CLASS XI BIOLOGY NOTES

CHAPTER – 4: ANIMAL KINGDOM

BASIS OF CLASSIFICATION

Animals are classified on the basis of arrangement of cells, body symmetry, nature of coelom, pattern of digestive, circulatory and reproductive system.

1. Levels of organization:
2. Body symmetry
3. Nature of coelom(cavity)
4. Embryonic germinal layers
5. Segmentation of the body
6. Presence/absence of notochord

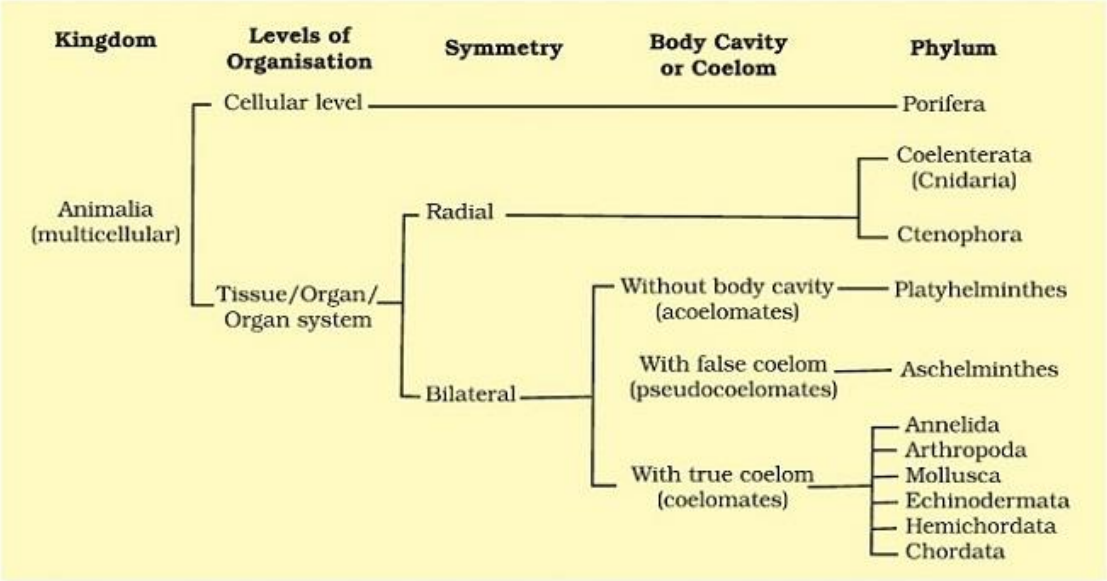
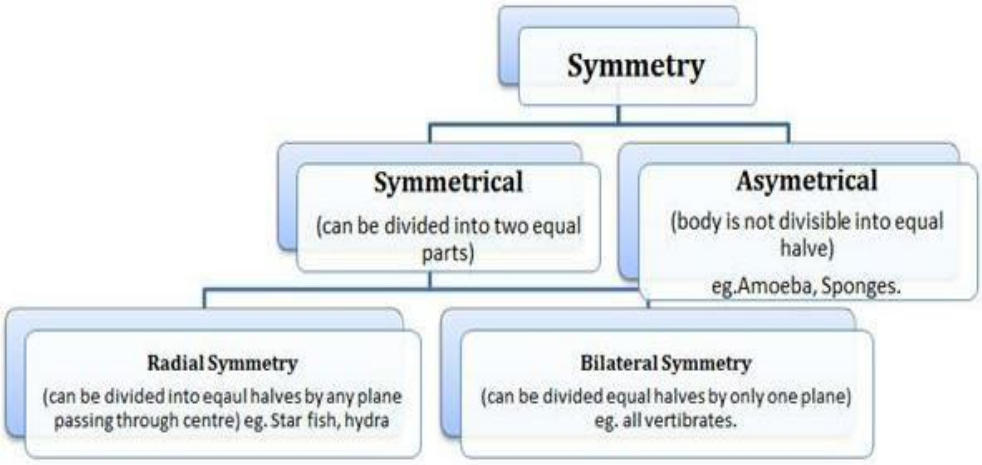


Figure 4. Broad classification of Kingdom Animalia based on common fundamental features

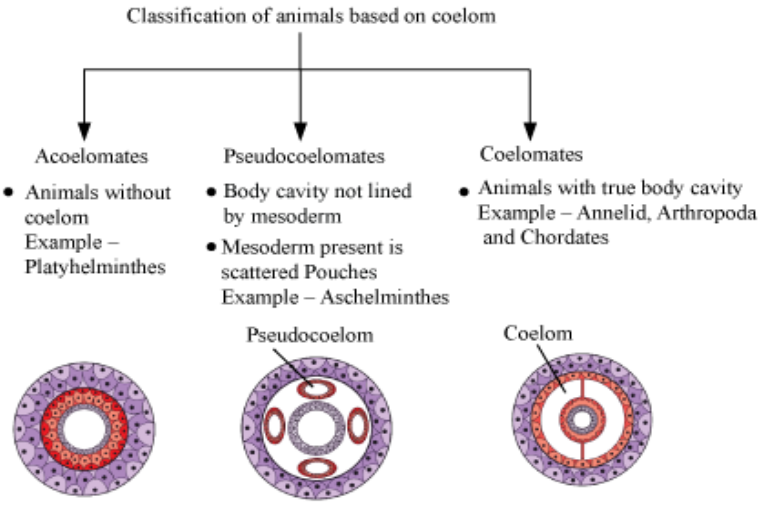
1. Level of organization

- Cellular level - organ level
- Tissue level – organ system level (open and closed circulation)
- Complete/incomplete digestive system. (hydra)
- The digestive system in Platyhelminthes has only a single opening to the outside of the body that serves as both mouth and anus, and is hence called incomplete. A complete digestive system has two openings, mouth and anus. Similarly, the circulatory system may be of two types:
- **Open type** in which the blood is pumped out of the heart and the cells and tissues are directly bathed in it and
- **Closed type** in which the blood is circulated through a series of vessels of varying diameters (arteries, veins and capillaries).

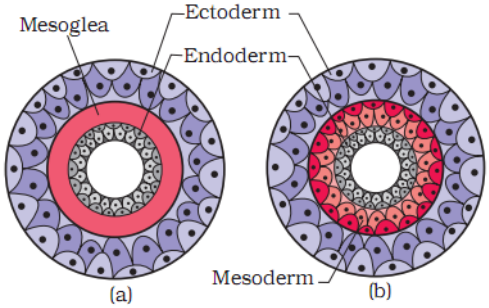
2. Body symmetry



3. Nature of Coelom(Body cavity)



4. Embryonic germinal layers



- A. Diploblastic (Coelenterates) – only ectoderm and endoderm
- B. Triploblastic organization (Platyhelminthes to Chordates)- ectoderm, endoderm and mesoderm

5. **Segmentation**-In some animals, body is externally and internally divided into segments with serial repetition as in earthworm, called metameric segmentation.

6. **Notochord**
   It is a mesodermal origin – rod like structure – animals with notochord is chordates and without that are non-chordates.

CLASSIFICATION OF ANIMALS:

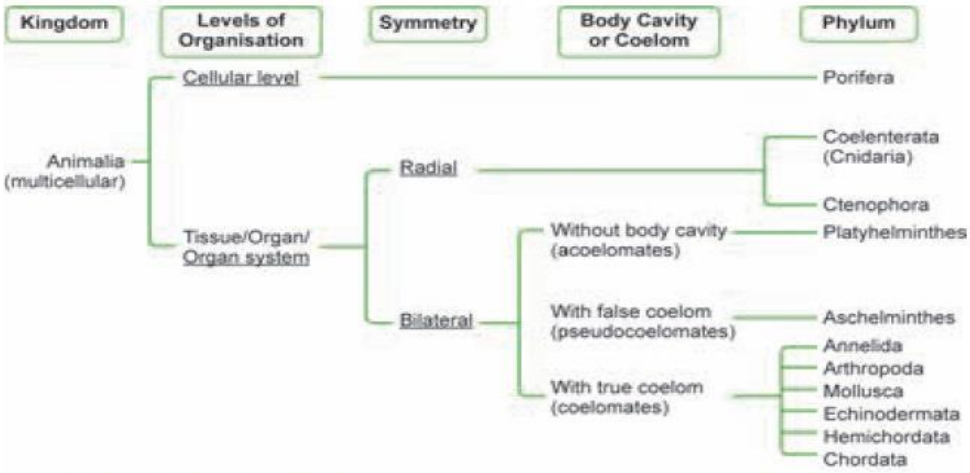


Figure 1 Classification of kingdom Animalia based on common features

1. **Phylum - Porifera**- Ex. Sponges.

- Marine , asymmetrical, cellular level of organization
- They have water transport or canal system. Water enters through minute pores, Ostia into central cavity Spongocoel, from where it goes out through Osculum
- Choanocytes/ collar cells line in the spongocoel
- Digestion is intracellular
- Skeleton made up of spicules/ sponging fibres
- Hermaphrodite –male and female organs present on the same body.
- Reproduce asexually by fragmentation
- Sexually by gametes
- Fragmentation is internal and development is indirect
    - Eg. Sycon, spongilla.

2. Phylum Coelenterata(cnidaria) - Ex. Hydra

- Aquatic /marine
- Sessile(fixed) /free swimming
- Radially symmetrical
- Have cnidoblasts/ cnidocytes, stinging capsule on tentacles
- Cnidoblastsare ued for defense, anchorage and to capture the prey
- Tissuelevel of organization diploblastic
- Mouth on hypostome.
- Digestion extracellular and intracellular
- Corals have skeleton made of calcium carbonate.
- Exhibit 2 basic forms called polyp and medusa.
- Polyp is sessile cylindrical (hydra)
- Medusa is umbrella shaped free living (jelly fish)
- They show alternation ofgeneration (metagenesis) wherepolyp forms medusa asexually and
- medusa forms polyp sexually. Ex. Obelia
    - Ex. - Hydra, Physalia, Sea anemone, Sea pen, Sea fan, Brain coral.

3. Phylum - Ctenophora(sea walnuts/comb jellies)

- Marine , radially symmetrical diploblastic
- Tissue level of organization
- Body bears 8 rows ciliated comb plates help in locomotion
- Digestion by intra and extra cellular
- Bioluminescence is well developed
- Sexes are not separate(monoecious)
- Reproduce by sexual reproduction
- Fertilizationis external and indirect development.
- Ex.-Pleurobrachiaand ctenoplana

4. Phylum – Platyhelminthes(flat worms)

- Dorso-ventrally flattened body
- Endoparasites,bilaterally symmetrical
- Organ level of organization
- Triploblastic - acoclomate
- Hooks and suckers are present
- Flame cells for excretions
- Sexes are not separate - fertilizationis internal and development is through many larval stages
- Have high regeneration capacity

  Ex.- Tape worm,Planaria,Liver fluke

5. **Phylum - Aschelminthes**(round worms)

- Free living, aquatic, terrestrial parasitic
- Organ system level of body organization
- Bilaterally symmetrical andtriploblastic
- Pseudocoelomate
- Digestive system is complete (mouth and anus)
- Sexes are separate (dioecious)
- Fertilization is internal and development is direct.
    - Ex. Ascaris, Wuchereria (filarial worm) and Ancylostoma (hookworm)

6. **Phylum – Annelida**(annulus little ring)

- Aquatic/terrestrial
- Freeliving/ parasites
- Organ system level of body organization
- Bilaterally symmetrical
- Triploblastic
- Metamerically segmented – coelomate
- Metameres/body is segmented
- Marine Nereis possess parapodia
- Possess longitudinal and circular muscles help in locomotion
- Closed circulatory system
- Nephridiahelp in osmoregulation and excretion
- Dioecious(sexes are separate)
- Earthworm and leeches are monoecious
- Reproductionis sexual
    - Eg. Nereis, Pheretima (earth worm) and Hirudinaria (blood sucking leech)

7. **Phylum – Arthropoda**– (jointed legs)

- Largest phylum 2/3 are insects
- Organ system level of body organization
- Bilaterally symmetrical
- Segmented andcoelomate
- Chitinous exoskeleton.
- Body has head thorax and abdomen.
- Have jointed appendages(organs for locomotion)respiratory organs are gills/book gills/Book lungs / tracheal system
- Open circulatory system.
- Sense organs are antennae, eye, statocysts (balance organs)
- Fertilization isinternal.
- Excretion by malpighian tubules.
- Sexes are separate (Dioecious)
- Oviparous
- Development may be direct/ indirect

Economic importance-

- Honey bees (*Apis*)
- Silkworm worm (*Bombyx*)
- Vectors. Mosquito, Housefly
- Aquatic –crab, prawn, lobster

8. Phylum - Mollusca: (soft bodied and shelled)

- Second largest phylum
- Terrestrial and aquatic
- Organ system level of body organization
- Bilaterally symmetrical
- Triploblasticand Coelomate
- Calcareous shell and unsegmented body with head muscular foot and visceral hump
- Soft spongy layer of skin forms a mantle over the visceral hump
- Gillsfor respiration and excretion
- Head has sensorytentacles
- Mouth has file like rasping organ for feeding radula
- Sexes are separate (Dioecious)
- Oviparous
- Indirect development
- Eg. Oyster, snail, squid, devil fish

9. Phylum - Echinodermata:(spiny skinned)

- Spiny skin has exoskeleton which is calcariousossicles
- Marine organ level of body organization
- Radially symmetrical
- Coelomate
- Triploblastic
- Mouth of the lower side and anus on the upper side.
- Have water vascular system, help in locomotion,to capture and transport of food andfor respiration
- Excretory system is absent
- Dioeciousand fertilization is external,development is indirectwith free swimming larva Ex. Starfish, sea urchin, sea lily, sea cucumber

10. Phylum – Hermichordata

- Under non chordate
- Worm like marine animals
- Organ system level oforganization
- Bilaterially symmetrical , triploblstic
- Coclomate – body has anterior proboscis , a collar and a long trunk
- Circulatory system is open type
- Respiration is through gills
- Excretory organ is proboscis gland
- Sexes are separate
- Fertilization is external

- Development is indirect
- Ex. Balanoglossus

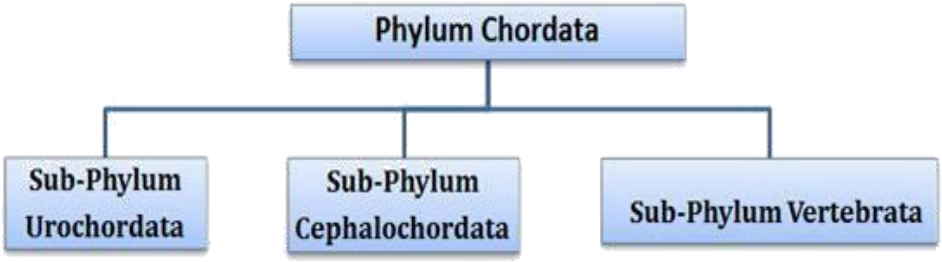
11. Phylum – Chordata

- Presence of notochord dorsal hollowspinal cord –nerve cord and paired pharyngeal gill slits

TABLE 1. Comparison of Chordates and Non-chordates

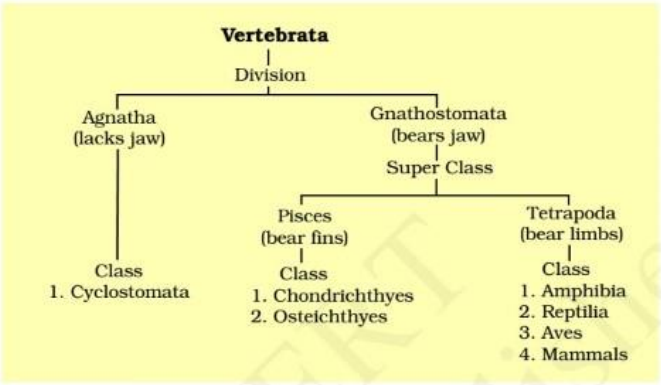
S.No.	Chordates	Non-chordates
1.	Notochord present.	Notochord absent.
2.	Central nervous system is dorsal, hollow and single.	Central nervous system is ventral, solid and double.
3.	Pharynx perforated by gill slits.	Gill slits are absent.
4.	Heart is ventral.	Heart is dorsal (if present).
5.	A post-anal part (tail) is present.	Post-anal tail is absent.

- Bilaterally symmetricalandtriploblastic
- Coelomate organ system level of organization
- Have post and tail
- Closed circulatory system Chordata -Urochordata,Cephalochordate and Vertebrata (protochordates) Urochordata – notochord present in larval tail eg. Ascidia, salpa Cephalochordate – notochord extends from head to tail eg. Amphioxus



1. Subphylum – Vertebrata:

The subphylum Vertebrata is further divided as follows:



- Possess notochord (replaced by vertebral column)
- All vertebrates are chordates but not all chordates are vertebrates(all vertebrates have vertebral column, but all chordates do not have vertebral chord).

- Ventral muscular heart
- Excretion by kidneys
- Fins / limbs for locomotion

a) Super class – Agnatha (without jaw)
Class – Cyclostomata

- Ectoparasites on some fishes.
- Elongated body with 6-15 pairs of gill slits
- Sucking circular mouth without jaw
- Body is devoid of scales – paired fins
- Cranium and vertebral column are cartilaginous
- Circulation is closed
- Cyclostomes are marine but migrate for spawning to fresh water.
- After spawning, within a few days, they die
- Their larva after metamorphosis return to the ocean
- Ex. Petromyzon (Lamprey) and Myxine (Hagfish).

b) Super class – Gnathostomata (with jaw)

- Jaws are present
- Paired lateral appendages There are six classes:

Class – Chondrichthyes:

Class – Osteichthyes- boney fish

Chondrichthyes		Osteichthyes	
(1)	Animals are marine only.	(1)	Animals are marine and fresh water.
(2)	Stream-lined body and skin is covered with placoid scales only.	(2)	Skin is covered by cycloid or ctenoid scales.
(3)	Caudal fin is heterocercal.	(3)	Caudal fin is homocercal.
(4)	Internal skeleton is made up of cartilage.	(4)	Internal skeleton is made up of bones.
(5)	5 - 7 pairs of gills and operculum is absent.	(5)	Pairs of gills which are covered by operculum.
(6)	Monoecious, fertilization is internal oviparous or ovoviviparous animals	(6)	Monoecious, fertilization external oviparous animals.
(7)	Mouth is anterior ventral, jaws are present.	(7)	Mouth is anterior and jaws are with teeth.
(8)	e.g. shark, ray fish.	(8)	e.g. sea horse, labeo, catla etc.

Class – Amphibia- dual life

- Live on land and move to water for breeding
- Body has head and trunk
- Tail is in larval stage – two pairs of limbs
- Digits without claws.
- Poikilotherms – eyes are with nictitating membranes
- Skin is smooth and moist with mucous glands
- Tympanum is ear drum
- Heart is three chambered (two auricle and one ventricle)
- Respiration by gills in larva and by lungs and skin in adults.
- Digestive system
- Urinary tract and reproductive tract open in to a common cloacal chamber and the
- Opening is called cloacal aperture.
- Sexes are separate
- Oviparous
- Fertilization is external and development is indirect with tadpole larva
- Ex. Toad, Frog

Class – Reptilia

- Skin is dry without glands.
- Covered by horny epidermal scales (scutes)
- Tympanum is small no external opening
- 12 pairs of cranial nerves
- Trunk bears two pairs of pentadactyl limbs with claws.
- Heart with three and half chambered (two auricle, one which is incompletely partitioned ventricle)
- Only Crocodiles have four chambered heart
- Respiration is by lungs.
- Fertilization is internal.
- Oviparous and egg is covered by hard calcareoue shells
- Ex. Snake, Tortoise, Turtle, Viper, Lizard

Class – Aves

- Streamlined body and covered with feathers
- Jaws are modified in to beaks, teeth absent, various shapes and sizes of beaks
- Digestive system has two structures – crop and gizzard (grinding the food)
- Forelimbs form wings.

- Hindlimbs modified for perching, swimming, running, etc.
- Respirationis by lungs.
- Skin is dry with oil glands, at the base of tail.
- Bones are pneumatic bones (air cavities) helps to make the body light.
- Homeiothermous
- Heart is 4 chambered
- Oviparous and eggis with calcareous shells.
- Sexes are separate, Fertilization is internal, development is direct
- Ex. Pigeon, Crow, Sparrow, Ostrich.

Class- Mammalia

- Aquatic/aerial/terrestrial
- Body has head, neck, trunk and tail
- Have mammary glands in females
- External ear(pinna)is present
- Skin has sweat glands and sebaceous glands
- Heart is 4 chambered
- Respiration is by lungs.
- Body has hair
- Excretion is by kidneys (ureotelic – urea)
- Sexes are separate
- Viviparous (give birth young ones)
- Few are oviparous – egg laying mammals (Platypus)
- Few are marsupials – pouched mammals with brood pouches (Kangaroo)
- Ex. *Canismacaca, Camelus, Dolphin*.

	Pisces	**Amphibia**	**Reptilia**	**Aves**	**Mammalia**
Habitat	Aquatic	Both land and water	Some terrestrial, others aquatic	Terrestrial (aerial)	Usually terrestrial, few aquatic.
Skin	Covered with scales/plates	Smooth skin with mucus glands and lacking scales	Water-proof skin with scales	Mostly covered with feathers	Covered with hair and contains sweat and oil glands.
Control of body temperature	Cold-blooded	Cold-blooded	Cold-blooded	Warm-blooded	Warm-blooded
No. of heart chambers	2	3	3(except crocodiles)	4	4
Respiration	Gills	Gills, lungs or skin	Lungs	Lungs	Lungs
Mode of reproduction	Oviparous	Oviparous	Oviparous	Oviparous	Viviparous
Locomotion	Tail and fins	Limbs	Limbs	Wings	Limbs
Examples	Rohu, shark, sea-horse, sting ray	Frog, salamander, toad	Crocodile, snake, turtle, lizard	Pigeon, ostrich, hen, duck	Human, whale, bat, lion

TABLE 4.2 Salient Features of Different Phyla in the Animal Kingdom

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 canals 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	Flat body, suckers.
Aschelminthes	Organ-system	Bilateral	Pseudo coelomate	Absent	Complete	Absent	Absent	Often worm-shaped, elongated.
Annelida	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Present	Body segmentation like rings.
Arthropoda	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Present	Exoskeleton of cuticle, jointed appendages.
Mollusca	Organ-system	Bilateral	Coelomate	Absent	Complete	Present	Present	External skeleton shell usually present.
Echinodermata	Organ-system	Radial	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.
Chordata	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Present	Notochord, dorsal hollow nerve cord, gill slits with limbs or fins.

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