous.
- Reproduction:
- Fertilization – Internal
- Sexes are separate.
- They are viviparous with exceptions (Example – Platypus which is oviparous).

- Development – Direct

- Examples of mammals – *Panthera leo* (Lion), *Homo sapiens* (Man), *Delphinus* (Dolphin), *Balaenoptera* (Blue whale)