

## **Chapter 3**

### **Diversity in living organisms**

#### **Key learning:**

- 1) Every living organism is unique and this uniqueness is the basis of the vast diversity displayed by the organisms in our world.
- 2) This huge diversity is the result of evolution, which has occurred over millions of years.
- 3) The massive biological diversity can only be studied by classification i.e. arranging organisms into groups based on their similarities and differences.
- 4) Different characteristics are used to determine the hierarchy of classification.
- 5) The primary characteristics that determine the broadest divisions in classification are independent of any other characteristics. The secondary characteristics depend on the primary ones.
- 6) Prokaryotic or eukaryotic cell organization is the primary characteristic of classification, since this feature influences every detail of cell design and capacity to undertake specialized functions.
- 7) Being a unicellular or multicellular organism forms the next basic feature of classification and causes huge differences in the body design of organisms.
- 8) The next level of classification depends on whether the organism is autotrophic or heterotrophic. Further classification depends on the various levels of organization of the bodies of these organisms.
- 9) The evolution of organisms greatly determines their classification.
- 10) The organisms who evolved much earlier have simple and ancient body designs whereas the recently evolved younger organisms have complex body designs.
- 11) Older organisms are also referred to as primitive or lower organisms whereas the younger organisms are also referred to as advanced or higher organisms.
- 12) The diversity of life forms found in a region is biodiversity.
- 13) The region of megadiversity is found in the warm and humid tropical regions of the Earth.
- 14) Aristotle classified organisms depending on their habitat.
- 15) Robert Whittaker proposed the five-kingdom scheme of classification, based on the cell structure, nutrition and body organization of the organisms.

16) The main characteristics considered in the five-kingdom scheme of classification are:

- i) Presence of prokaryotic or eukaryotic cells
- ii) If eukaryote, whether the organism is unicellular or multicellular.
- iii) Whether the cells possess or lack cell wall and whether they can prepare their own food.

17) The categories or taxa used in the classification of organisms are kingdom, phylum/division, class, order, family, genus and species. The smallest unit of classification is species whereas the highest unit is kingdom.

18) The 5 kingdoms proposed by Whittaker are Monera, Protista, Fungi, Plantae and Animalia. Carl Woese further divided Monera into Archaeobacteria and Eubacteria.

19) Prokaryotic one-celled organisms such as bacteria, cyanobacteria and mycoplasma are included in Monera.

20) Monerans show either autotrophic or heterotrophic nutrition. Cell wall may be present or absent.

21) Unicellular eukaryotic organisms such as protozoans, unicellular algae and diatoms are grouped under Protista. They may be autotrophic or heterotrophic and may use appendages for locomotion.

22) Fungi, such as yeast and mushrooms, include heterotrophic, eukaryotic organisms, which are normally saprophytes. Their cell walls are composed of chitin.

23) Lichens are symbiotic associations of certain fungi with blue green algae.

24) Multicellular, autotrophic eukaryotes possessing cell wall are included under kingdom Plantae.

25) Classification of plants is done at three levels on the basis of

- i) Presence or absence of well-differentiated body
- ii) Presence or absence of vascular tissue
- iii) Ability to bear seeds, which could be naked or enclosed in fruits.

26) The important divisions of Plantae are Thallophyta, Bryophyta, Pteridophyta, Gymnospermae and Angiospermae.

27) Thallophytes, Bryophytes and Pteridophytes possess inconspicuous reproductive organs and are called Cryptogams. Gymnosperms and Angiosperms are grouped under Phanerogamae, since they possess well-differentiated, seed producing reproductive tissues.

28) Thallophytes (or algae) are the simplest plants lacking well-differentiated body design. E.g. – *Spirogyra*.

29) Bryophytes, such as moss and *Riccia*, show differentiated plant body lacking vascular tissue.

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- 30) Plants grouped under Pteridophyta show well-differentiated plant body with vascular tissues for conduction. E.g. Ferns.
- 31) Gymnosperms, for e.g. pines and deodar, are phanerogams bearing naked seeds.
- 32) In Angiosperms/flowering plants, the seeds are enclosed in fruits.
- 33) Cotyledons are present in the embryos of seeds.
- 34) Monocot plants possess seeds with single cotyledons whereas dicots are plants with 2 cotyledons in seeds.
- 35) Monocots show fibrous root system, parallel venation of leaves and flowers with three (or multiple of three) petals.
- 36) Tap root system, reticulate venation of leaves and flowers with five (or multiple of five) petals are features of dicots.
- 37) Organisms grouped under Animalia are eukaryotic, multicellular, heterotrophic and lacking cell walls.
- 38) Animals are further divided into ten groups – Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata, Protochordata and Vertebrata.
- 39) In Porifera, also called sponges, the body is perforated by numerous pores and shows cellular level of organization. In addition, a hard exoskeleton and canal system are present. Sponges are non-motile. E.g. – *Sycon*.
- 40) Coelenterates are radially symmetrical and show a cavity called coelenteron between epidermis and gastrodermis. Some like *Hydra* are solitary forms whereas others like corals live in colonies.
- 41) Platyhelminthes includes the flat worms which are bilaterally symmetrical, dorsoventrally flattened, triploblastic and acoelomate. They may be free-living (e.g. *Planaria*) or parasitic (e.g. tape worm).
- 42) The body of nematode worms is cylindrical, bilaterally symmetrical, triploblastic and pseudocoelomate. They are usually parasitic. E.g. *Ascaris*.
- 43) Annelids are triploblastic, bilaterally symmetrical with true coelom and found in diverse habitats. Segmentation and extensive organ differentiation is seen. E.g. Earthworm and *Nereis*.
- 44) The largest phylum of animal kingdom, Arthropoda, contains triploblastic, bilaterally symmetrical and segmented animals. These animals possess jointed legs and open circulatory system. E.g. Butterfly, centipede, crab, spider.
- 45) In phylum Mollusca, (e.g. snail and *Octopus*) organisms show bilateral symmetry, soft body, open circulatory system and reduced coelom.

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46) Echinodermata includes spiny skinned organisms with calcareous skeleton. They are triploblastic, coelomate, marine and free-living. Water vascular system is an important feature. Starfish and *Holothuria* are examples of this phylum.

47) All chordates have a notochord, dorsal nerve cord and paired pharyngeal gill slits/pouches. Also they are triploblastic, coelomic and bilaterally symmetrical.

48) Vertebrates and Protochordates are grouped under Chordata.

49) The Protochordates possess notochord at some or the other stage of their life. E.g. *Balanoglossus*, *Amphioxus*.

50) Vertebrates show true vertebral column and endoskeleton. Complex body organization and differentiation is seen.

51) The five classes of vertebrates are Pisces, Amphibia, Reptilia, Aves and Mammalia.

	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

52) The endoskeleton in fish may be cartilaginous or bony.

53) Mammary glands produce milk in mammals to nourish the young ones.

54) Binomial nomenclature, developed by Carolus Linnaeus, uses two names to identify an organism. The first name is the generic name beginning with a capital letter whereas the second name is the species name which begins with a small letter.

55) Binomial nomenclature makes it possible to identify every species of organisms in the astounding diversity of life present in our planet.

### **Top definitions**

1) Classification – The method of arranging organisms into groups on the basis of similarities and differences.

2) Characteristic – A distinguishing feature of an individual or group.

3) Evolution – A gradual and continuing process of change in body design of organisms, occurring over a period of time due to various factors, which leads to better survival of organisms as well as development of new species.

4) Biodiversity – The variety of life forms found in a particular region.

5) Regions of megadiversity – Regions rich in diversity of plant and animal life.

6) Habitat – The natural abode of an animal or plant.

7) Species – It refers to all organisms that are similar enough to breed and perpetuate.

8) Saprophytes – Organisms obtaining their nourishment from dead and decaying organic material.

9) Lichens - Symbiotic associations of certain fungi with blue-green algae.

10) Cotyledon - Embryonic leaf in seed-bearing plants.

11) Monocots – Plants with seeds having a single cotyledon.

12) Dicots - Plants with seeds having two cotyledons.

13) Bilateral symmetry- Symmetrical arrangement of an organism along a central axis, so that the body is divided into equivalent right and left halves by only one plane.

14) Radial symmetry –A type of symmetry having only one body axis, through which the body can be divided in multiple planes to give mirror image halves OR A form of symmetry, in which dividing the animal's body in any direction along the central axis would always result in 2 identical halves being obtained.

15) Notochord - A long flexible rod-shaped support structure that runs along the back of the animal separating the nervous tissue from the gut.

16) Nerve cord - A dorsal tubular cord of nervous tissue above the notochord of a chordate.

17) Diploblastic animals - Animals having 2 primary germ layers i.e. ectoderm and endoderm in the embryo.

18) Triploblastic animals - Animals having 3 primary germ layers i.e. ectoderm, mesoderm and endoderm in the embryo.

19) Ectoderm – The outermost germ layer of multicellular animals that develops into skin and nervous tissue.

20) Endoderm - The innermost germ layer of multicellular animals that develops into the lining of the digestive and respiratory systems.

21) Mesoderm - The middle germ layer that develops into muscle and bone and cartilage and blood and connective tissue.

22) Acoelomates – Animals lacking a body cavity between their gut and body wall.

23) Coelom - A fluid filled cavity formed within the mesoderm, in which well-developed organs can be accommodated.

24) Pseudocoelom - An internal body cavity of some primitive invertebrates, similar to a coelom but lacking a mesodermal lining.

25) Coelenteron – The central gastrovascular cavity of a coelenterate animal.

26) Cold-blooded organisms – Organisms whose body temperature varies according to the external environmental temperature.

27) Warm-blooded organisms – Organisms whose internal body temperature is dependent upon its metabolic processes and is maintained at a constant level.

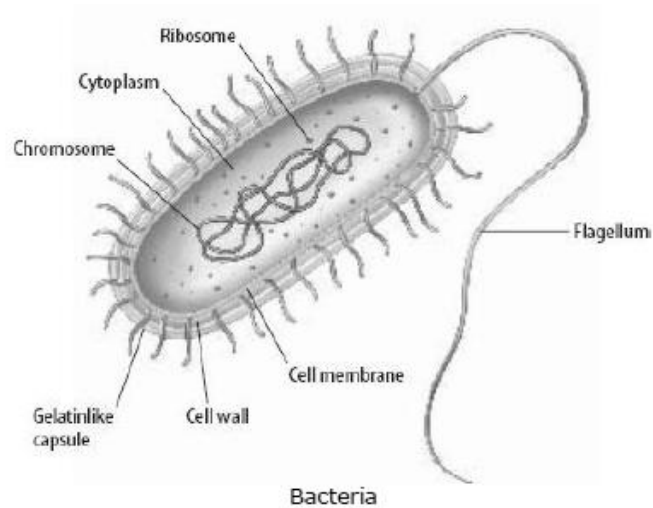
28) Oviparous animals – Animals that lay eggs.

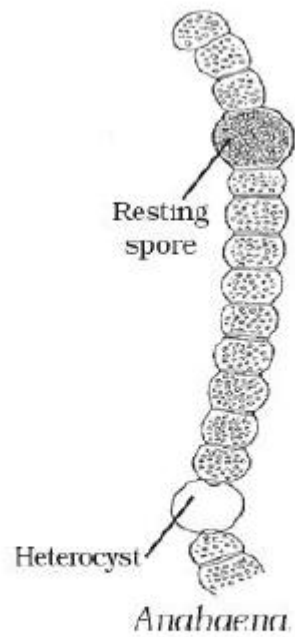
29) Viviparous animals – Animals giving birth to live young ones.

30) Binomial nomenclature – The scientific system of naming each species of organism with two names, a genus name and a species name.

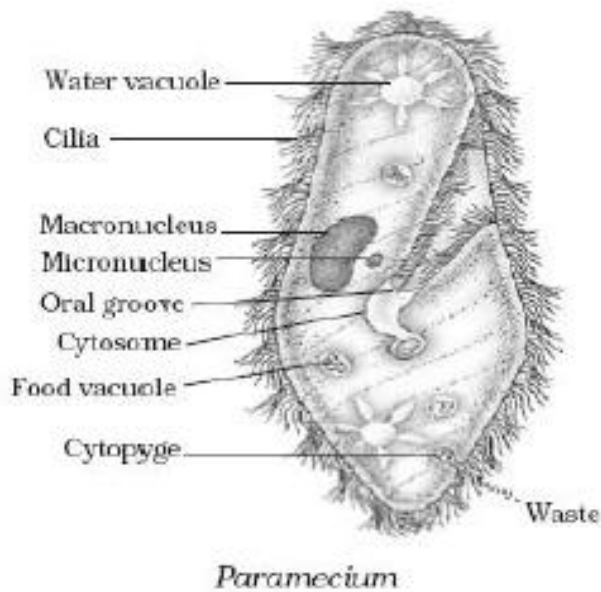
## Top diagrams

### A) Kingdom Monera

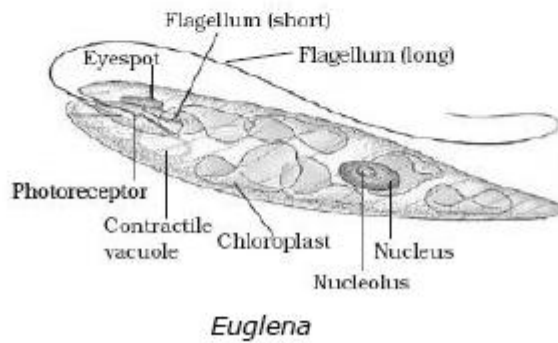
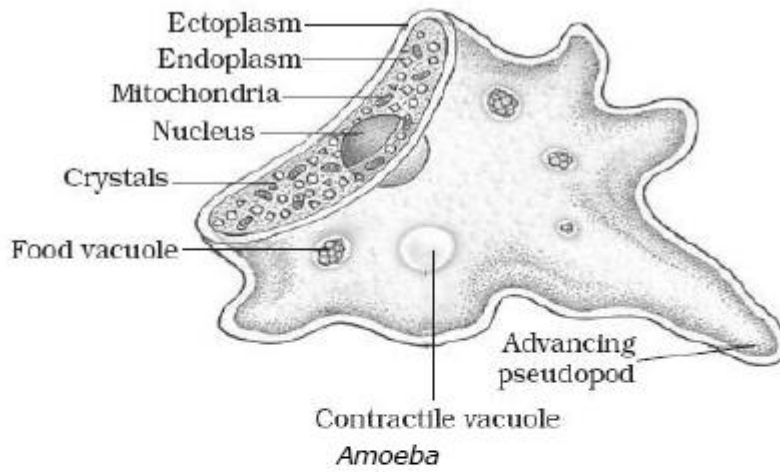




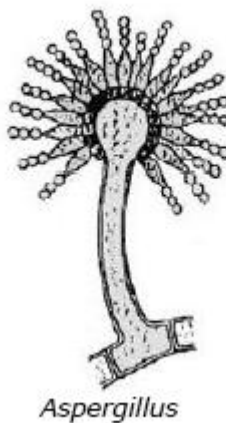
**B) Kingdom Protista**







### C) Kingdom Fungi





*Penicillium*



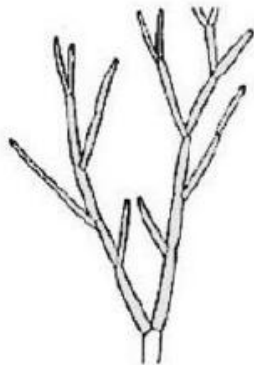
*Agaricus*

**D) Kingdom Plantae**

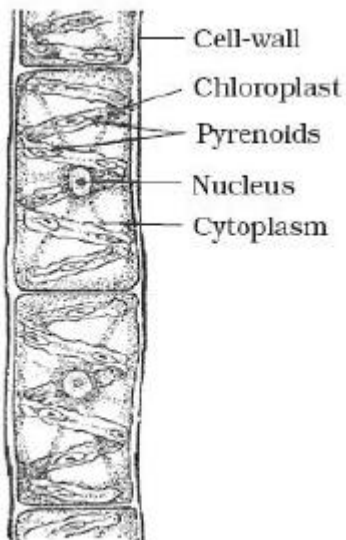
**i) Division Thallophyta**



*Ulothrix*



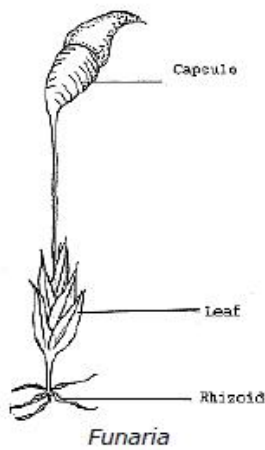
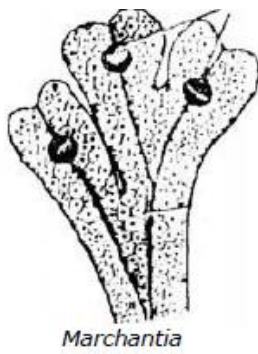
*Cladophora*



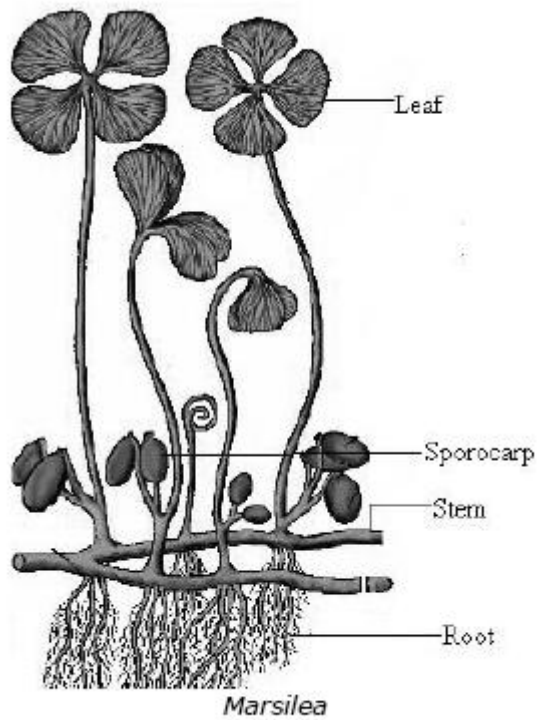
*Spirogyra*



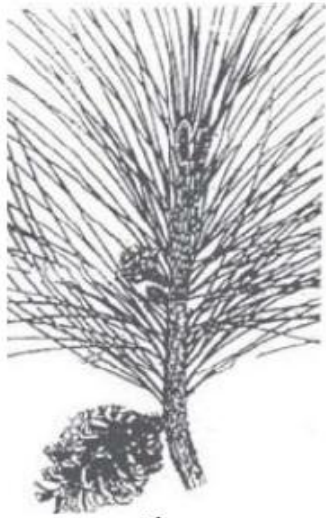
**ii) Division Bryophyta**



### iii) Division Pteridophyta



**iv) Division Gymnospermae**



*Pinus*



*Cycas*

**v) Division Angiospermae**



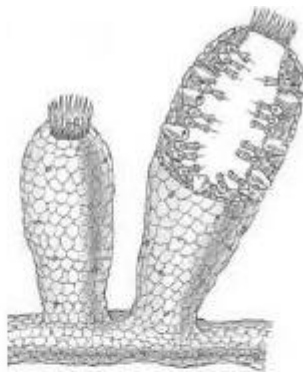
*Ipomoea*

**E) Kingdom Animalia**

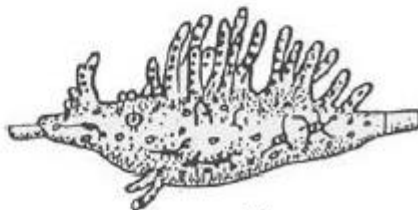
**i) Phylum Parazoa**



*Euplectella*

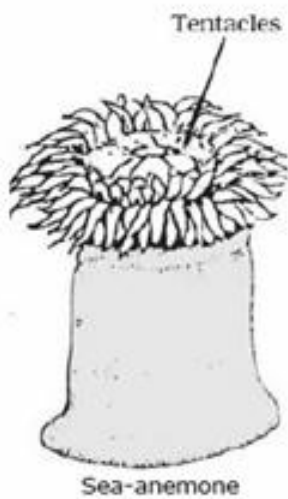
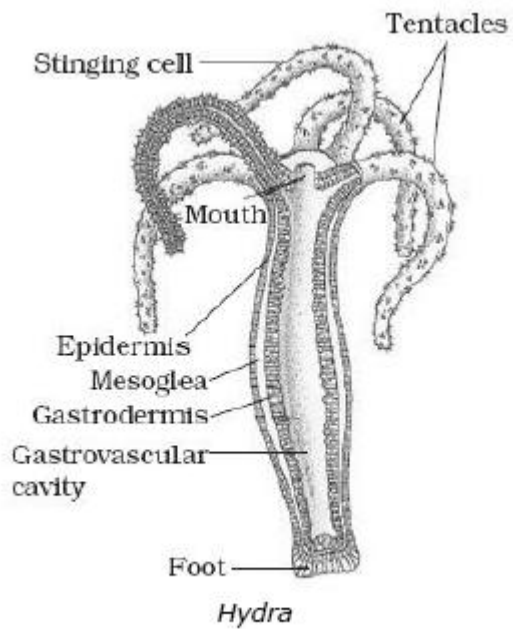


*Sycon*



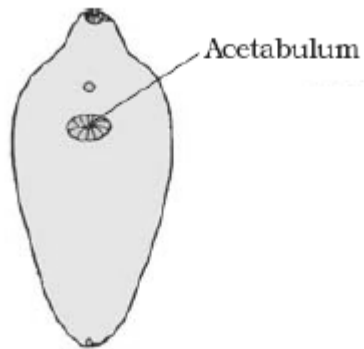
*Spongilla*

## ii) Phylum Coelenterata

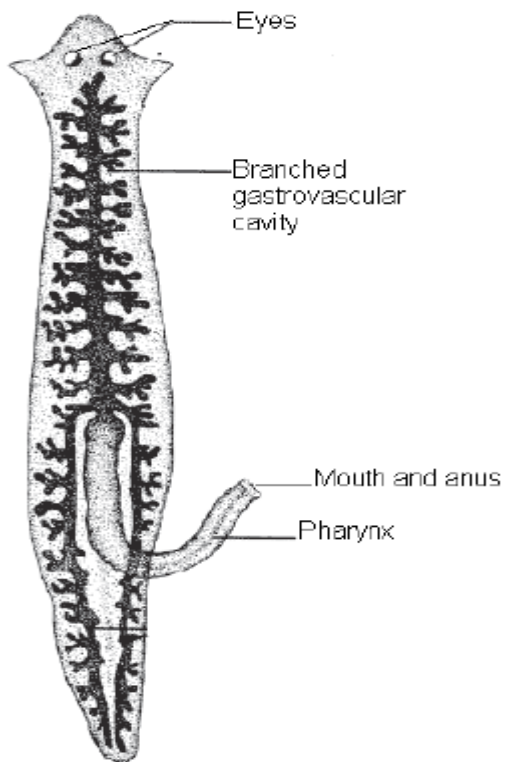




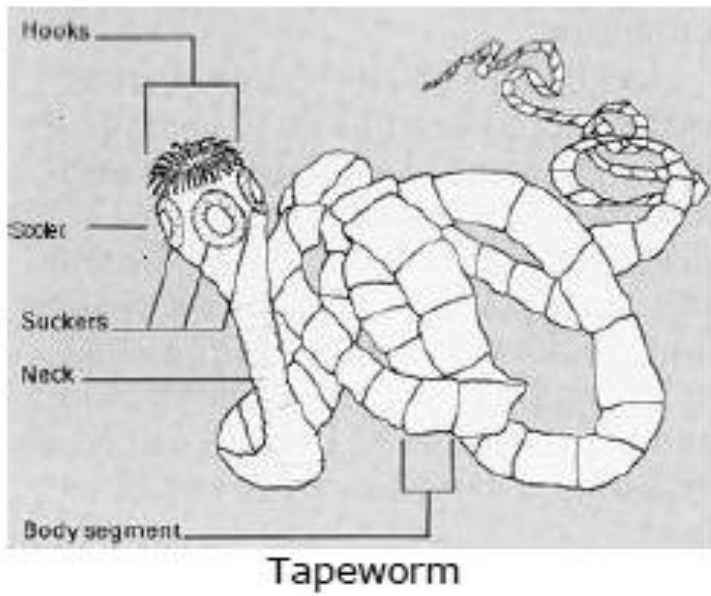
### iii) Phylum Platyhelminthes



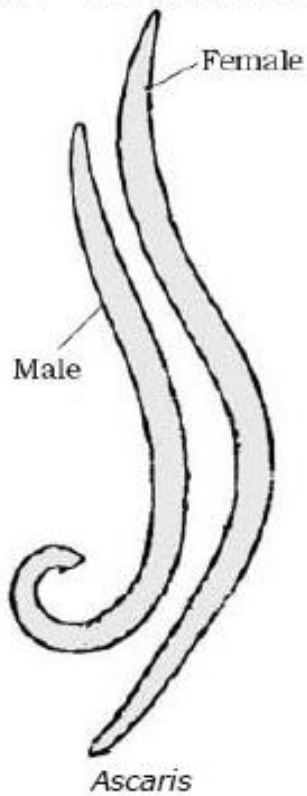
Liver-fluke



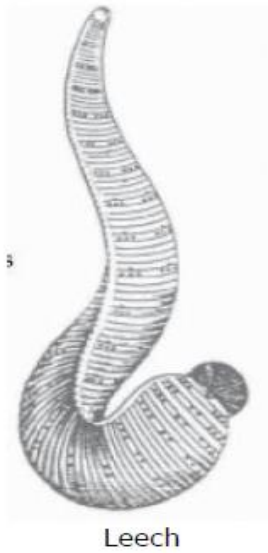
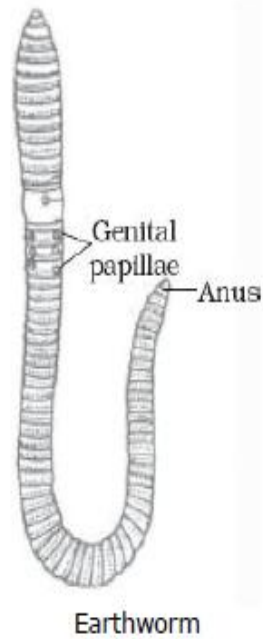
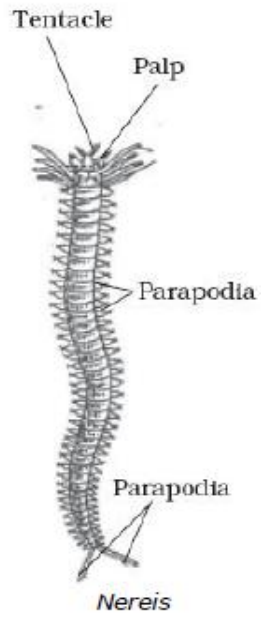
*Planaria*



iv) **Phylum Nematoda**

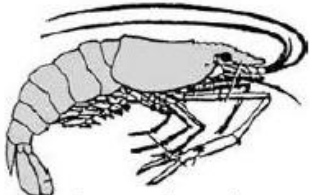


**v) Phylum Annelida**

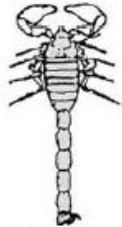


Leech

**vi) Phylum Arthropoda**



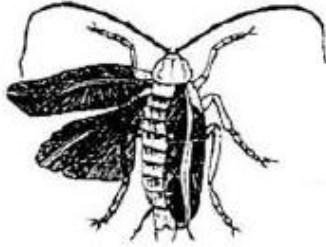
*Palaemon* (prawn)



*Palamnaeus* (scorpion)



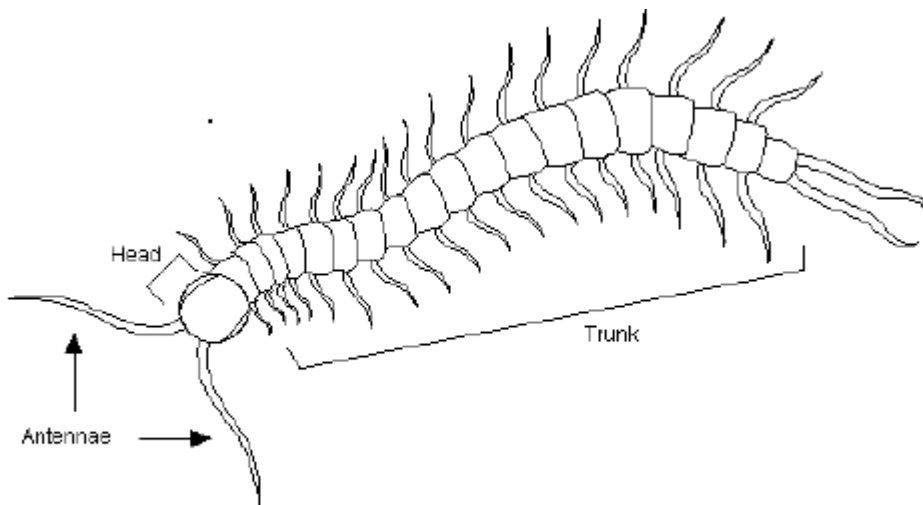
*Aranea* (spider)



*Periplaneta* (cockroach)

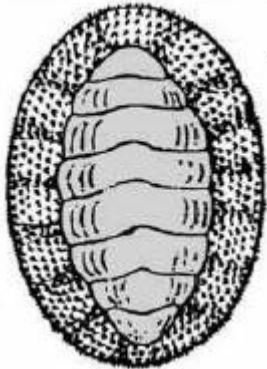


Butterfly (*Pieris*)



Centipede

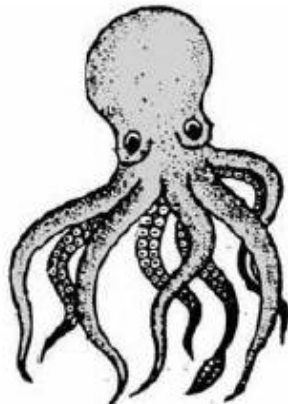
**vii) Phylum Mollusca**



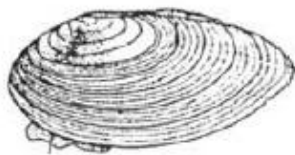
*Chiton*



*Pila*

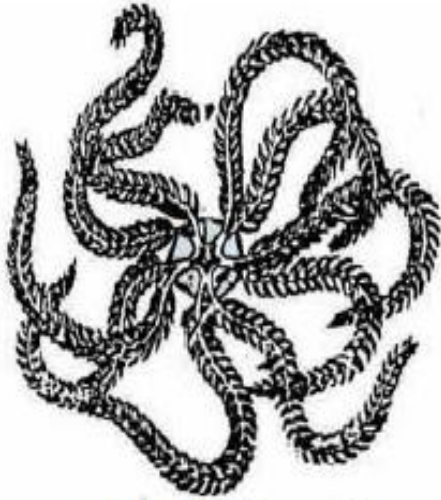


*Octopus*

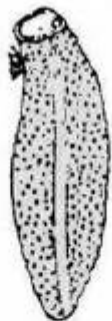


*Unio*

**viii) Phylum Echinodermata**



*Antedon* (feather-star)

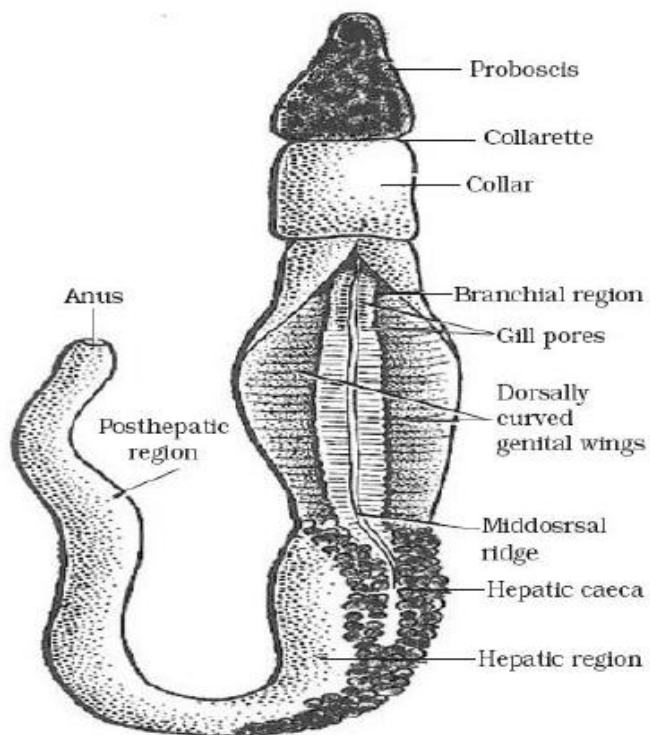


*Holothuria* (sea cucumber)



*Asterias* (star fish)

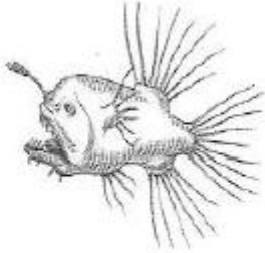
### ix) Protochordata



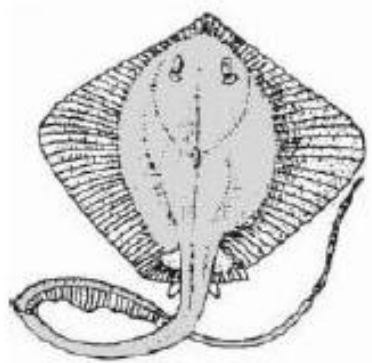
*Balanoglossus* (A Protochordata)



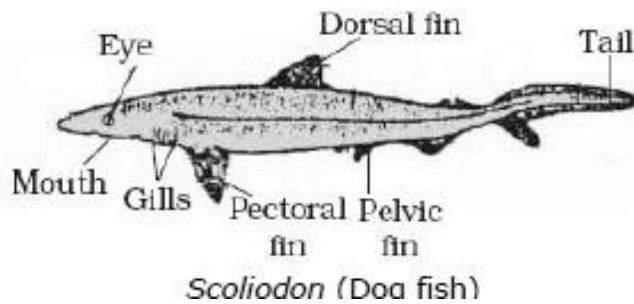
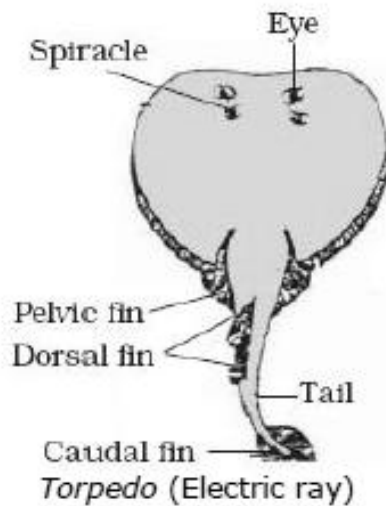
**x) Vertebrata**

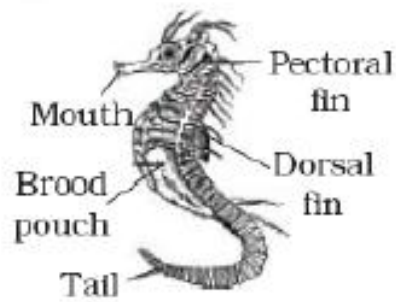
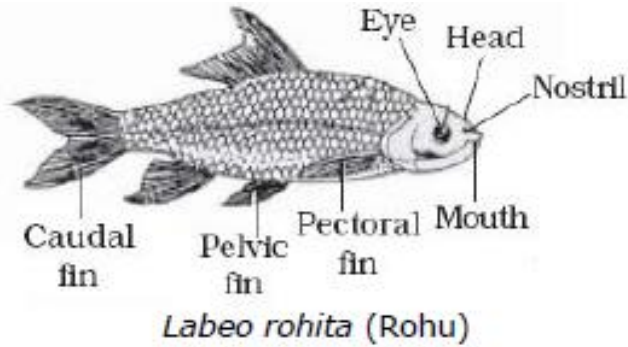


*Caulophryne jordani* (Angler fish)

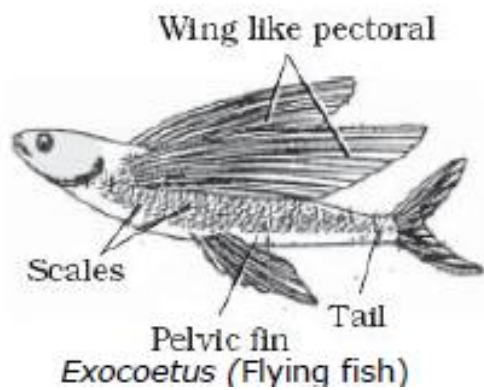


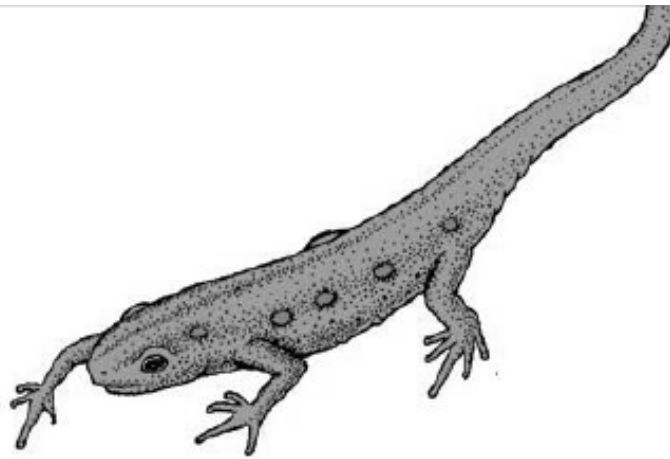
Sting ray



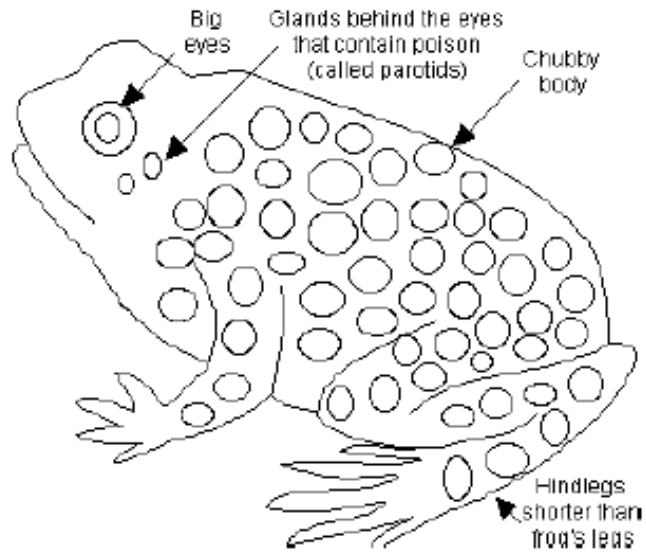


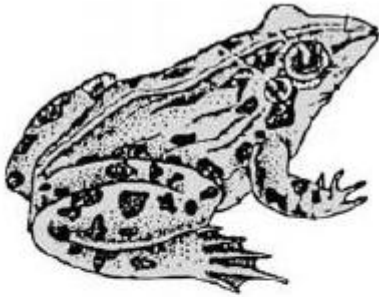
*Hippocampus* - male (sea horse)





*Salamander*

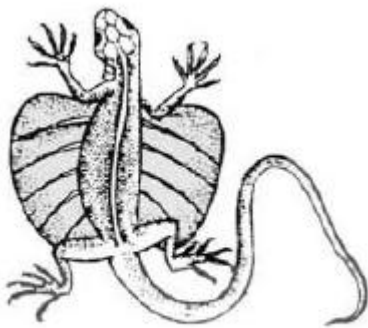




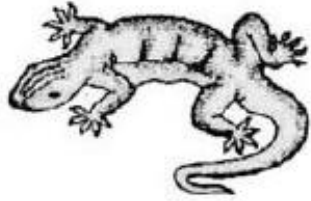
*Rana tigrina* (Common frog)



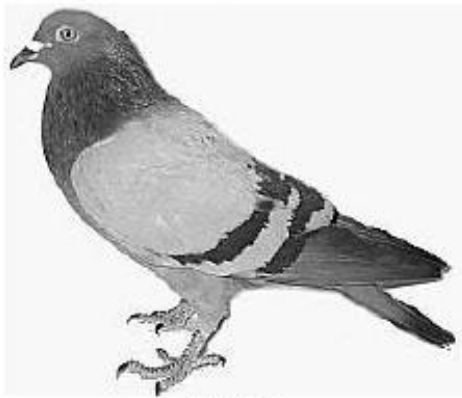
*Hyla* (Tree frog)



*Draco* (flying lizard)



*Hemidactylus* (House wall lizard)



Pigeon



Crow

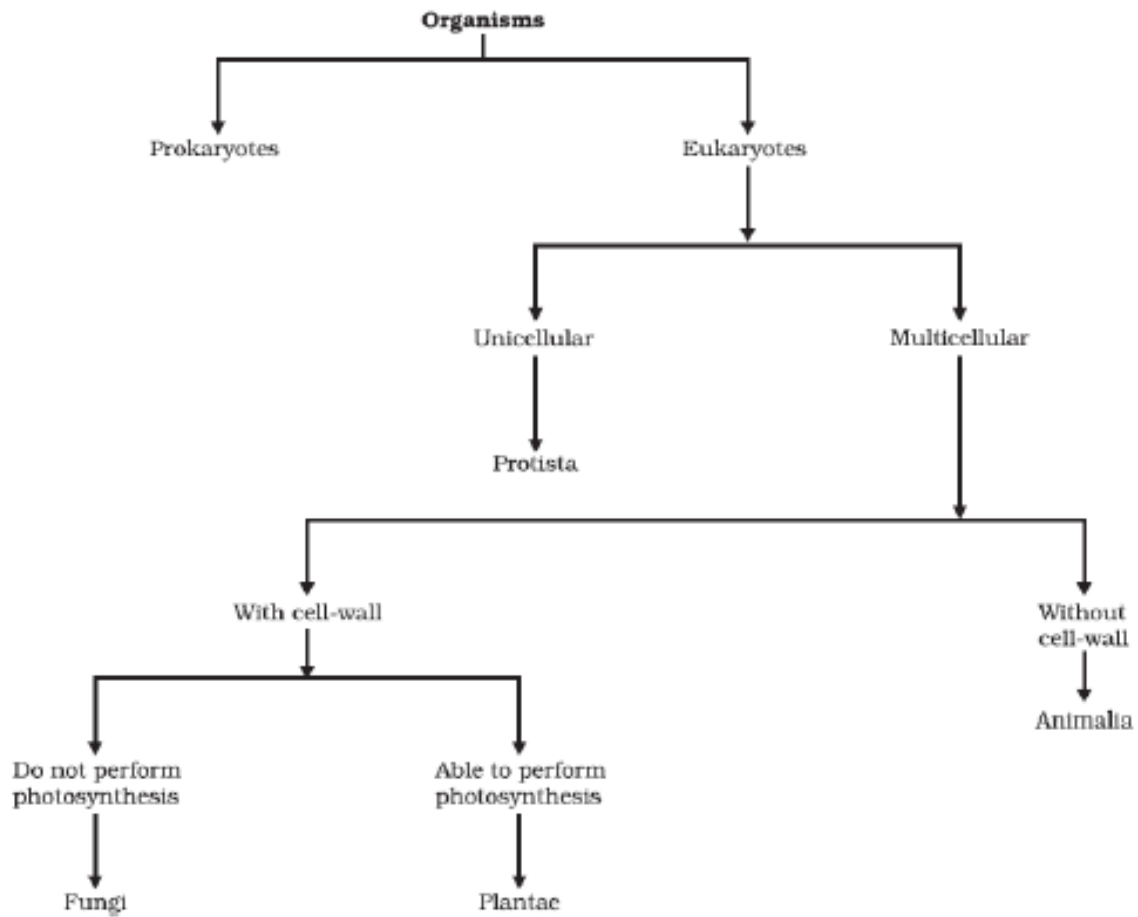


Rat



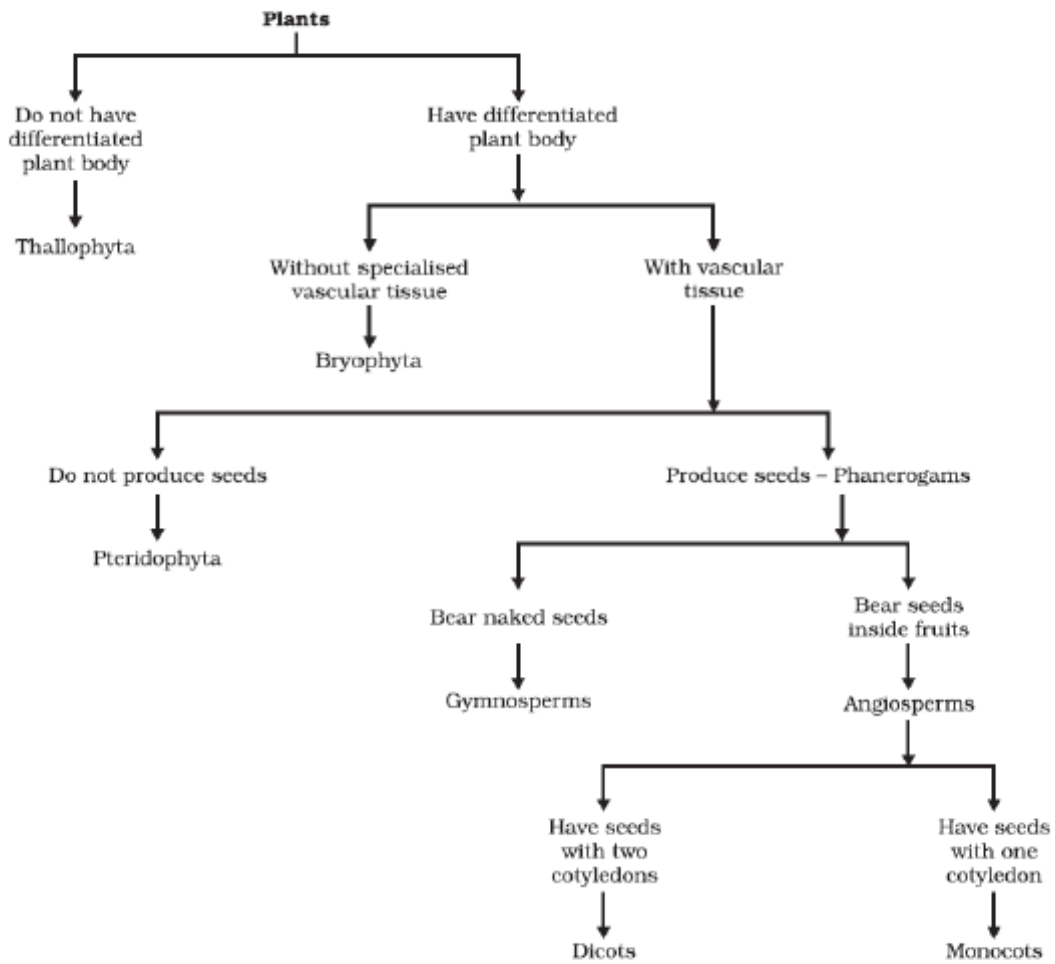
Bat

### Top flow-charts

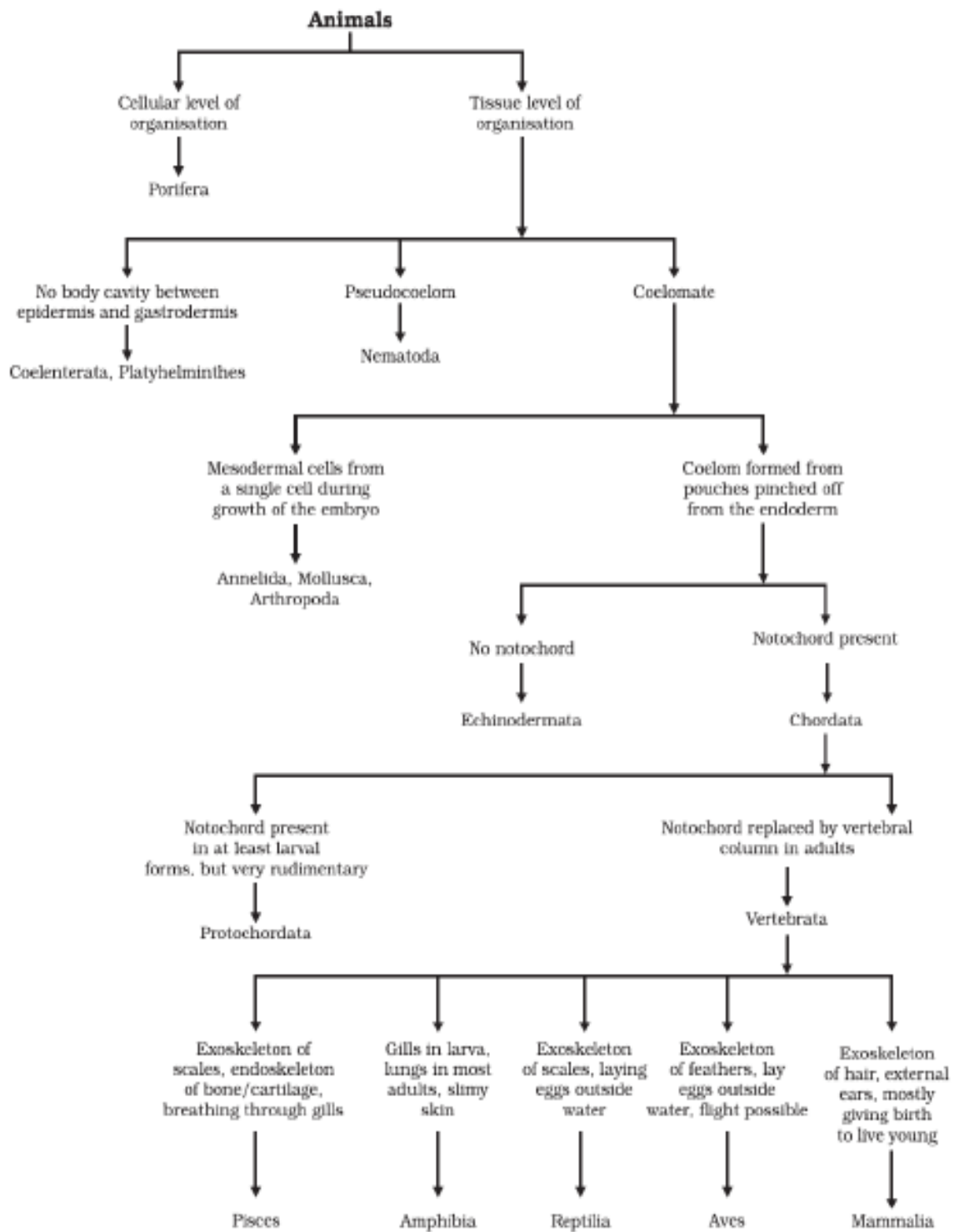


Basis of five-kingdom classification.





Classification of plants



Classification of animals

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