

Chapter - 4

Animal Kingdom

Basis of classification -

1. Level of organization -

- a. Cellular level - Cells are arranged as loose or cell aggregates. Some division of labour (activities) occur among the cells. Eg - Sponges
- b. Tissue level - the cells performing the same are arranged into tissue. Eg - Coelenterates
- c. Organ level - tissues are grouped together to form organs, each specialised for a particular function. Eg - Platyhelminthes, Aschelminthes
- d. Organ system level - Organs are associated to form functional systems, each system concerned with a specific physiological function.
Eg - Annelids, Arthropods, Molluscs, Echinoderms & Chordates.

2. Symmetry

- a. Asymmetrical - any plane that passes through the centre does not divide body into equal halves
Eg - Sponges.
- b. Radial symmetry - when any plane passing through the central axis of the body divides the

organism into two identical halves
 Eg - Coelenterates, Ctenophores, Echinoderms (only adults)

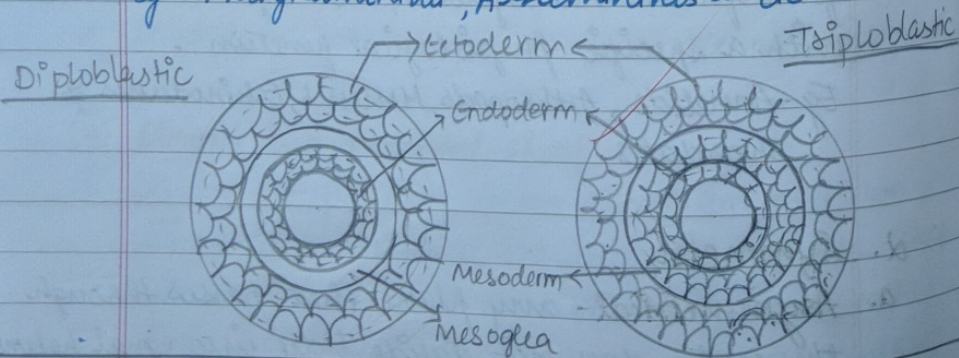
3. Bilateral symmetry - the body can be divided into identical left and right halves in only one plane. Eg - Annelids, Arthropods, Echinoderms (larvae) and Chordates.

3 Germ Layer

- a. Diploblastic - Animals in which cells are arranged into two embryonic layers, ectoderm (external) & endoderm (internal).

Mesoglea (undifferentiated layer) present between two layers.
 Eg - Sponges, Coelenterates.

- b. Triploblastic - Animals in which cells are arranged in three embryonic layers, ectoderm (external), mesoderm (middle), & endoderm (internal).
 Eg - Platyhelminths, Aschelminths --- etc.



4 Coelom

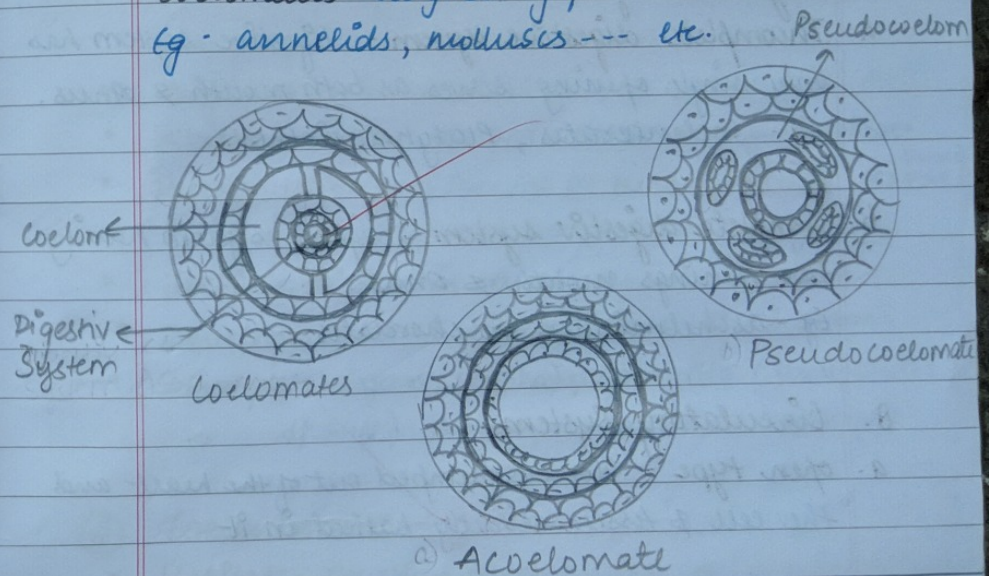
The body cavity which is lined by mesoderm on both sides is called coelom.

- a. Acoelomates - body cavity absent
 Eg sponges, Coelenterates, Platyhelminths

- b. Pseudocoelomates - animals in which body cavity is not lined by mesoderm. Instead, mesoderm is present as scattered pouches b/w ectoderm and endoderm. Such cavity is called pseudocoelom.

• Eg - Aschelminths.

- c. Coelomates - body cavity present
 Eg - annelids, molluscs --- etc.



5 Segmentation -

- In some animals, body is externally & internally divided into segments with serial repetition of at least some organs.
- The body shows this pattern called metamerism. Segmentation and phenomenon called metamerism.
- Eg - Earthworms.

6. Notochord -

Mesodermally derived rod like structure formed on dorsal side during embryonic development.

a. Chordatus - Animals without Notochord, at this life.
Eg - Fishes, Amphibians, Birds, Mammals etc

b. Nonchordatus - Animals without Notochord.
Eg - Porifera, Echinoderms

7. Digestive system -

a. Incomplete digestive system - digestive system has only single opening serves as both mouth & anus.
Eg - Coelenterates, Platyhelminthes.

b. Complete digestive system - digestive system having two openings mouth & anus.
Eg - Aschelminthes to chordates.

8. Circulatory System -

a. open type - Blood is pumped out of the heart and the cell & tissue directly bathed in it

b. closed type - Blood is circulated through vessels.

* CLASSIFICATION OF ANIMALS

→ PHYLUM

① Porifera - (Sponges)

- Habitat - Aquatic, generally marine; some fresh water
- Organization Level - Multicellular with cellular level of organisation - diploblastic
- Body cavity - absent / acoelomates.

• Symmetry - ~~As~~ Asymmetric

• Canal system - Sponges have water transport or canal system - Water enters through ostia (minute pores in sponges) in the body wall into a central cavity, Spongocoel, from where water goes out through osculum.

This path way is helpful in food gathering, respiratory exchange, removal of waste.

• Special cell - Choanocytes or collar cells line the spongocoel and the canals. These cells are flagellated.

• Digestion - Intracellular,

• Skeleton - Made of spicules or sponging fibre.

• Reproduction - Bisexual or hermaphrodite (sexes ^{same} or asexually (fragmentation) or Sexually.

• Fertilisation - Internal

• Development - Indirect (have larval stage)

• Example - Sycon (scapha), Spongilla (fresh water sponge) & Euspongia (Bath sponge).

② Coelenterata - (Cnidaria)

• Habitat - Aquatic - mostly marine, sessile or free-swimming.

• Organisation level - tissue level - diploblastic

• Symmetry - Radially symmetrical

• Body cavity - Absent, central gastrovascular cavity present with single opening (hypostome)

• Special Cell - Cnidoblasts / cnidocytes (contain stinging capsules or nematocytes) present on tentacles & body; Help for anchorage, defence

• Digestion - Extracellular & Intracellular.
Incomplete

- Skeleton - Some Cnidarians (like corals) have skeleton of CaCO_3
- Basic body form - have two basic form.
 - a) POLYP - sessile & cylindrical, eg Hydra, Adamsia.
 - b) MEDUSA - umbrella-shaped & free swimming eg Aurelia or jelly fish.
- Alteration of generation :
METAGENESIS - Cnidarian exist in both polyp & medusa forms & exhibit alteration of generation.
 - ie Polyps produce medusa asexually } eg Obelia (sea fan)
 - Medusa produce / form polyps sexually }
- Examples - Hydra, Aurelia (Jelly fish), Adamsia (sea anemone)

③ Ctenophora - (sea walnuts / comb jellies)

- Habitat - Exclusively marine
- Symmetry - Radial
- Level of organisation - tissue level
- Special organ - eight external rows of ciliated comb plates that help in locomotion.
- Digestion - extracellular & intracellular, Incomplete
- Special property - BIOLUMINESCENCE - the property of living organisms to emit light.
- Reproduction - (Bisexual or Hermaphrodites) only sexual reproduction
- Fertilization - External
- Development - indirect
- Example - Pleurobrachia and Ctenoplana
- Body cavity - absent.
- Germ layer - diploblastic

④ Platyhelminthes - (flatworms)

- Habitat - Endoparasites (found in animals)
- Symmetry - Bilateral
- Body organisation - organ level
- Coelom - triploblastic - Germ layer.
- Special structure - Hooks & suckers are present in parasitic forms for absorption. Some absorb nutrients from host directly through their body
- Body cavity - Absent / acelomates.
- Reproduction - ~~As~~ Bisexual animals (Hermaphrodite)
- Fertilisation - Internal
- Development - Indirect through many larval stage. (Planaria possess high regeneration capacity)
- Body shape - dorso-ventrally flattened, thus called flatworms
- Example - Taenia (Tapeworm), Fasciola (Liver fluke)

⑤ Aschelminthes - (Nematohelminthes, Roundworm)

- Habitat - free living, aquatic, terrestrial or parasitic
- Level of organisation - organ system
- Coelom - Germ layer - triploblastic
- Symmetry - Bilateral
- Body cavity - ~~triploblastic~~ Pseudocoelomates.
- Digestive System - Alimentary canal is complete with well developed muscular pharynx.
- Excretion - Excretory tube present (removes waste from body cavity through excretory pore)
- Reproduction - Unisexual (dioecious). Shows sexual dimorphism (females are longer than male)

- Fertilisation - Internal
- Development - Direct and Indirect
- Body shape - Circular in cross-section
- Eg - *Ascaris* (Round worm) *Wuchereria* (Filaria worm)
Ancylostoma (Hookworm).

⑥ Annelida

- Habitat - aquatic (marine - free living) and terrestrial; free-living, sometimes parasitic.
- Symmetry - Bilateral
- Level of organisation - organ-system level
- Germ layer - triploblastic
- Body cavity - present or Coelomates
- Locomotory organ - possess longitudinal & circular muscles. Some aquatic annelids (*Nereis*) possess lateral appendages, parapodia (for swimming)
- Circulatory system - closed
- Excretory organ - NEPHRIDIA (help in osmoregulation & excretion).
- Nervous system - consist - paired ganglia connected by lateral nerves to a double ventral nerve cord.
- Reproduction - Some are unisexual/dioecious (*Nereis*) and bisexual/monoecious (earthworms). Reproduce Sexually.
- Body shape - Body divided into segments or metamerites.
- Example - *Nereis*, *Pheretima* (earthworm)
Hirudinaria (Blood sucking leech).

⑦ Arthropoda - (Largest Phylum)

- Level of organisation - organ system
- Symmetry - Bilateral
- body cavity -
- Germ layer - triploblastic
- Skeleton - exoskeleton made of chitin
- Body design - Body is segmented
- Body divided into head, thorax, abdomen
- Locomotion - by jointed appendages. (arthro - joint, poda - appendages) hence called arthropoda.
- Respiration - by gills, book gills, book lungs, tracheal system
- Circulatory system - open type
- Sensory organs - antennae, eye (compound & simple)
Statocysts or balance organs are present
- Excretion - ~~Malpighian tubules~~
- Digestive system - complete
- Reproduction - dioecious
- Fertilisation - Internal, mostly oviparous (lay egg)
- Development - direct or indirect
- Example - Economically important insects -
Apis (honey bee), *Bombyx* (silkworm), *Lacifer* (lac insect)
Vectors : *Anopheles*, *Culex*, *Aedes* (Mosquitoes)
Gregarious pest : *Locusta* (Locust)
Living fossils : *Limulus* (King Crab)

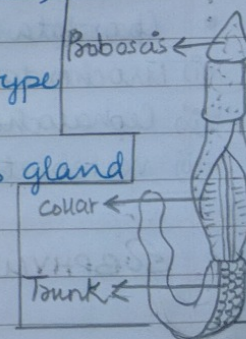
- ⑧ Mollusca - (Second largest phylum)
- Habitat - terrestrial or aquatic (marine or fresh water)
 - Symmetry - Bilateral
 - Coelom - coelomate / present
 - Germ layer - triploblastic
 - Body skeleton - body covered with calcareous shell
 - Body shape - Unsegmented. with distinct head, muscular foot & visceral hump
 - Special structure - soft-spongy layer of skin form a mantle over visceral hump.
 - Respiration & excretion - They have features like gills (between hump and mantle called mantle cavity). They have respiratory & excretory functions.
 - Sense organ - anterior head region has tentacles
 - Feeding organ - Mouth contain file-like rasping organ called radula.
 - Level of organisation - organ - system
 - Reproduction - dioecious and oviparous
 - Development - Indirect
 - Example - Pila (Apple snail), Octopus (devil fish), Sepia (cuttlefish).

- ⑨ Echinodermata -
- Habitat - All marine
 - Symmetry - Radial but larvae are bilateral
 - Digestive system - Complete, with mouth on lower (ventral) side and anus on upper (dorsal) side
 - Excretory system - absent
 - Level of organisation - organ system
 - Coelom; Germ layer - coelomate; triploblastic.

- Reproduction - Dioecious, Reproduce sexually.
- Fertilisation - usually external
- Development - Indirect, with free living larva
- Water vascular system - distinctive feature help in locomotion, capture & transportation food and respiration
- Example - Asterias (star fish), Echinus (sea urchin), Cucumaria (sea cucumber)

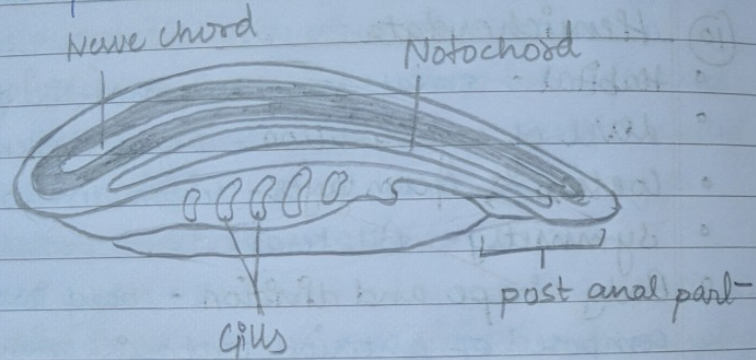
⑩ Hemichordata

- Habitat - small group of worm-like marine animals.
- Level of organisation - organ - system
- Coelom; Germ layer - coelomate, triploblastic
- Symmetry - Bilateral
- Body shape and division - body is cylindrical composed of anterior proboscis, a collar and a long trunk
- Circulatory system - open type
- Respiration - through gills
- Excretory organ - proboscis gland
- Reproduction - Dioecious
- Fertilisation - External
- Development - Indirect
- Notochord - Absent but have a rudimentary structure in the collar region called stomochord similar to notochord.
- Example - Balanoglossus and Saccoglossus



(ii) Chordata -

- Notochord - present
- Symmetry - Bilateral
- Level of organisation - organ-system level
- Coelom ; Germ layer - coelomate ; triploblastic
- Circulatory system - Closed
- have dorsal hollow nerve chord
- have paired pharyngeal gill slits.
- have post anal tail.



- Chordata is divided into three subphylum

(i) Urochordata/Tunicata,] - protochordates.

(ii) Cephalochordata

(iii) Vertebrata

SUBPHYLUM OF CHORDATA

(i) Urochordata (Tunicata)

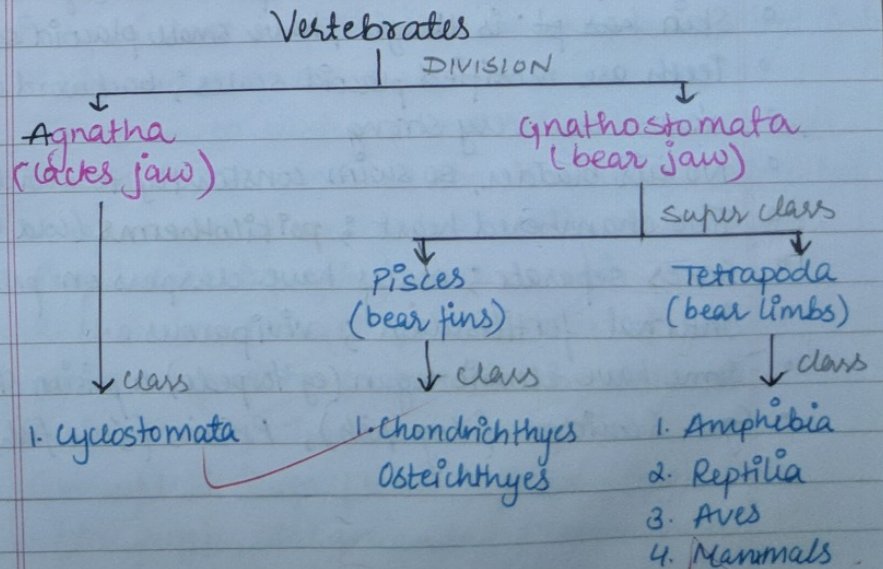
- Exclusively Marine
- Notochord is present only in larval tail
- Example : Ascidia, Salpa, Doliodium

(ii) Cephalochordata -

- Notochord extends from head to tail region and is persisted throughout their life.
- Example : Branchiostoma (Amphioxus or lancelet).

(iii) Vertebrata

- Possess notochord during the embryonic period.
- Later notochord is replaced by a cartilaginous or bony vertebral column in adults.
- * Thus all vertebrates are chordates but all chordates are not vertebrates.
- They have ventral muscular heart with two, three or four chambers.
- have kidney for excretion and osmoregulation
- have paired appendages (may be fins or limbs)
- Vertebrates are further divided into



* CLASS OF SUBPHYLUM VERTEBRATES

- Agnatha (Jawless)

1. Cyclostoma

- Habitat - Marine - ectoparasite on some fishes.
- have sucking and circular mouth; without jaw
- No scales, no paired fins
- Gill slits for respiration
- Cranium & vertebral column is cartilaginous
- Marine, migrate to fresh water spawning then die.
- Larva returns the ocean after metamorphosis
- Eg - Petromyzon (lamprey), Myxine.

- Gnathostomata (Bearing Jaw)

- Super class - Pisces (have fins)

1. Chondrichthyes -

- Habitat - Aquatic & Marine
- Have cartilaginous endoskeleton; Streamlined body.
- Have Gill slits without operculum (gill cover)
- Skin has pt. is tough, have small placoid scales.
- Teeth are modified placoid scales; backward directed
- Jaws are very strong
- No air bladder, so swim constantly to avoid sinking
- Two chambered heart; poikilotherms (cold blooded)
- Sexes separate; males have claspers on pelvic fins
- Internal fertilisation; viviparous.
- Some have electric organ (eg torpedo) or poison sting (hagfish)
- Eg - Scoliodon (dog fish), Pristis (saw fish)

2. Osteichthyes -

- Habitat - Aquatic (Marine & fresh water)
- Have bony endoskeleton; Streamlined body; terminal mouth.
- gill slits (4 pairs) covered by operculum.
- Two chambered heart; cold blooded.
- Skin has cycloid / ctenoid scales.
- Have air bladder to regulate buoyancy.
- Sexes separate
- Usually oviparous; External fertilisation; direct development
- Eg - Hippocampus; Exocoetis (flying fish)
- Fresh water: Labeo (Rohu), Catla (katta)
- Aquarium: Betta (Fighting fish), Pterophyllum

3. Super-class - Tetrapoda (have limbs)

1. Amphibia -

- Habitat - Aquatic & Terrestrial both
- Body divided into head, & trunk; have paired limb
- Skin moist; No scales.
- Tympanum represents ear; Eye have Eyelids.
- Cloaca is the common chamber where alimentary canal, urinary and reproductive tracts opens
- Respiration by gills, lungs or skin.
- 3-chambered heart; cold blooded
- Sexes separate; fertilisation external,
- oviparous; Indirect development
- Example: Bufo (toad), Rana (Frog), Hyla (tree frog), Salamandra (Salamander).

2. Reptilia

- Habitat - Mostly terrestrial
- Creep or crawl to locomote
- Body has dry & cornified skin and epidermal scales or scutes.
- Tympanum represent ear.
- Limbs (when present) are two pairs
- 3-chambered heart [Exception - Crocodile - 4-chamber]
- Sexes separate; fertilisation internal; Oviparous; Direct Development
- Cold Blooded
- Example - Chameleon (tree lizard) Naja (Cobra) Hemidactylus (wall lizard)

3. Aves

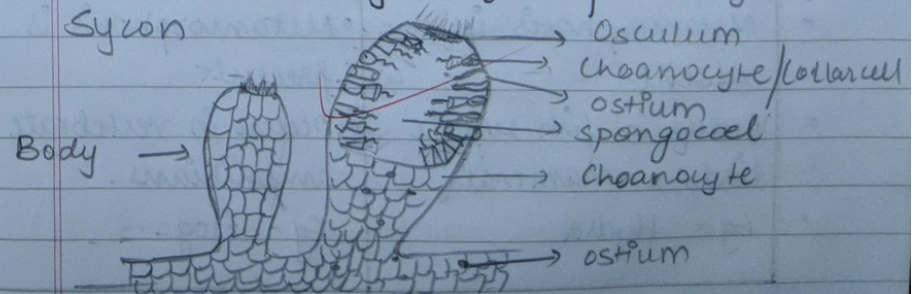
- Presence of feathers, except flightless birds; have Beak (modified jaw) without teeth.
- Forelimbs modified into wings.
- Hind limbs have scales, modified for walking, swimming or clasp.
- dry skin as no glands on skin except oil gland (pre gland) at base of tail
- Have ossified (bony) endoskeleton with air cavity (pneumatic) & hollow bones to assist in flight
- Crop & Gizzard - additional chamber in digestive tract
- Air Sacs are connected to lungs to supplement respiration
- Warm-Blooded (homiothermous); 4-chambered heart
- Separate sexes; Internal fertilisation;

- Oviparous; Direct Development
- Example: Corvus (crow), Columba (Pigeon) Pavo (Peacock).

4 Mammalia -

- Habitat - found in variety of habitat, desert, mountains, grasslands, Aquatic etc.
- Have mammary gland to nourish young ones.
- Have two pairs of limbs, adapted to perform special work.
- Skin has hairs
- External ear or pinna present.
- Different types of teeth in jaw.
- Homiothermous (warm-blooded);
- 4-chambered heart; Lungs for respiration
- Sexes are separate; Internal fertilisation; Viviparous; Direct Development
- Example mainly viviparous Exception - platypus and echidna they are oviparous
- Example - Camelus (camel), Macaca (Monkey) Rattus (Rat), Elephas (Elephant).

Ques Draw labuled diagram of Porifera (Sycon)



Ques 2 Differentiate between the following
(i) Intracellular and Extracellular Digestion.

Intracellular Digestion	Extracellular Digestion
• Occur within cells • It occurs in lower & unicellular organisms • Enzymes associated are very few • Less efficient	• Occurs within cavity of alimentary canal, outside the cell • It occurs in multicellular organisms • Large no. of digestive glands and enzymes required • Highly efficient

(ii) Direct Development & Indirect development

Direct Development	Indirect development
• The embryo develops into a well-grown individual without involving in a larval stage • Metamorphosis is absent • Occurs in fish, reptile, birds & mammals • Eg - Hydra	• It involves a immature larval stage. • Metamorphosis is present • Occurs in vertebrate amphibians. • Eg - Frog.

(ii)

Chordates

- Notochord present
- Central nervous system is dorsal, hollow and single.
- Pharynx perforated by gill slits
- Heart is ventral
- A post-anal part (tail) is 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 is absent.