

4. Animal Kingdom

POINTS TO REMEMBER :

Levels of organization :

- Cellular level
- Tissue level
- Organ level
- Organ system level

Circulatory System :

Open type: Blood pumped out through heart. Cells and tissues are directly bathed in it.

Closed type: Blood is circulated through vessels.

Symmetry :

- **Asymmetrical:** Cannot be divided into equal halves through median plane. e.g., Sponges.
- **Radial symmetry:** Any plane passing through central axis can divide organism into equal halves. e.g., Hydra.
- **Bilateral symmetry:** Only one plane can divide the organism into equal halves. e.g., Annelids and Arthropods.

CLASSIFICATION ON BASIS OF GERMINAL LAYERS :

- **Diploblastic:** Cells arranged in two embryonic layers i.e. external ectoderm and internal endoderm. (Mesoglea may be present in between ectoderm and endoderm) e.g., Coelenterates. (Cnidarians)
- **Triploblastic:** Three layers present in developing embryo i.e., ectoderm, endoderm and mesoderm. e.g., Chordates.
- **Coelom** (Body cavity which is lined by mesoderm)
- **Coelomates:** Have coelom e.g., Annelids, Chordates etc.
- **Pseudocoelomates:** No true coelom as mesoderm is present in scattered pouches between ectoderm and endoderm. e.g., Aschelminthes.
- **Acoelomates:** Body cavity is absent. E.g. Platyhelminthes.
- **Metamerism:** If body is externally and internally divided into segments with serial repetition of at least some organs then phenomenon is called metamerism. e.g., Earthworm.
- **Notochord:** Rod-like structure of mesodermal origin, formed during embryonic development on the dorsal side. e.g., Chordates.

PHYLUM PORIFERA :

- Also called sponges.
- Are usually marine and **asymmetrical**.
- Have **cellular level** of organization.
- Food gathering, respiratory exchange and removal of wastes occur through water **canal system**.
- Digestion **intracellular**.
- **Ostia** (minute pores on body), **spongocoel** (body cavity) and **osculum** help in water transport. They are lined by **choanocytes** (collar cells).
- Body wall has **spicules** and **spongin** fibers.
- Animals are **hermaphrodite**.
- Fertilization internal.

- Development is indirect, with larval stage which metamorphoses to adult. e.g., *Sycon*, *Euspongia*.

PHYLUM COELENTERATA :

- Also called Cnidarians.
- Are usually marine and radially symmetrical.
- Sessile or free-swimming.
- Have **tissue level** of organization
- Diploblastic.
- Presence of **cnidoblast**, for anchorage, defense and capture of prey.
- Central body cavity called **gastro-vascular cavity** or **coelenterone**.
- Digestion extracellular and intracellular.
- Blind sac type body plan, with one opening called **hypostome**.
- Body wall composed of calcium carbonate.
- Exhibit two body forms: **polyp** and **medusa** e.g., Hydra, Aurelia.
- Alternation of generation between body forms called **Metagenesis** occurs in *Obelia* where Medusa sexually reproduced and polyp asexually reproduced. •e.g., *Physalia*, *Adamsia*.

PHYLUM CTENOPHORA :

- Also called as **sea walnuts** or **comb jellies**.
- Are exclusively marine, radially symmetrical.
- Have tissue level organisation, are diploblastic.
- Digestion both extra and intracellular.
- Body has eight external rows of ciliated **comb plates** for locomotion.
- Show Bioluminescence (living organism emit light).
- Sexes are not separate i.e. hermaphrodite.
- Reproduce only by sexual methods.
- External fertilization.
- Indirect development

e.g., *Ctenoplana*, *Pleurobranchia*

PHYLUM PLATYHELMINTHES :

- Also called as '**flat worms**'.
- Have dorsoventrally flattened body.
- Mostly endoparasites in animals including human.
- Bilaterally symmetrical,
- **Triploblastic**
- Acoelomate
- Organ level organization.
- Absorb nutrients through body surface.
- Parasite forms have hooks and suckers.
- '**Flame cells**' help in osmoregulation and excretion.
- Fertilization internal. Many larval stages.
- *Planaria* has high **regeneration** capacity.

e.g., *Taenia*, *Fasciola*.

PHYLUM ASCHELMINTHES :

- Also called '**round worms**'.
- May be free living, parasitic, aquatic or terrestrial.
- Are bilaterally symmetrical, triploblastic, **Pseudocoelomates**.
- Alimentary canal complete (has muscular pharynx), wastes removed through excretory pore.
- Organ system level of organization.
- Sexes separate i.e. **dioecious**.
- Shows **sexual dimorphism**.
- Females longer than males.
- Fertilisation internal.
- Development direct or indirect.

e.g., Ascaris, Wuchereria.

PHYLUM ANNELIDA :

- Are aquatic or terrestrial, free-living or parasitic.
- Are bilaterally symmetrical, triploblastic,
- Organ-system level of organization
- **Metamerically** segmented body.
- Have longitudinal and circular muscles in body wall for locomotion.
- Aquatic annelid like *Nereis* has oar shaped **parapodia** for movement.
- Have **nephridia** for osmoregulation and excretion.
- Nervous system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord.
- Circulatory system is closed type.
- Earthworm (*Pheretima*) and Leech (*Hirudinaria*) which are hermaphrodites (i.e., monoecious).
- *Nereis* an aquatic form is dioecious.
- Fertilization is external
- Development is direct or indirect.

PHYLUM ARTHROPODA :

- Largest phylum of Animalia includes insects.
- Are bilaterally symmetrical, triploblastic and organ system level of organization, coelomate and segmented body.
- Body divisible into **head, thorax, abdomen**.
- Body covered by a **chitinous exoskeleton**.
- They have **jointed appendages**.
- Respiration by **gills, book gills, lungs** or **tracheal system**.
- **Circulation is open type**.
- Excretion through **malpighian tubules**.
- Sensory organs: Antennae, eyes; Organs of balance: Statocysts.
- Mostly dioecious.
- Fertilisation internal.
- Are mostly oviparous.
- Development is indirect or direct. e.g., *Apis*, *Bombyx*, *Anopheles*, *Locusta*, *Limulus*.

PHYLUM MOLLUSCA :

- Second largest phylum of Animalia.
- Terrestrial or aquatic.
- Are bilaterally symmetrical, triploblastic and organ system level of organization, coelomate.
- Body divisible into **head, muscular foot** and **visceral hump** and is covered by a soft and spongy layer of skin called **mantle**.
- Unsegmented body.
- Body is covered by calcareous shell.
- Respiration and excretion by feather like gills (ctenidium) in mantle cavity.
- Head has sensory tentacles. **Radula**-file like rasping organ for feeding.
- Usually dioecious, dioecious, have indirect development.

e.g., *Pila*, *Pinctada*, *Octopus*.

PHYLUM ECHINODERMATA :

- Are spiny bodied organisms.
- Endoskeleton of **calcareous ossicles**.
- Are exclusively marine.
- Radially symmetrical in adult but bilaterally symmetrical in larval stage.
- Organ system level of organization.
- Triploblastic and **eucoelomate**.
- Digestive system complete. Mouth ventral, Anus on dorsal side.
- Food gathering, respiration, locomotion carried out by **water vascular system**.
- Excretory system is absent.
- Dioecious i.e. sexes are separate.
- Fertilization external. Development indirect (free swimming larva)

e.g., *Asterias*, *Cucumaria*.

PHYLUM HEMICHORDATA :

- Have small worm-like marine animals.
- Was earlier placed as sub-phylum of Phylum Chordata.
- Bilaterally symmetrical, triploblastic and coelomate.
- Body cylindrical, has proboscis, collar and trunk.
- Circulation is open type.
- Respiration by gills
- Excretion by proboscis gland.
- Sexes separate, external fertilization, indirect development.

e.g., *Balanoglossus*

PHYLUM CHORDATA :

- Presence of Notochord (between gut and nerve cord)
- Have dorsal hollow nerve chord.
- Have paired pharyngeal gill slits.
- Heart is ventral.
- Post anal tail present.
- Bilaterally symmetrical, triploblastic, and coelomate with organ system level of organization.
- Circulation is closed type.

SUB-PHYLA UROCHORDATA :

- Notochord present only in tail of larval stage. e.g., *Ascidia*, *Salpa*, *Doliolum*.

SUB-PHYLA CEPHALOCHORDATA :

- Notochord extends from head to tail. e.g., *Amphioxus*.

SUB-PHYLA VERTEBRATA :

- Have notochord only during embryonic period.
- Notochord gets replaced by bony or cartilaginous vertebral column.
- Have ventral muscular heart with two, three or four chambered.
- Paired appendages which may be fins or limbs.
- Kidneys for excretion and osmoregulation.

Division Agnatha (lack jaws) -

Class: Cyclostomata :

- Have sucking and circular mouth without jaws.
- Live as ectoparasites on some fishes.
- Devoid of scales, no paired fins.
- Cranium and vertebral column is cartilaginous.
- Marine habit but migrates to fresh water for spawning and die after spawning.
- Larva returns to ocean after metamorphosis.

e.g., *Petromyzon*.

Division Gnathostomata (Bear Jaws) -

SUPER-CLASS: PISCES -

Class 1: Chondrichthyes :

- Have cartilaginous endoskeleton.
- Mouth ventrally located.
- Notochord persists throughout life.
- Gill slits are separate and without operculum.
- Skin has **placoid scales**.
- Jaw contains teeth, which are modified placoid scales.
- Mostly predaceous.
- **Swim bladder absent**.
- Heart is two chambered. (one auricle and one ventricle)
- Some of them contain electric organs (e.g. Torpedo)
- Some possesses poison sting. (e.g. Trygon)
- Poikilotherm or cold blooded.
- Dioecious.
- Sexually dimorphic, male's pelvic fin bears claspers.
- Fertilization internal.

- Many of them viviparous.

e.g., *Torpedo*, *Trygon*, *Scoliodon*.

Class 2 : Osteichthyes :

- Includes both marine and fresh water fishes.
- Bony endoskeleton.
- Mouth is usually terminal.
- Four pairs of gill slits covered by operculum.
- Skin has cycloid/ctenoid scales.
- Air bladder is present for buoyancy.
- Heart is two chambered.
- Cold blooded animals.
- Dioecious.
- Sexually monomorphic.
- Fertilization external.
- Mostly oviparous
- Development is indirect.

e.g., *Hippocampus*, *Labeo*, *Catla*, *Betta*.

SUPER CLASS: TETRAPODA -

Class-1: Amphibia

- Can live in aquatic as well as terrestrial habitats.
- Most of them have two pairs of limbs.
- Body divisible into head and trunk.
- Skin moist, without scales.
- Tympanum represents ear.
- **Cloaca** is the common chamber where alimentary, urinary and reproductive tracts open.
- Respiration by gills, lungs or skin.
- Heart is 3-chambered.(two auricle and one ventricle)
- Cold blooded animals.
- Sexes separate.
- Fertilization is external and requires water.
- Oviparous. Indirect development.

- e.g., *Bufo*, *Rana*, *Hyla*.

Class - 2: Reptilia

- Creeping or crawling mode of locomotion.
- Body has dry and cornified skin and epidermal scales or scutes.
- Tympanum represents ear.
- Limbs when present are two pairs.
- Mostly three chambered heart but 4-chambered in crocodiles.

- Snakes and lizards shed scales as skin cast.
- Poikilotherm.
- Sexes are separate.
- Fertilization internal.
- Oviparous. Direct development.

• e.g., *Testudo*, *Naja*, *Vipera*, *Calotes*.

Class - 3: Aves

- Presence of feathers and most can fly except flightless bird like ostrich.
- Jaw modified to beak without teeth.
- Forelimbs are modified into wings.
- Hind limbs have scales.
- No glands on skin except oil gland at base of tail.
- Endoskeleton bony with air cavities (pneumatic) and hollow bones to assist in flight.
- Digestive tract has additional chambers like crop and gizzard.
- Heart is four chambered.
- Homoiothermous or warm blooded, able to maintain constant temperature.
- Air sacs are connected to lungs to supplement respiration.
- Oviparous. Direct development.

• e.g., *Columba*, *Struthio*, *Corvus*.

Class- 4: Mammalia

- Have mammary glands to nourish young ones by secreting milk.
- Have two pairs of limbs.
- Skin has hairs.
- External ears or pinna present.
- Different types of teeth in jaw.
- Heart is four chambered.
- Homoiothermous.
- Respiration by lungs.
- Sexes separate, fertilization internal.
- Viviparous or oviparous. Direct development.

e.g., *Rattus*, *Canis*, *Elephas*, *Equus*. Oviparous mammal is *Ornithorhynchus*."