Diversity In Living Organisms

CLASS-9TH CHAPTER-7TH

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Classification and Evolution

- All living things are identified and categorised on the basis of their body design in form and function.

- Charles Darwin first described this idea of evolution in 1859 in his book, The Origin of Species.

- The first group are frequently referred to as ‘primitive’ or ‘lower’ organisms, while those in the second group are called ‘advanced’ or ‘higher’ organisms.

- **Biodiversity means** the diversity of life forms.

- It is a word commonly used to refer to the variety of life forms found in a particular region. Diverse life forms share the environment, and are affected by each other too.

- As a result, a stable community of different species comes into existence.

- Humans have played their own part in recent times in changing the balance of such communities.

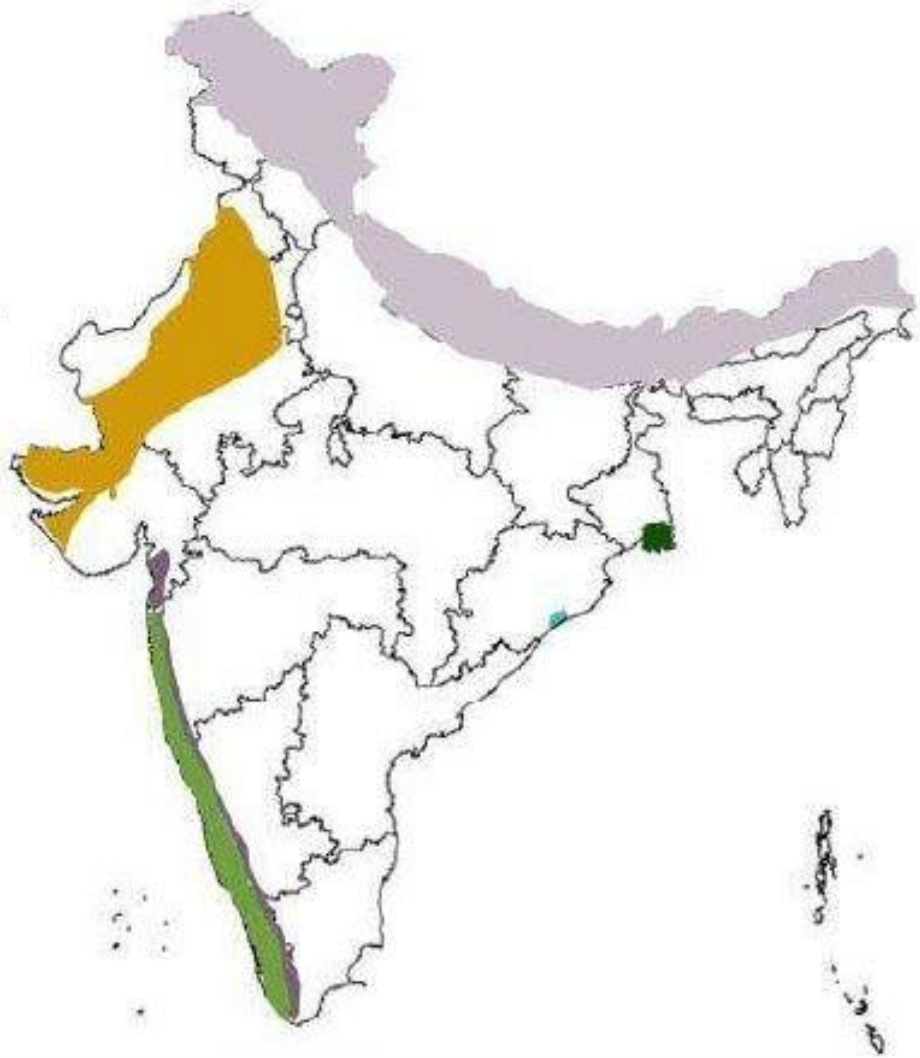
- Of course, the diversity in such communities is affected by particular characteristics of land, water, climate and so on.

- Rough estimates state that there are about ten million species on the planet, although we actually know only one or two millions of them.

- The warm and humid tropical regions of the earth, between the tropic of Cancer and the tropic of Capricorn, are rich in diversity of plant and animal life.

- This is called the region of megadiversity. Of the biodiversity on the planet, more than half is concentrated in a few countries — Brazil, Colombia, Ecuador, Peru, Mexico, Zaire, Madagascar, Australia, China, India, Indonesia and Malaysia.

BIODIVERSITY IN INDIA



Himalayas - This majestic range of mountains is the home of a diverse range of flora and fauna. Eastern Himalayas is one of the two biodiversity hotspots in India.

Chilika - This wetland area is protected under the Ramsar convention.

Sunder bans - The largest mangrove forest in India.

Western Ghats - One of the two biodiversity hotspots in India.

Thar desert - The climate and vegetation in this area is a contrast to the Himalayan region.

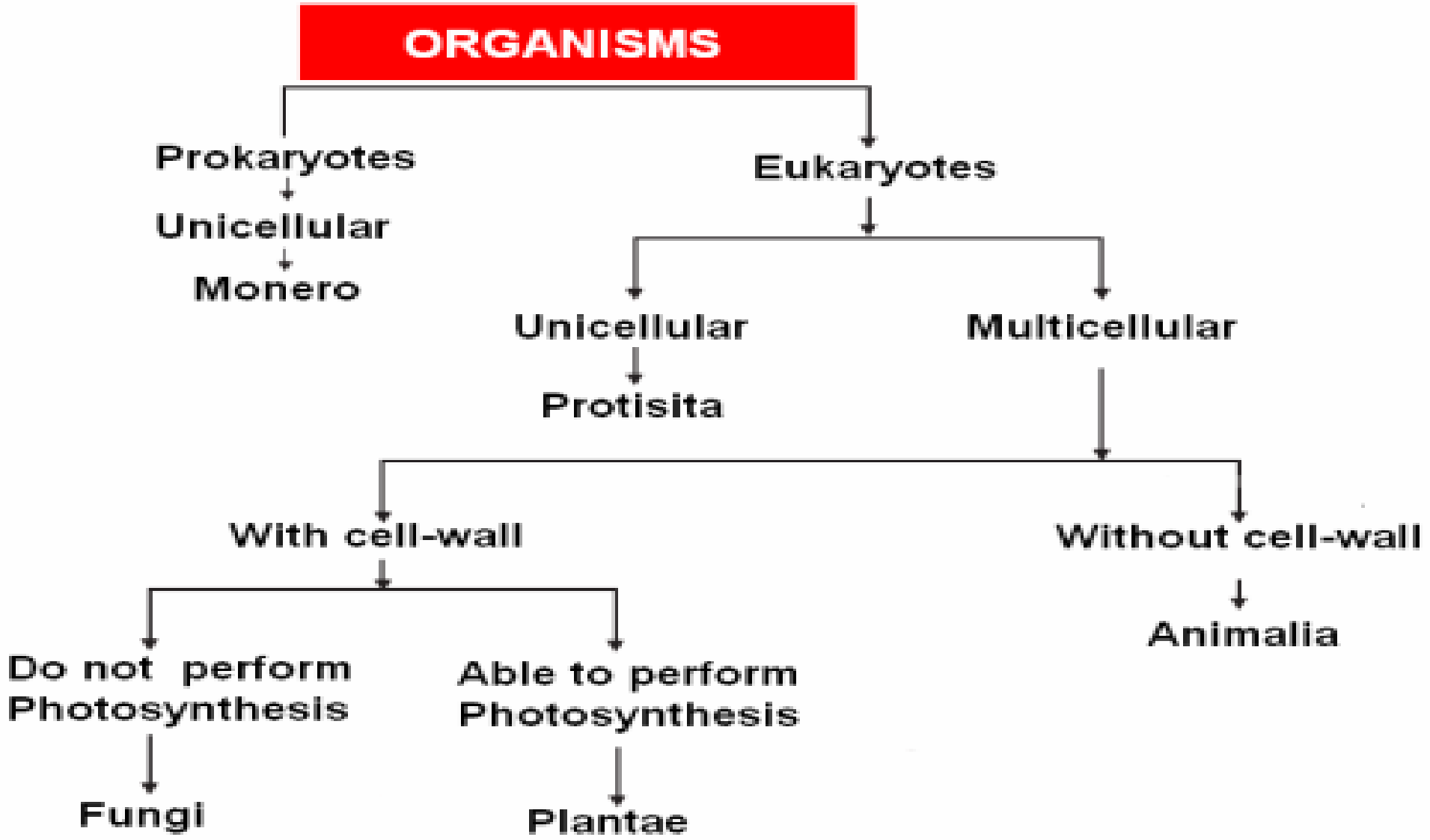
The Hierarchy of Classification- Groups

- Biologists, such as Ernst Haeckel (1894), Robert Whittaker (1969) and Carl Woese (1977) have tried to classify all living organisms into broad categories, called kingdoms.

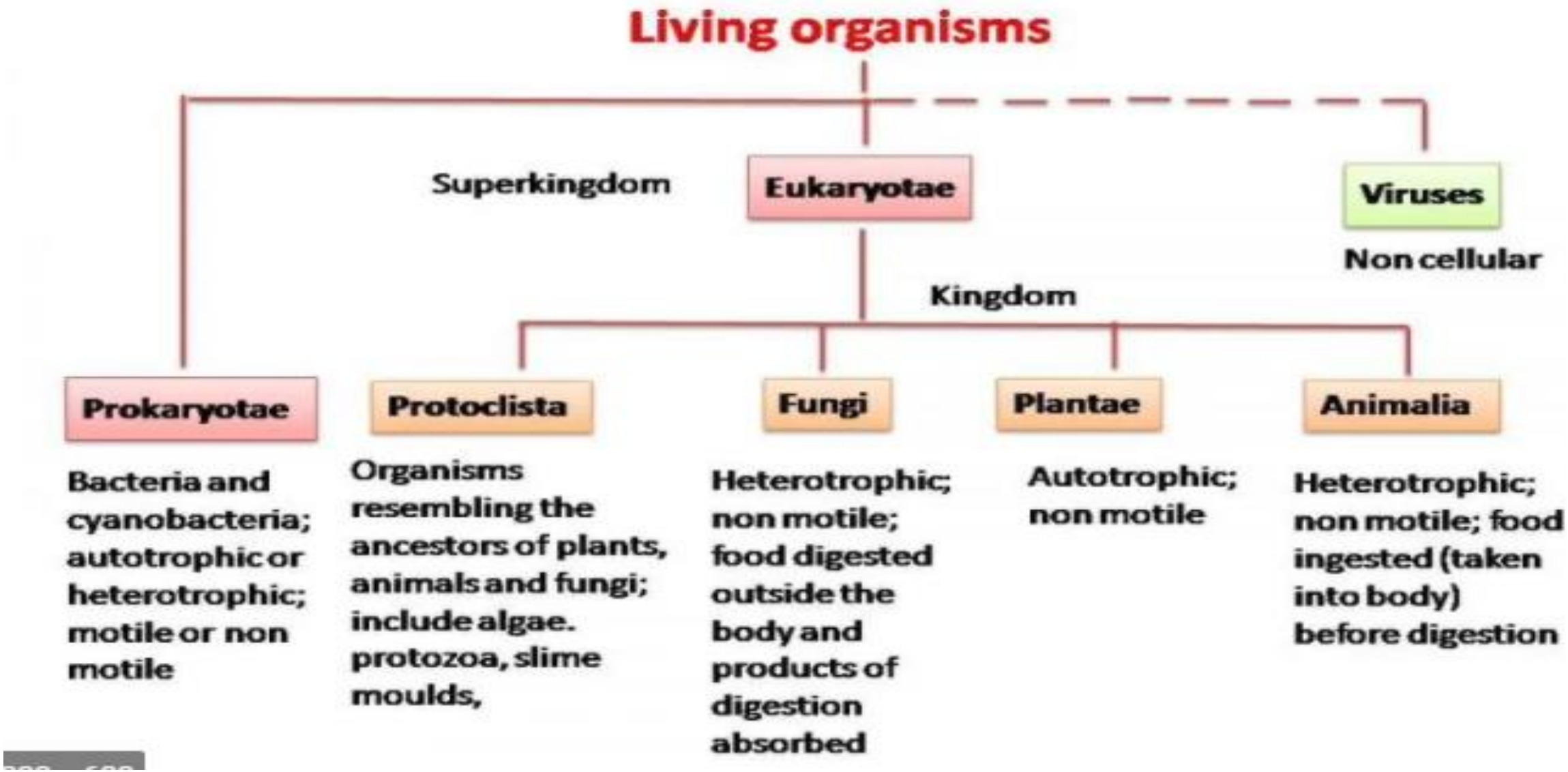
- The classification Whittaker proposed has five kingdoms: Monera, Protista, Fungi, Plantae and Animalia, and is widely used.

- These groups are formed on the basis of their cell structure, mode and source of nutrition and body organisation.

- The modification Woese introduced by dividing the Monera into Archaebacteria (or Archaea) and Eubacteria (or Bacteria) is also in use.



Classification of Organisms into five Kingdoms


Living organisms
Superkingdom
Eukaryotae
Viruses
Non cellular
Kingdom
Prokaryotae
Protoclista
Fungi
Plantae
Animalia
Bacteria and cyanobacteria; autotrophic or heterotrophic; motile or non motile
Organisms resembling the ancestors of plants, animals and fungi; include algae. protozoa, slime moulds,
Heterotrophic; non motile; food digested outside the body and products of digestion absorbed
Autotrophic; non motile
Heterotrophic; non motile; food ingested (taken into body) before digestion

Further classification is done by naming the sub-groups at various levels as given in the following scheme:

- Kingdom
- Phylum (for animals) / Division (for plants)
- Class
- Order
- Family
- Genus
- Species

Thus, by separating organisms on the basis of a hierarchy of characteristics into smaller and smaller groups, the basic unit of classification, which is a ‘species’.

A species includes all organisms that are similar enough to breed and perpetuate The important characteristics of the five kingdoms of Whittaker are as follows:

MONERA

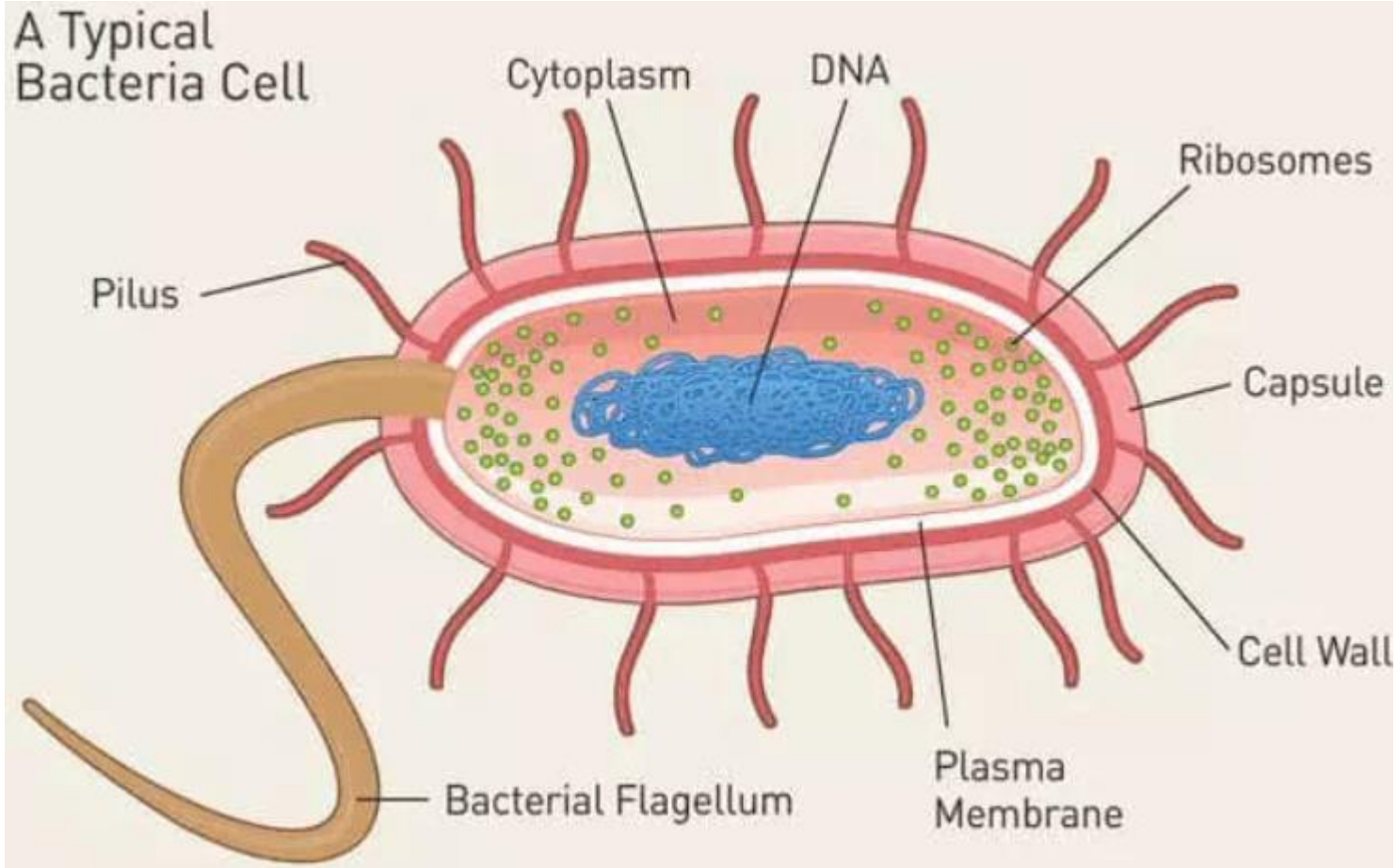
- These organisms do not have a defined nucleus or organelles, nor do any of them show multi-cellular body designs.

- On the other hand, they show diversity based on many other characteristics.

- Some of them have cell walls while some do not. Of course, having or not having a cell wall has very different effects on body design here from having or not having a cell wall in multicellular organisms.

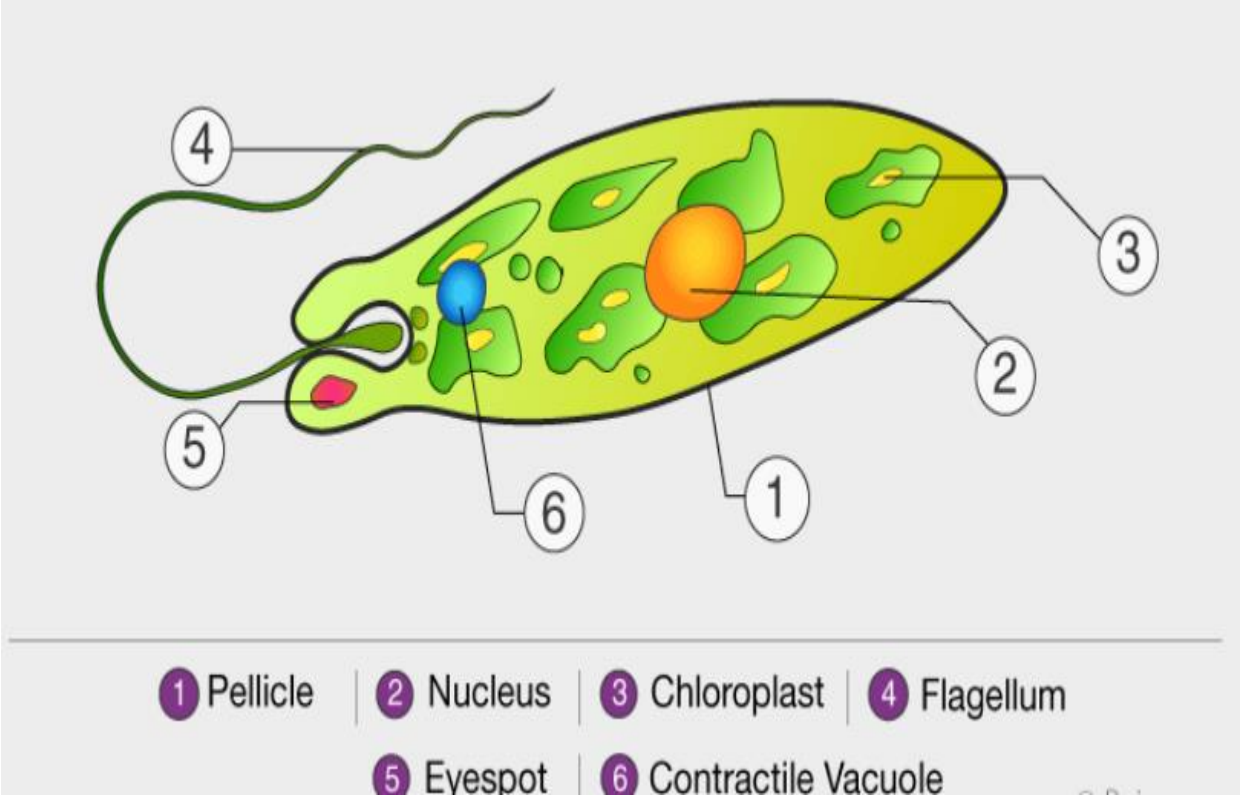
- The mode of nutrition of organisms in this group can be either by synthesising their own food (autotrophic) or getting it from the environment (heterotrophic).

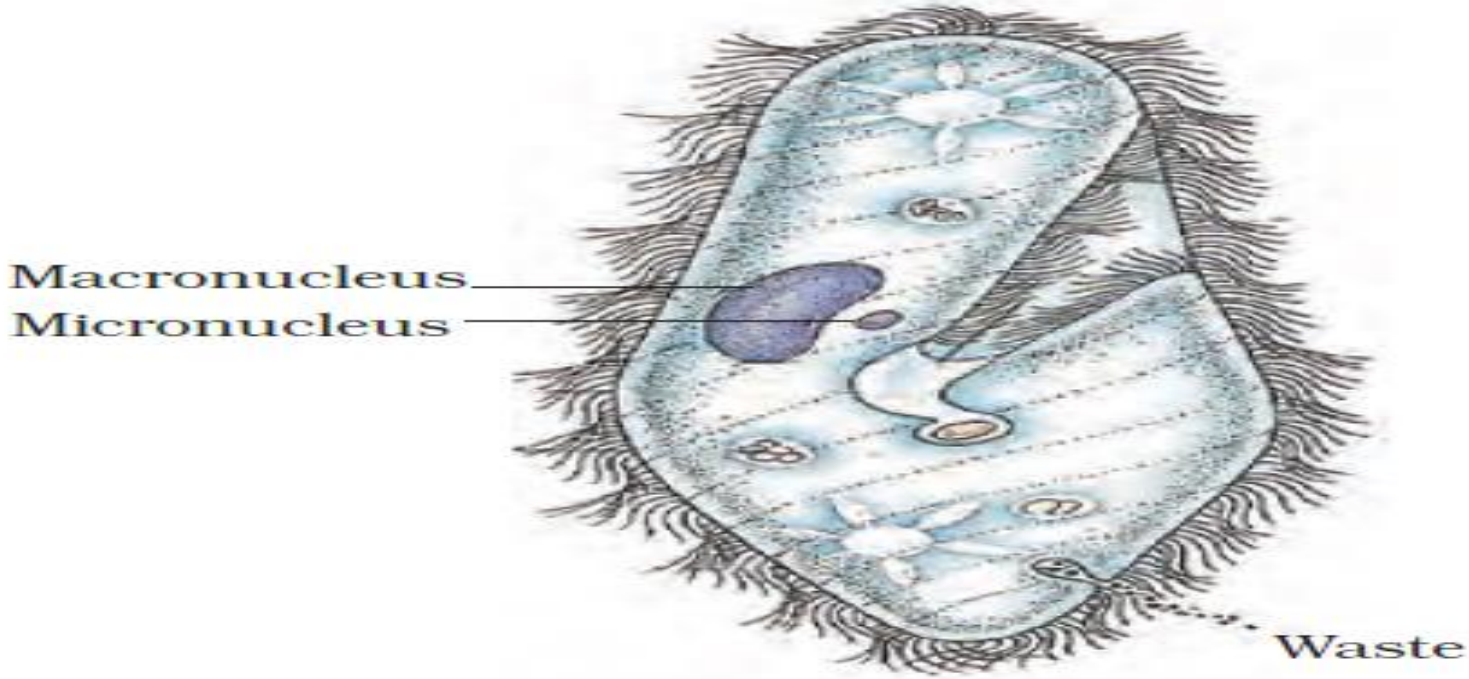
- This group includes bacteria, blue-green algae or cyanobacteria, and mycoplasma.


A Typical
Bacteria Cell
Cytoplasm
DNA
Ribosomes
Pilus
Capsule
Cell Wall
Plasma
Membrane
Bacterial Flagellum

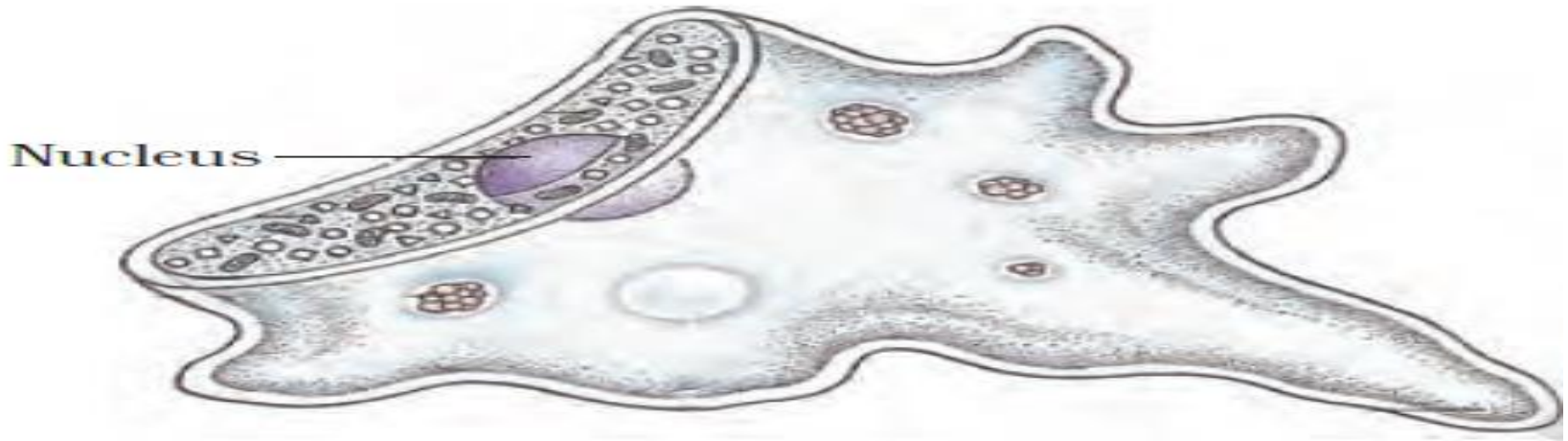
PROTISTA

- **This** group includes many kinds of unicellular eukaryotic organisms.
- Some of these organisms use appendages, such as hair-like cilia or whip-like flagella for moving around.
- Their mode of nutrition can be autotrophic or heterotrophic. Examples are unicellular algae, diatoms and protozoans





Paramecium



FUNGI

- These are heterotrophic eukaryotic organisms.

- Some of them use decaying organic material as food and are therefore called saprotrophs. Others require a living protoplasm of a host organism for food.

- They are called parasites. Many of them have the capacity to become multicellular organisms at certain stages in their lives.
- They have cell walls made of a tough complex sugar called chitin.

- Examples are yeasts, molds and mushrooms Some fungal species live in permanent mutually dependent relationships with blue-green algae (or cyanobacteria).

- Such relationships are called symbiotic. These symbiotic life forms are called lichens.

PLANTAE

- These are multicellular eukaryotes with cell walls.

- They are autotrophs and use chlorophyll for photosynthesis.

- Thus, all plants are included in this group. Since plants and animals are most visible forms of the diversity of life around us.

ANIMALIA

- These include all organisms which are multicellular eukaryotes without cell walls.

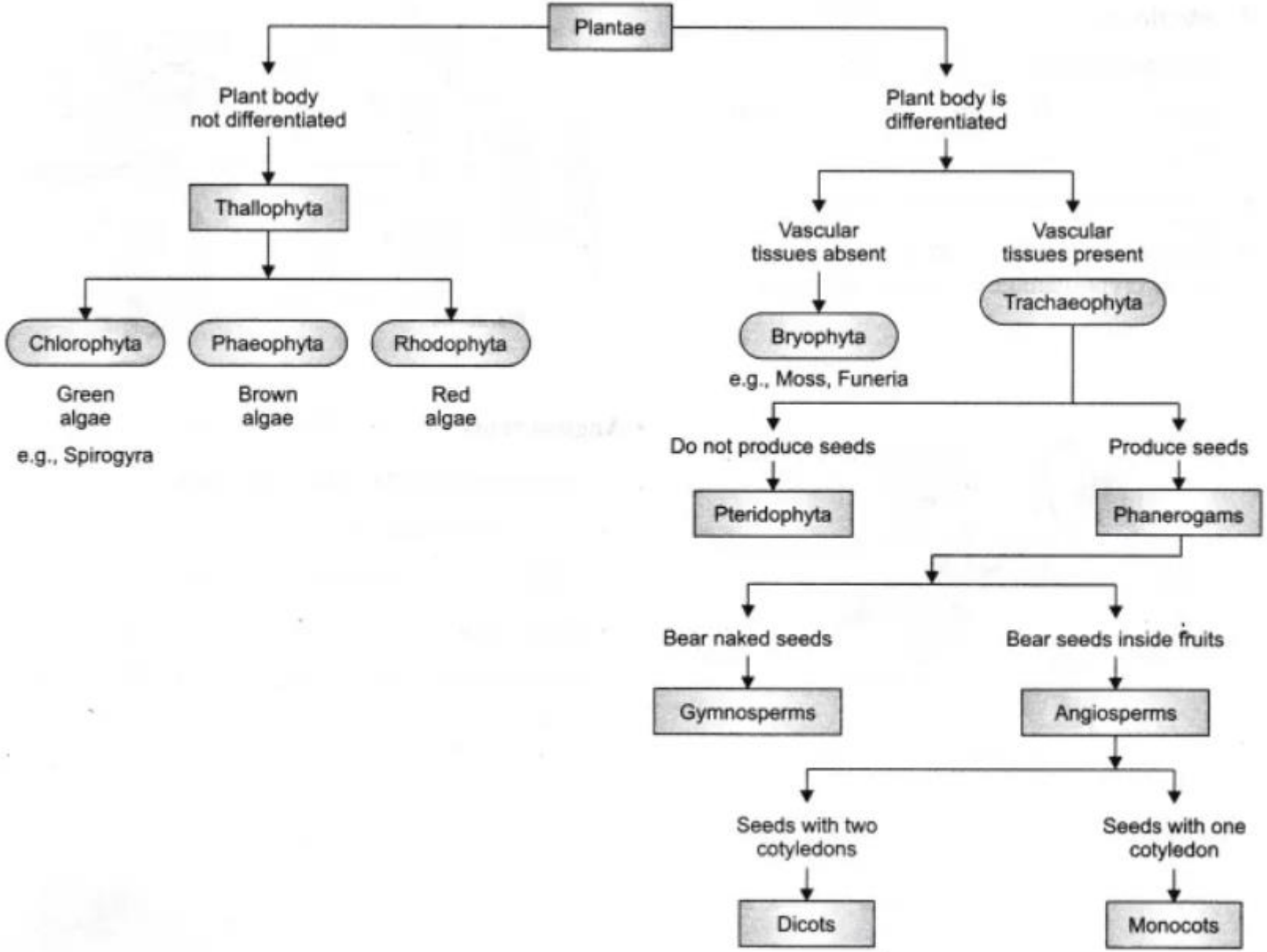
- They are heterotrops

Plantae

- The first level of classification among plants depends on whether the plant body has well differentiated, distinct parts.

- The next level of classification is based on whether the differentiated plant body has special tissues for the transport of water and other substances.

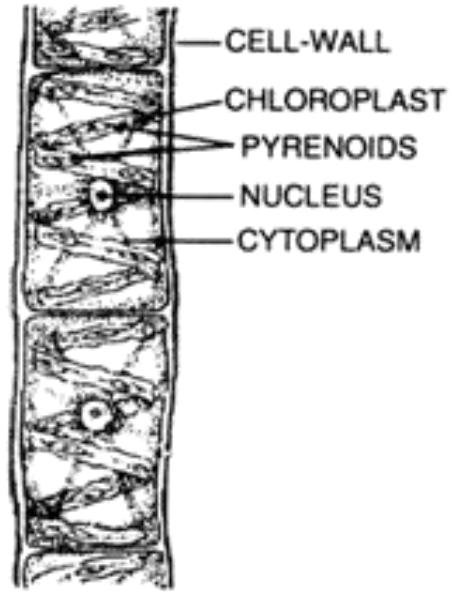
- Further classification looks at the ability to bear seeds and whether the seeds are enclosed within fruits.


Plantae
Plant body not differentiated
Thallophyta
Chlorophyta
Phaeophyta
Rhodophyta
Green algae
e.g., Spirogyra
Brown algae
Red algae
Plant body is differentiated
Vascular tissues absent
Vascular tissues present
Bryophyta
e.g., Moss, Funeria
Trachaeophyta
Do not produce seeds
Produce seeds
Pteridophyta
Phanerogams
Bear naked seeds
Bear seeds inside fruits
Gymnosperms
Angiosperms
Seeds with two cotyledons
Seeds with one cotyledon
Dicots
Monocots

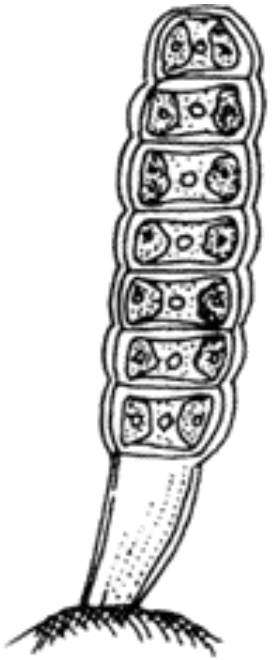
THALLOPHYTA

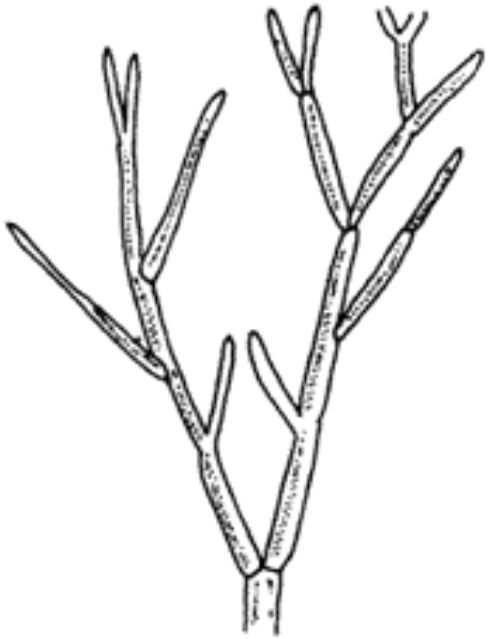
- Plants that do not have well-differentiated body design fall in this group. The plants in this group are commonly called **algae.**

- These plants are predominantly aquatic. Examples are Spirogyra, Ulothrix, Cladophora, Ulva and Chara



SPIROGYRA


ULOTHRIX


CLADOPHORA


ULVA


CHARA

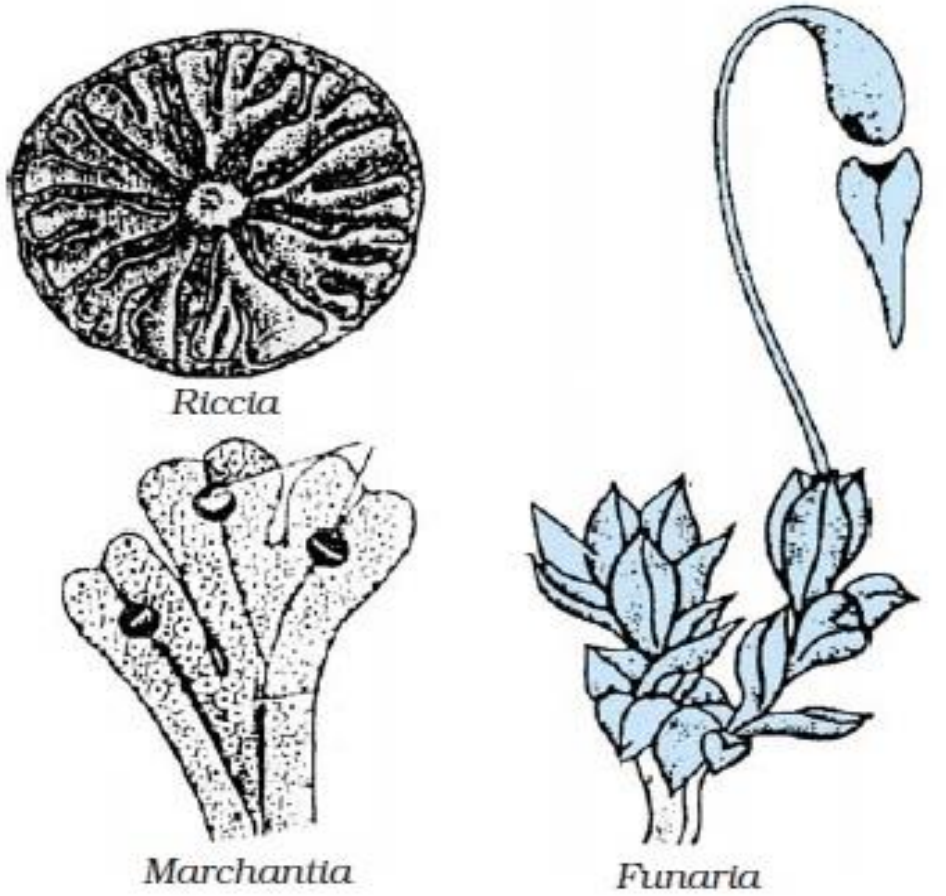
BRYOPHYTA

- These are called the amphibians of the plant kingdom.

- The plant body is commonly differentiated to form stem and leaf-like structures.

- However, there is no specialised tissue for the conduction of water and other substances from one part of the plant body to another.

- Examples are **moss** (Funaria) and Marchantia



PTERIDOPHYTA

- In this group, the plant body is differentiated into roots, stem and leaves and has specialised tissue for the conduction of water and other substances from one part of the plant body to another.

- Some examples are Marsilea, ferns and horse-tails.

- The reproductive organs of plants in all these three groups are very inconspicuous, and they are therefore called ‘cryptogams’, or ‘those with hidden reproductive organs’.

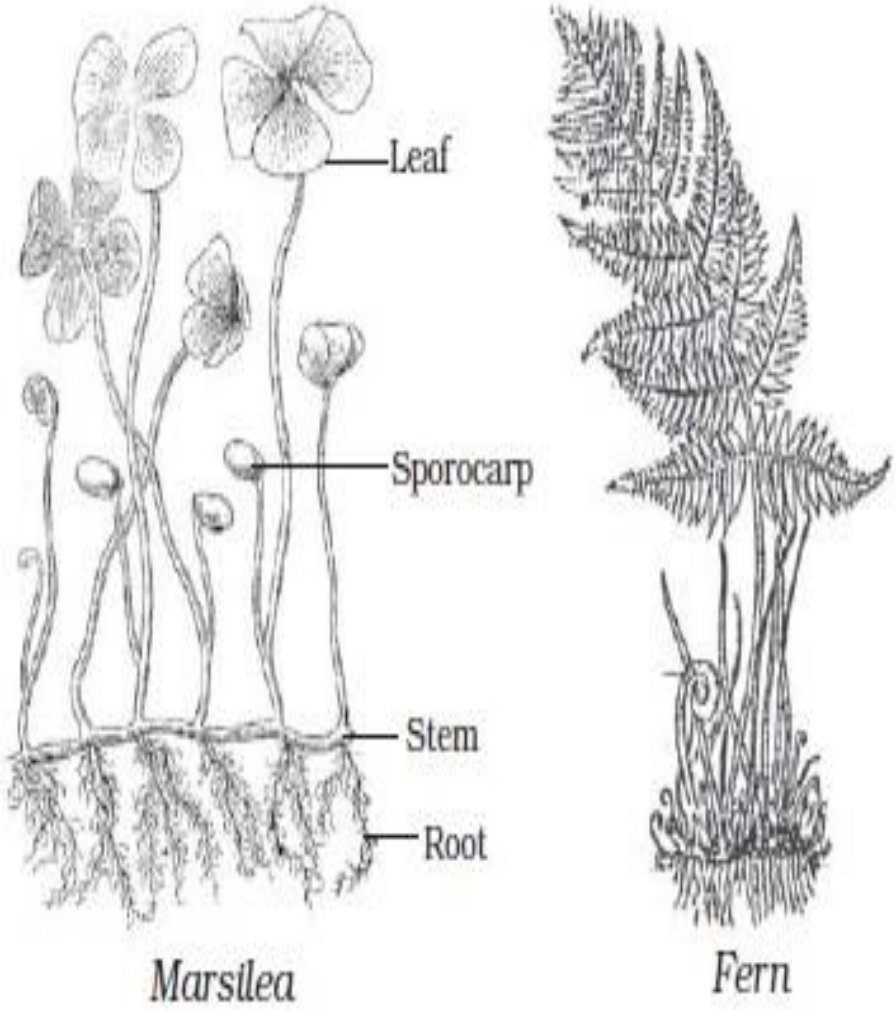


Fig. 7.7: *Pteridophyta*

- On the other hand, plants with well differentiated reproductive parts that ultimately make seeds are called phanerogams.

- Seeds are the result of sexual reproduction process.

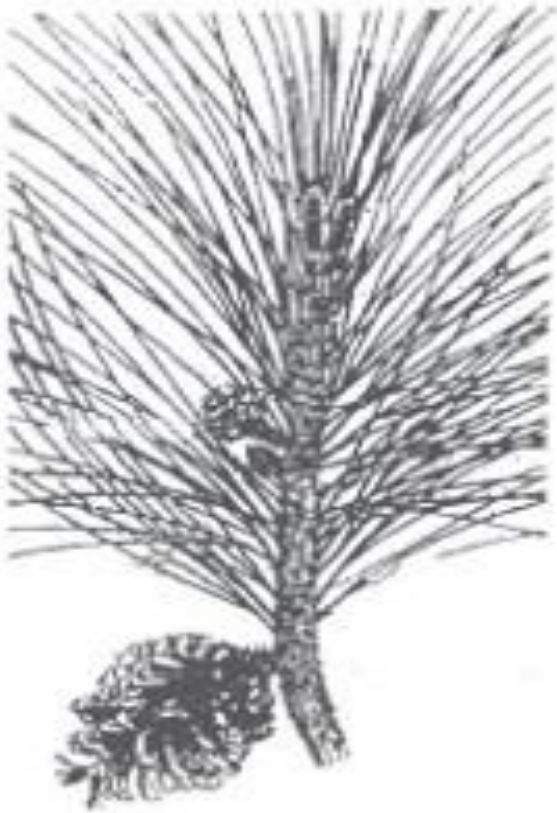
- They consist of the embryo along with stored food, which assists for the initial growth of the embryo during germination.

- This group is further classified, based on whether the seeds are naked or enclosed in fruits, giving us two groups**: gymnosperms and angiosperms**.

GYMNOSPERMS

- This term is derived from two Greek words: gymno– means naked and sperma– means seed.

- The plants of this group bear naked seeds and are usually perennial, evergreen and woody. Examples are pines and deodar.



Pinus

Cycas

ANGIOSPERMS

- This word is made from two Greek words: angio means covered and sperma– means seed.

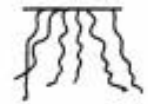
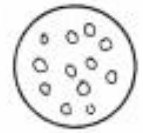
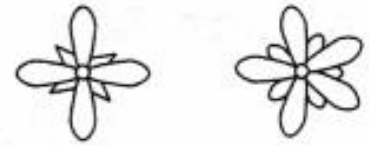
- These are also called flowering plants. The seeds develop inside an ovary which is modified to become a fruit.

- Plant embryos in seeds have structures called cotyledons.

- Cotyledons are called ‘seed leaves’ because in many instances they emerge and become green when the seed germinates.

- The angiosperms are divided into two groups on he basis of the number of cotyledons present in the seed.

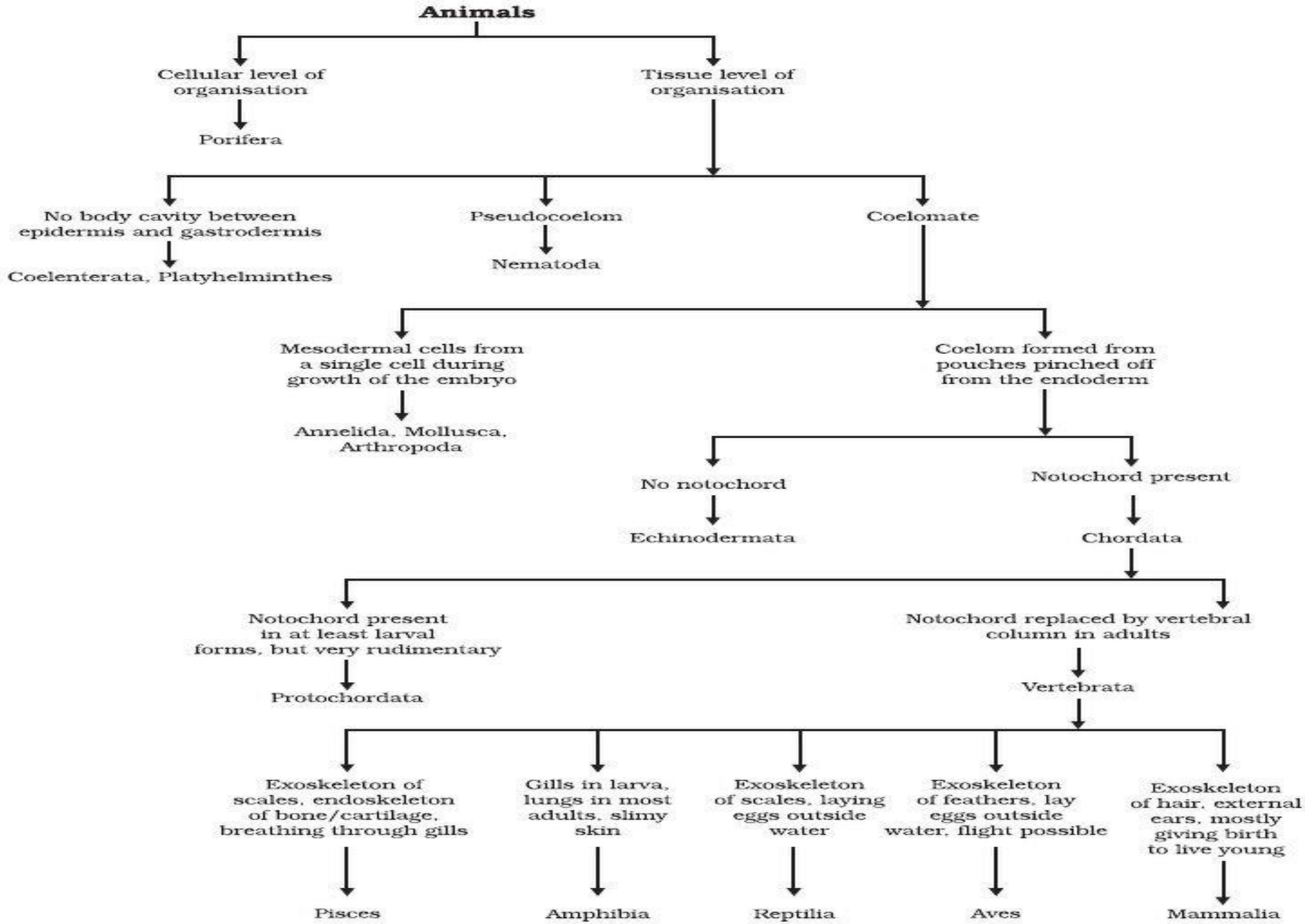
- Plants with seeds having a single cotyledon are called monocotyledonous or monocots. Plants with seeds having two cotyledons are called dicots

Character	Monocots	Dicots
Leaf Venation	Parallel 	Reticulate 
Root system	Fibrous root 	Tap Root 
Vascular bundles in stem	V.B. scattered 	V.B. in rings 
Flowers	Multiple of 3 petals 	Multiple of 4 petals and 5 petals. 
Embryo	single cotyledon 	two cotyledons 
Examples of Plants	Grass, Orchids. (largest family of monocot).	Sunflower Maples, Oaks. Cassava,
Ornamental flowers	Tulips, lilies, irises, cannas.	Pleneria.
Food crops	Corn, wheat, barley, rice, sugarcane, banana, pineapple.	Bean, Peas
Floating Plants	Duckweed	
Germination time	Corn-3 days.	Bean-7 days.
Seeds on soaking in water.	Does not break into two halves	Seeds break into two equal halves.

Animalia

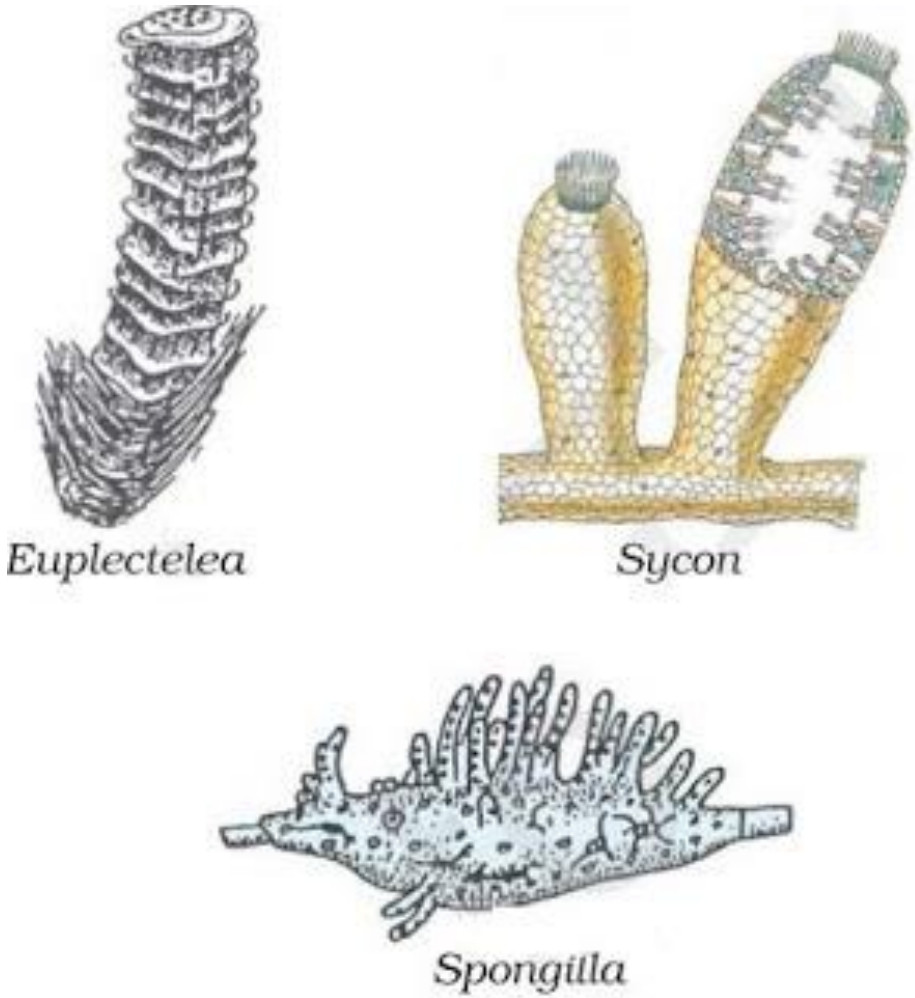
- These are organisms which are eukaryotic, multicellular and heterotrophic. Their cells do not have cell-walls. Most animals are mobile.

- They are further classified based on the extent and type of the body design differentiation found.


Animals
Cellular level of organisation
Porifera
Tissue level of organisation
No body cavity between epidermis and gastrodermis
Coelenterata, Platyhelminthes
Pseudocoelom
Nematoda
Coelomate
Mesodermal cells from a single cell during growth of the embryo
Annelida, Mollusca, Arthropoda
Coelom formed from pouches pinched off from the endoderm
No notochord
Echinodermata
Notochord present
Chordata
Notochord present in at least larval forms, but very rudimentary
Protochordata
Notochord replaced by vertebral column in adults
Vertebrata
Exoskeleton of scales, endoskeleton of bone/cartilage, breathing through gills
Pisces
Gills in larva, lungs in most adults, slimy skin
Amphibia
Exoskeleton of scales, laying eggs outside water
Reptilia
Exoskeleton of feathers, lay eggs outside water, flight possible
Aves
Exoskeleton of hair, external ears, mostly giving birth to live young
Mammalia

PORIFERA

- The word Porifera means organisms with holes.
- These are non-motile animals attached to some solid support.
- There are holes or ‘pores’, all over the body. These lead to a canal system that helps in circulating water throughout the body to bring in food and oxygen.
- These animals are covered with a hard outside layer or skeleton.
- The body design involves very minimal differentiation and division into tissues.
- They are commonly called sponges, and are mainly found in marine habitats.



Porifera

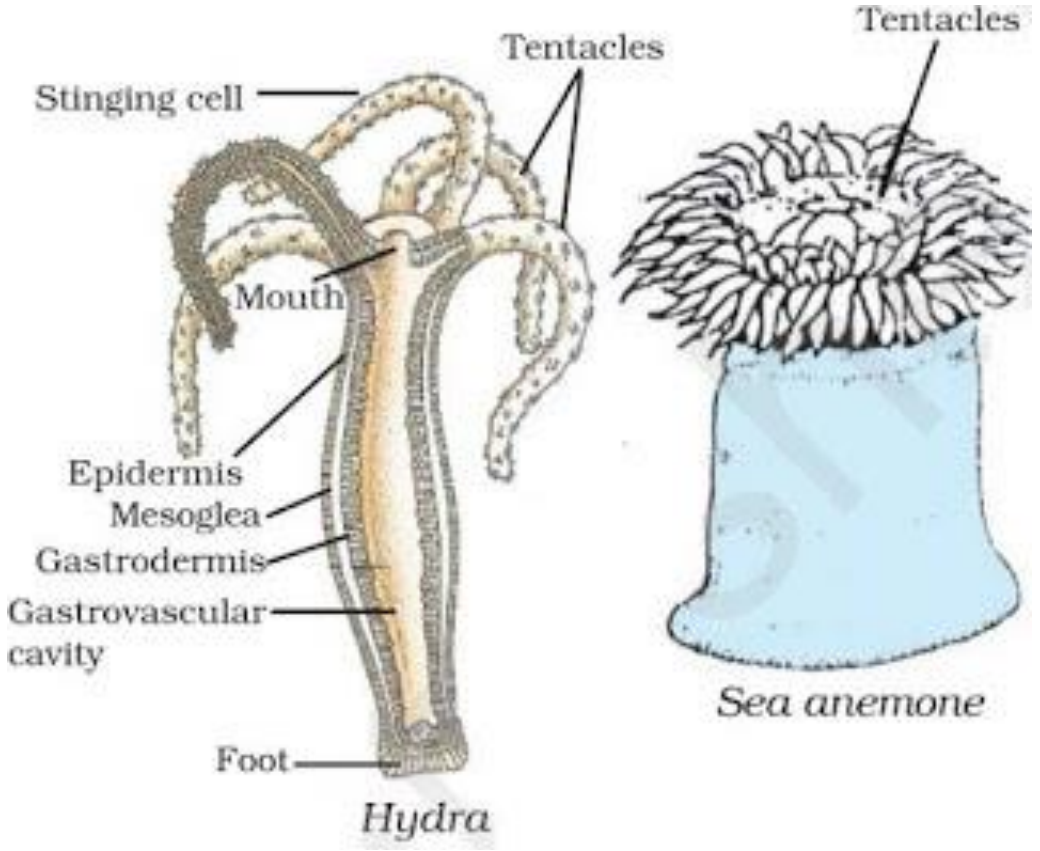
COELENTERATA (CNIDARIA)

- These are animals living in water.

- They show more body design differentiation. There is a cavity in the body.

- The body is made of two layers of cells: one makes up cells on the outside of the body, and the other makes the inner lining of the body.

- Some of these species live in colonies (corals), while others have a solitary like–span (Hydra). Jellyfish and sea anemones are common examples.



PLATYHELMINTHES

- The body of animals in this group is far more complexly designed than in the two other groups we have considered so far.

- The body is bilaterally symmetrical, meaning that the left and the right halves of the body have the same design.

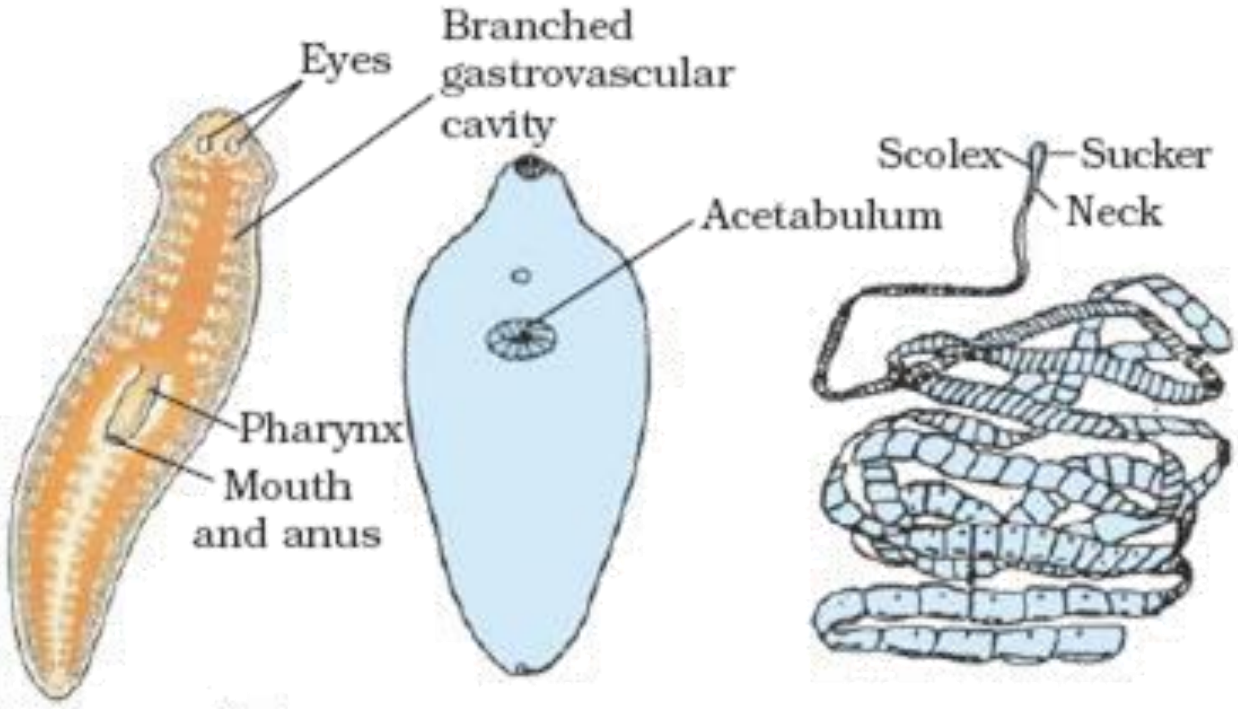
- There are three layers of cells from which differentiated tissues can be made, which is why such animals are called triploblastic.

- This allows outside and inside body linings as well as some organs to be made. There is thus some degree of tissue formation.

- However, there is no true internal body cavity or coelom, in which well developed organs can be accommodated.

- The body is flattened dorsoventrally (meaning from top to bottom), which is why these animals are called flatworms.

- They are either free-living or parasitic. Some examples are free-living animals like planarians, or parasitic animals like liver flukes.

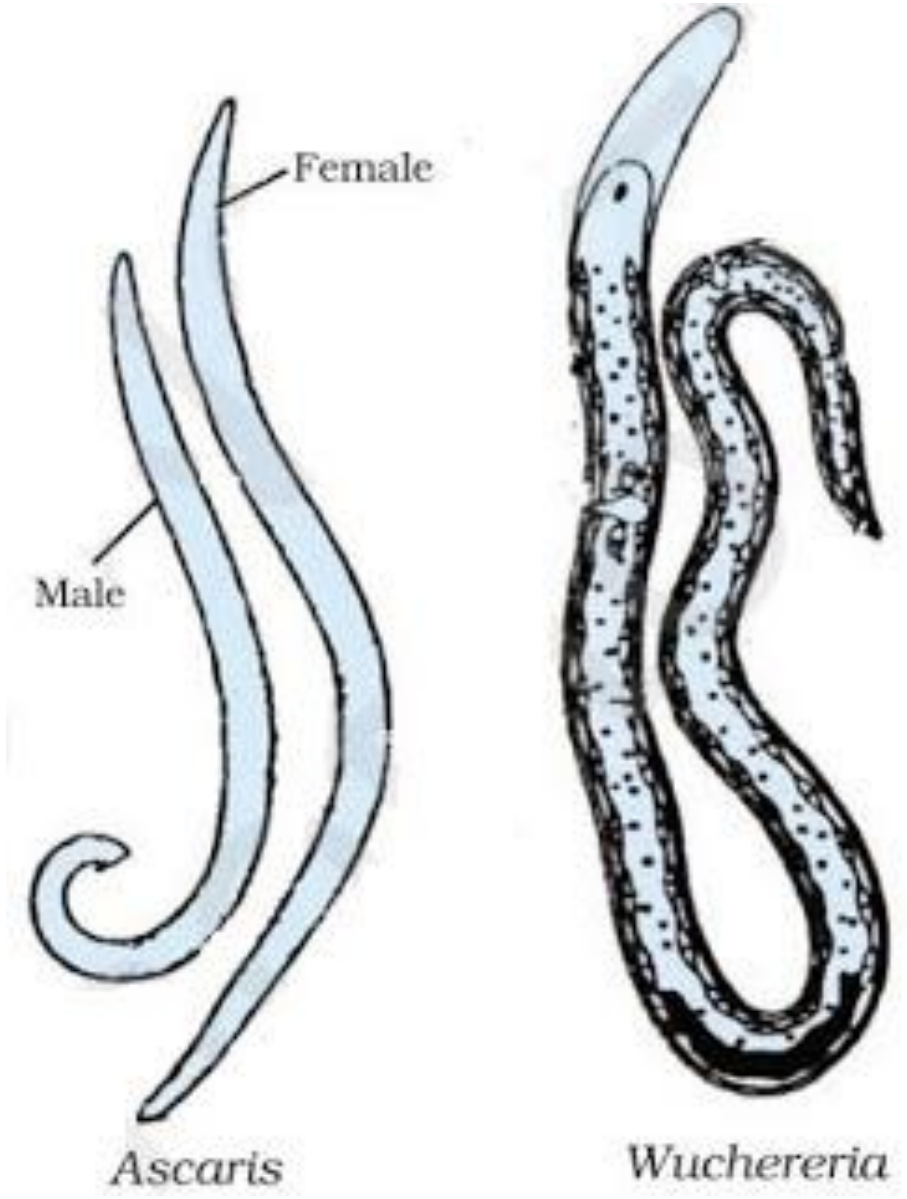


NEMATODA

- The nematode body is also bilaterally symmetrical and triploblastic. However, the body is cylindrical rather than flattened.

- There are tissues, but no real organs, although a sort of body cavity or a pseudocoelom, is present.

- These are very familiar as parasitic worms causing diseases, such as the worms causing elephantiasis (filarial worms) or the worms in the intestines (roundworm or pinworms).



ANNELIDA

- Annelid animals are also bilaterallym symmetrical and triploblastic, but in addition they have a true body cavity.

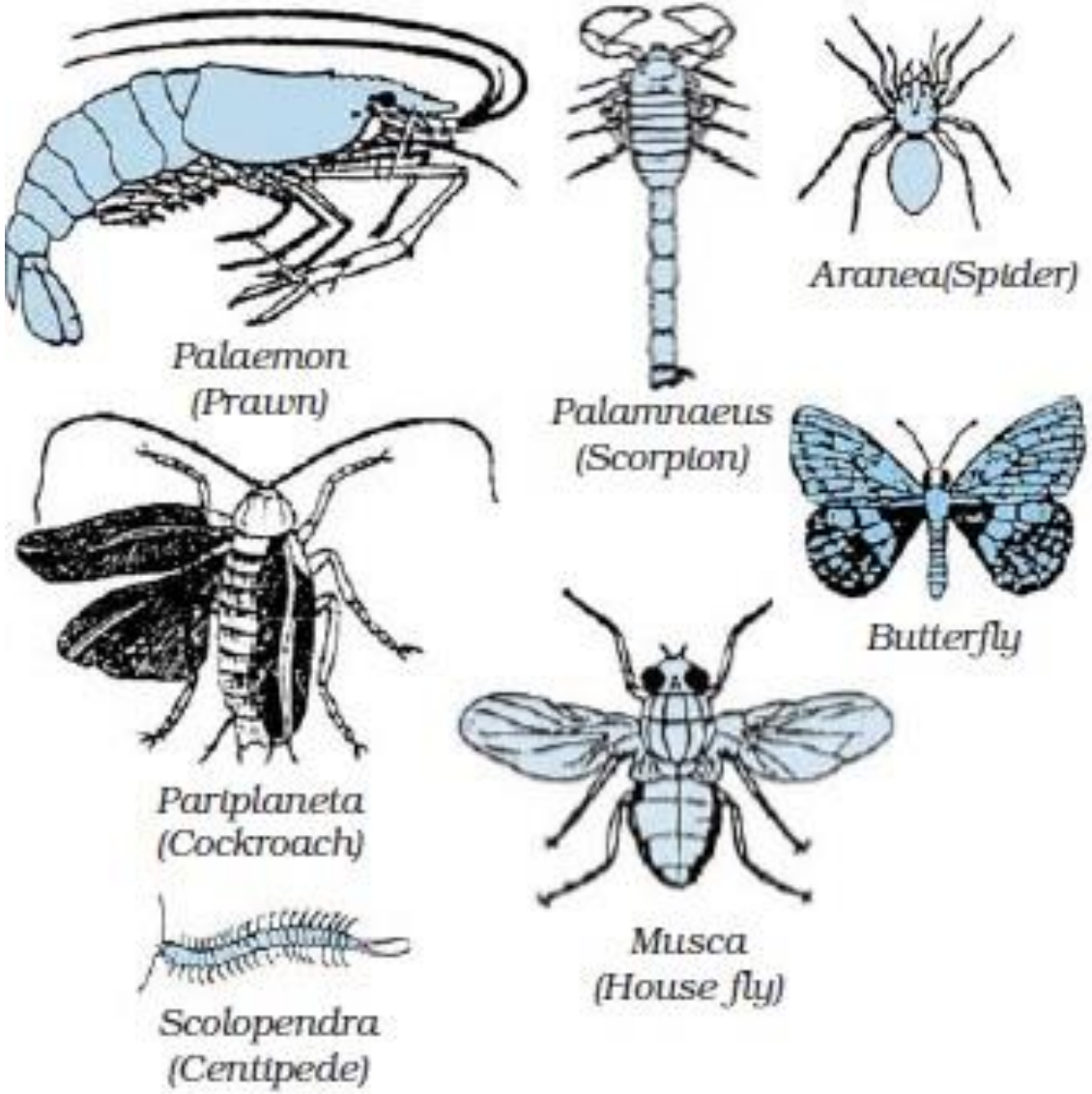
- This allows true organs to be packaged in the body structure. There is, thus, extensive organ differentiation.

- This differentiation occurs in a segmental fashion, with the segments lined up one after the other from head to tail.

- These animals are found in a variety of habitats– fresh water, marine water as well as land. Earthworms and leeches are familiar examples

ARTHROPODA

- This is probably the largest group of animals.
- These animals are bilaterally symmetrical and segmented.
- There is an open circulatory system, and so the blood does not flow in well defined blood vessels.
- The coelomic cavity is blood-filled. They have jointed legs (the word ‘arthropod’ means ‘jointed legs’).
- Some familiar examples are prawns, butterflies, houseflies, spiders, scorpions and crabs


Palaemon
(Prawn)
Palamnaeus
(Scorpion)
Aranea(Spider)
Butterfly
Periplaneta
(Cockroach)
Musca
(House fly)
Scolopendra
(Centipede)

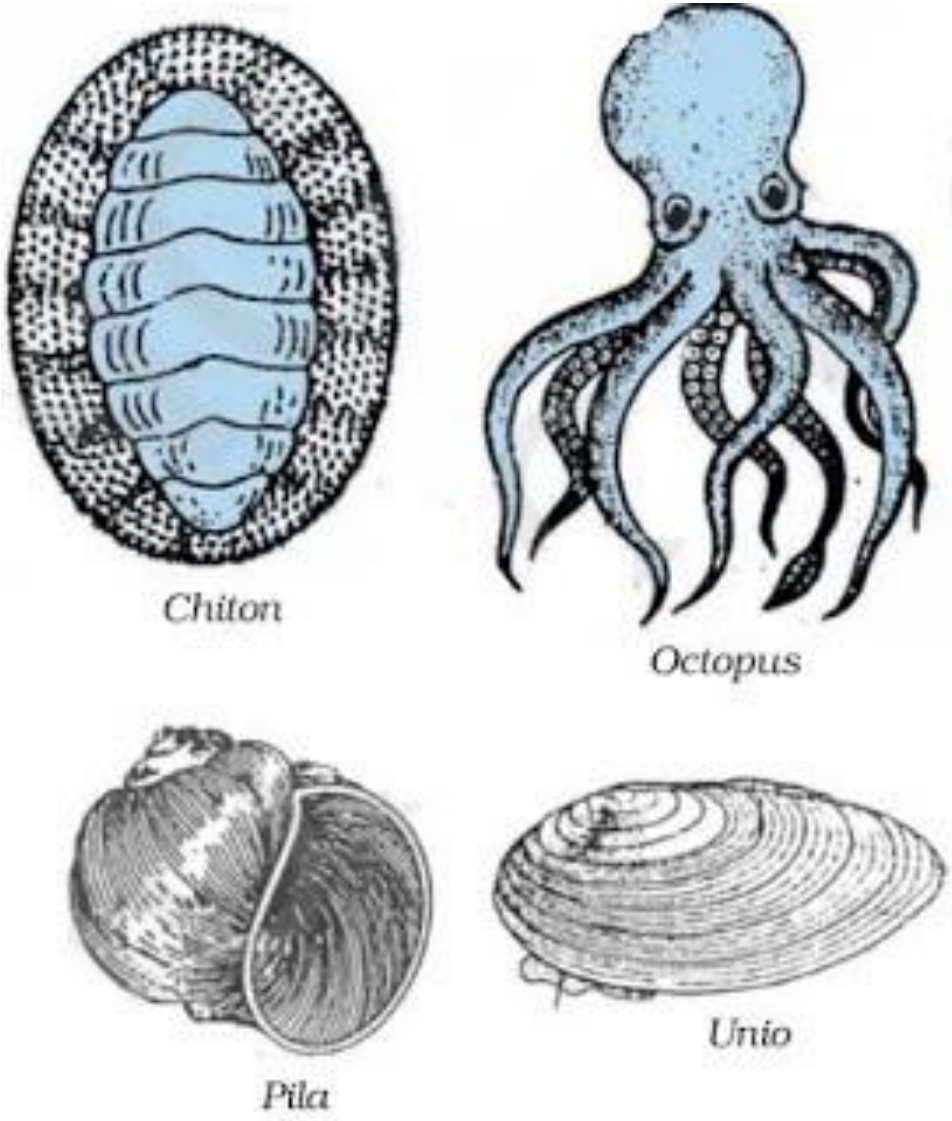
Arthropoda

MOLLUSCA

- In the animals of this group, there is bilateral symmetry. The coelomic cavity is reduced.

- There is little segmentation. They have an open circulatory system and kidney-like organs for excretion.

- There is a foot that is used for moving around.



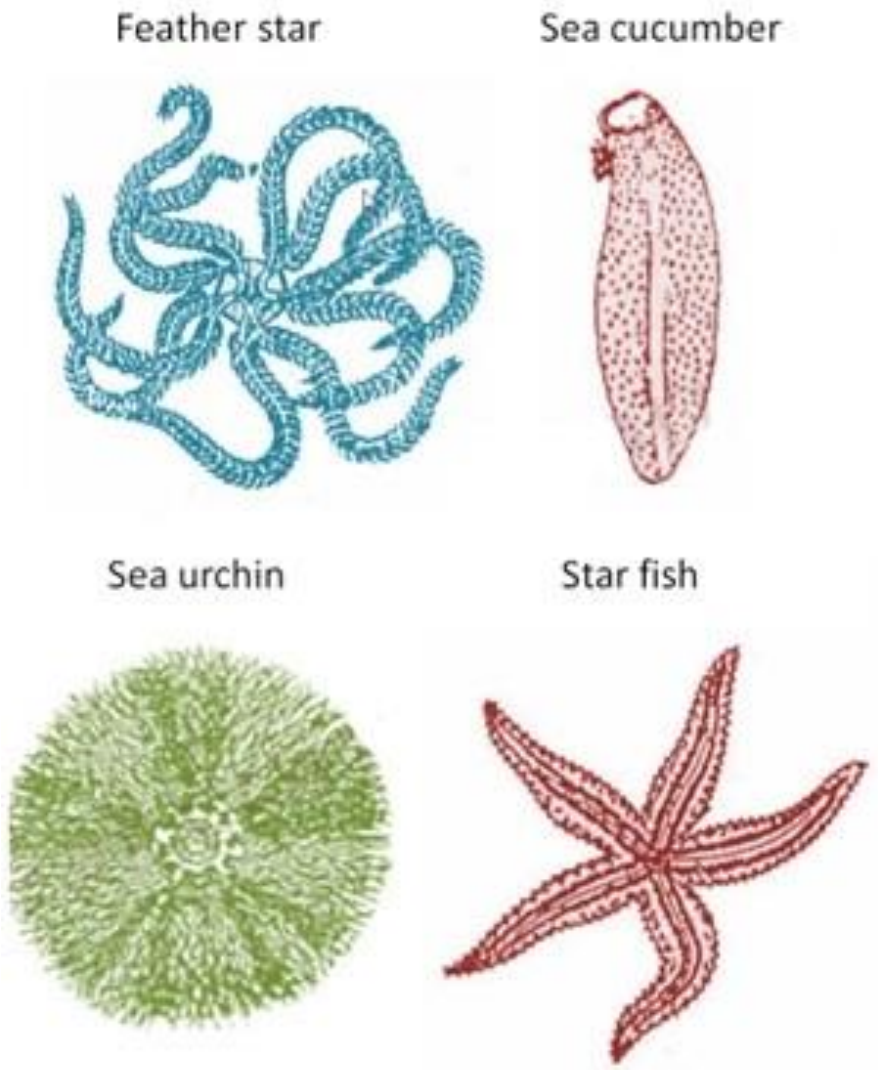
ECHINODERMATA

- In Greek, echinos means hedgehog (spiny mammal), and derma means skin. Thus, these are spiny skinned organisms.

- These are exclusively free-living marine animals.

- They are triploblastic and have a coelomic cavity. They also have a peculiar water-driven tube system that they use for moving around.

- They have hard calcium carbonate structures that they use as a skeleton. Examples are sea-stars and sea urchins



PROTOCHORDATA

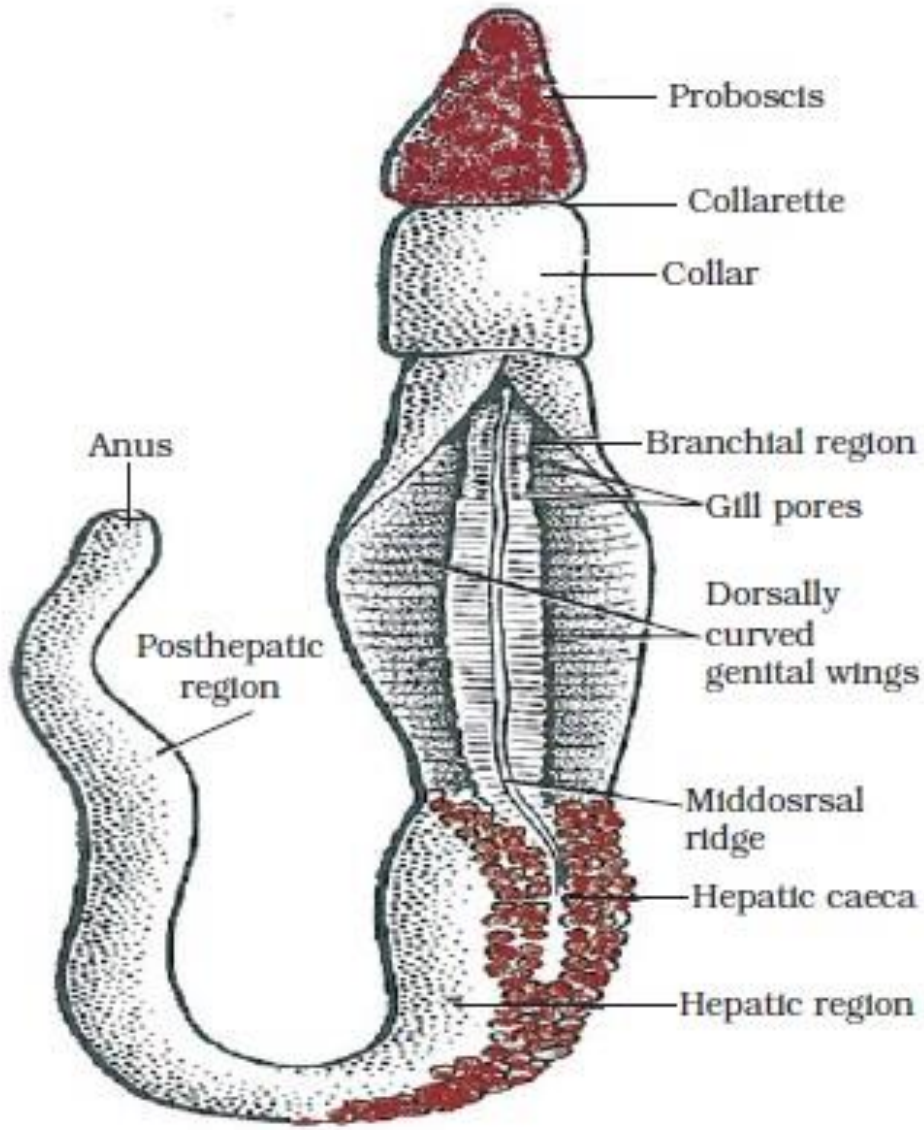
- These animals are bilaterally symmetrical, triploblastic and have a coelom.

- In addition, they show a new feature of body design, namely a notochord, at least at some stages during their lives.

- The notochord is a long rod-like support structure (chord=string) that runs along the back of the animal separating the nervous tissue from the gut.

- It provides a place for muscles to attach for ease of movement. Protochordates may not have a proper notochord present at all stages in their lives or for the entire length of the animal.

- Protochordates are marine animals. Examples are Balanoglossus, Herdmania and Amphioxus


Proboscis
Collarette
Collar
Branchial region
Gill pores
Dorsally
curved
genital wings
Anus
Posthepatic
region
Middosrsal
ridge
Hepatic caeca
Hepatic region

VERTEBRATA

These animals have a true vertebral column and internal skeleton, allowing a completely different distribution of muscle attachment points to be used for movement.

Vertebrates are bilaterally symmetrical, triploblastic, coelomic and segmented, with complex differentiation of body tissues and organs.

All chordates possess the following features:

(i) have a notochord

(ii) have a dorsal nerve cord

(iii) are triploblastic

(iv) have paired gill pouches

(v) are coelomate.

Vertebrates are grouped into six classes


Petromyzon
10 cm
4 inches

(i) CYCLOSTOMATA

- Cyclostomes are jawless vertebrates. They are characterised by having an elongated eel-like body, circular mouth, slimy skin and are scaleless.

- They are ectoparasites or borers of other vertebrates. Petromyzon (Lamprey) and Myxine (Hagfish) are examples.

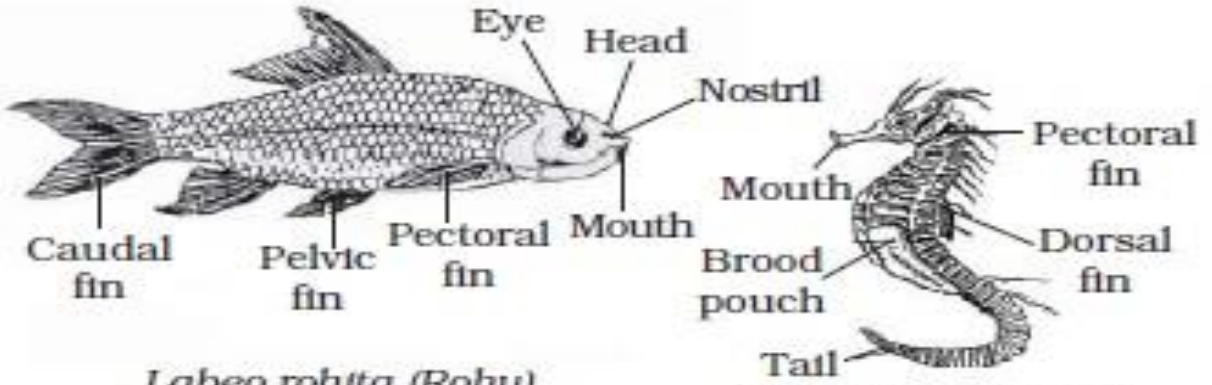
(ii) PISCES

- These are fish. They are exclusively aquatic animals. Their skin is covered with scales/ plates.

- They obtain oxygen dissolved in water by using gills. The body is streamlined, and a muscular tail is used for movement.

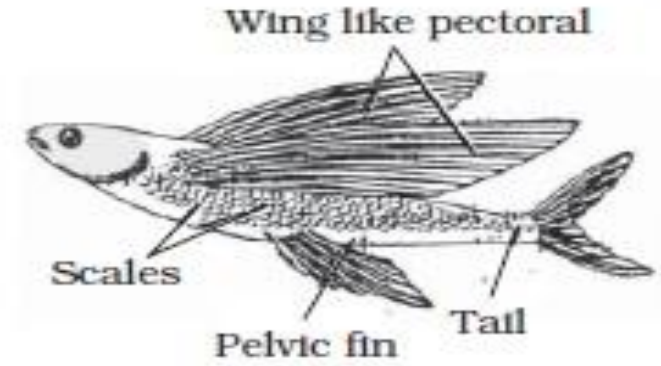
- They are cold-blooded and their hearts have only two chambers, unlike the four that humans have.

- They lay eggs. Many kinds of fish, some with skeletons made entirely of cartilage, such as sharks, and some with a skeleton made of both bone and cartilage, such as tuna or rohu

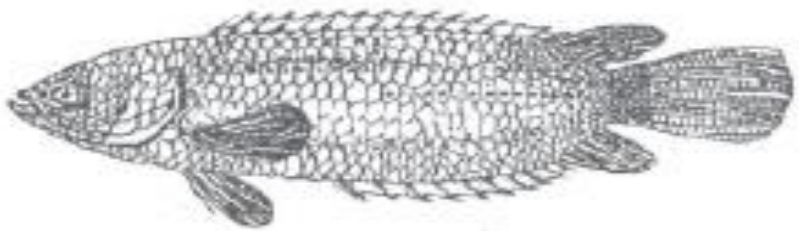


Labeo rohita (Rohu)

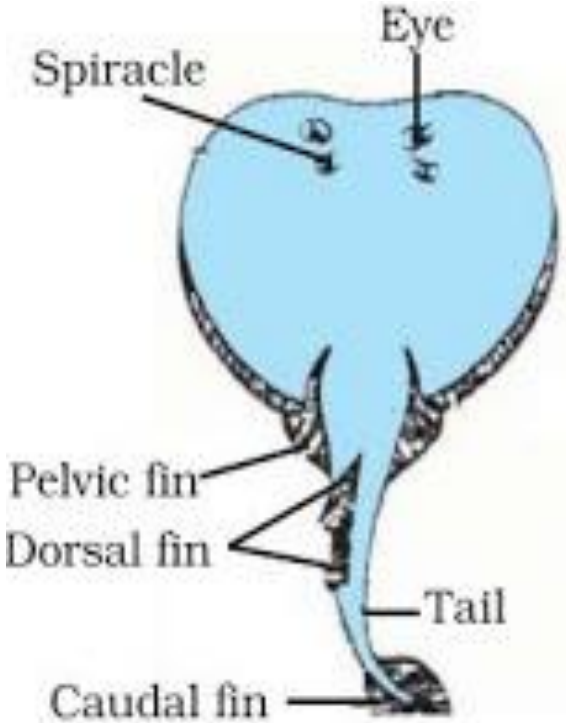
Male Hippocampus (Sea horse)



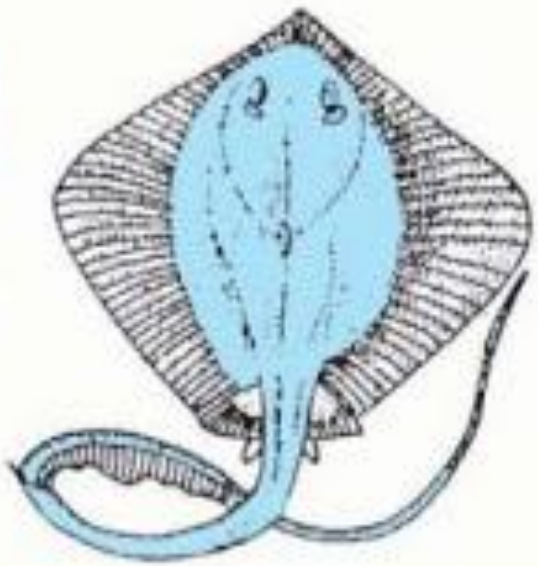
Exocoetus (Flying fish)



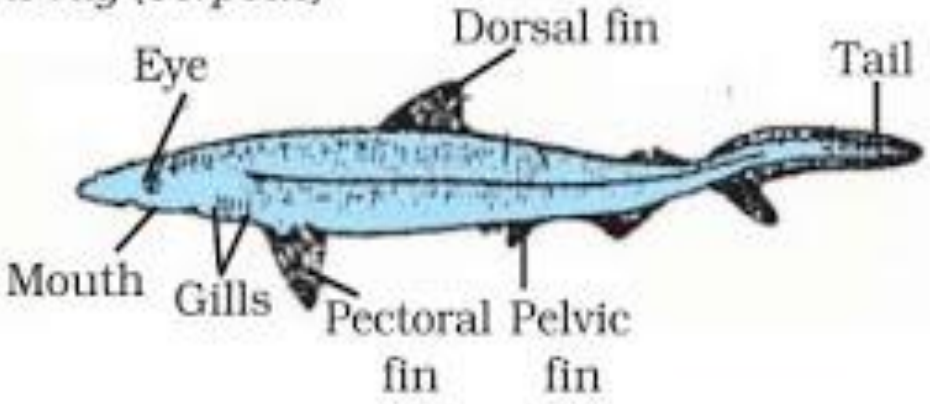
Anabas (Climbing perch)



Electric ray (Torpedo)



Sting ray



Scoliodon (Dog fish)

Pisces

(iii) AMPHIBIA

- These animals differ from the fish in the lack of scales, in having mucus glands in the skin, and a three-chambered heart.

- Respiration is through either gills or lungs.

- They lay eggs. These animals are found both in water and on land. Frogs, toads and salamanders are some examples

(iv) REPTILIA

- These animals are cold-blooded, have scales and breathe through lungs.

- While most of them have a three-chambered heart, crocodiles have four heart chambers.

- They lay eggs with tough coverings and do not need to lay their eggs in water, unlike amphibians. Snakes, turtles, lizards and crocodiles fall in this category

Reptiles (Class Reptilia)

Turtles, lizards, snakes, crocodiles, alligators

Water-tight skin is made out of **scales** – hard, overlapping layers of protein

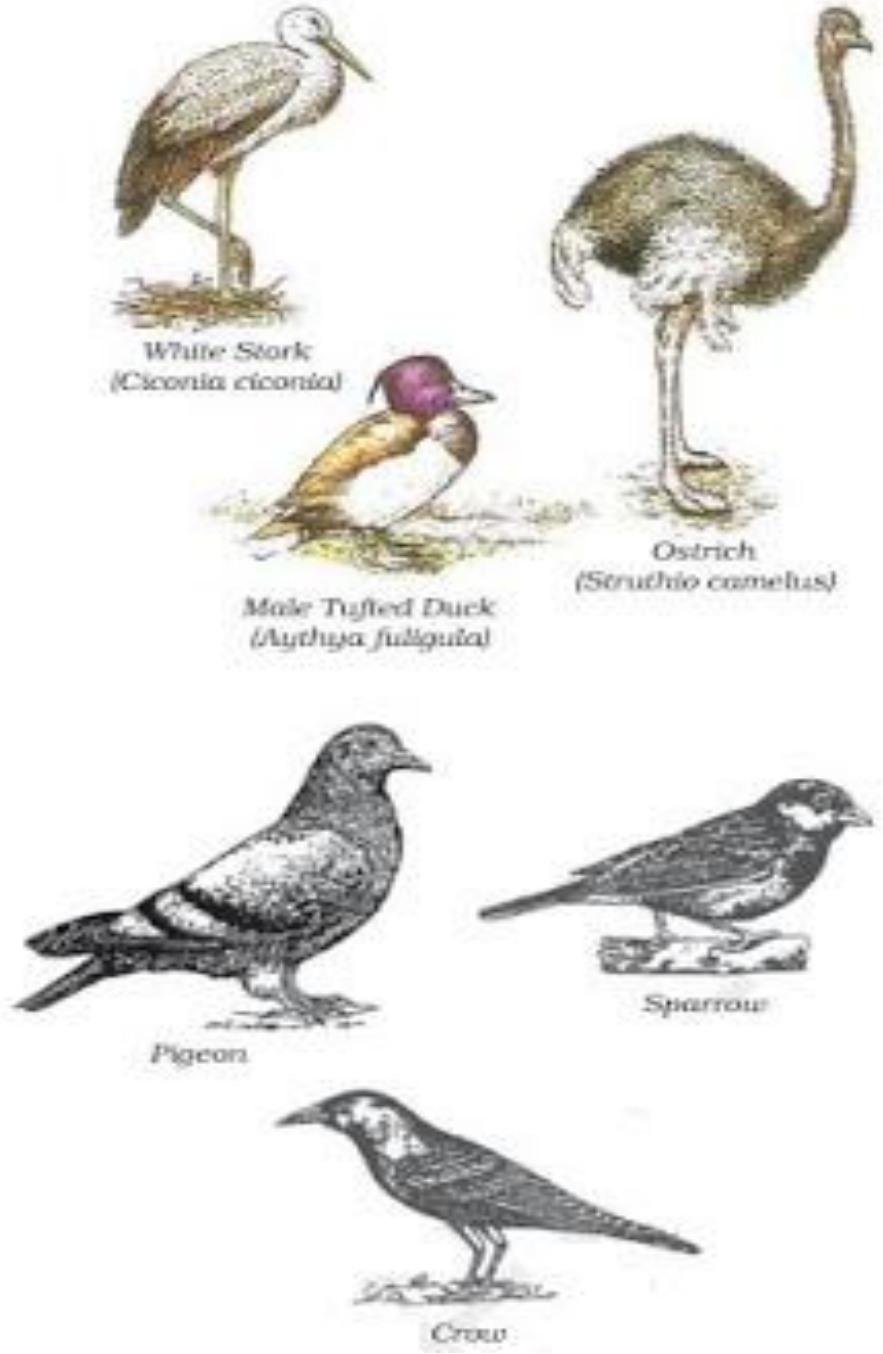
Scales cannot expand, so to grow bigger a reptile must molt

Most lay eggs, but some give birth to live young

(v) AVES

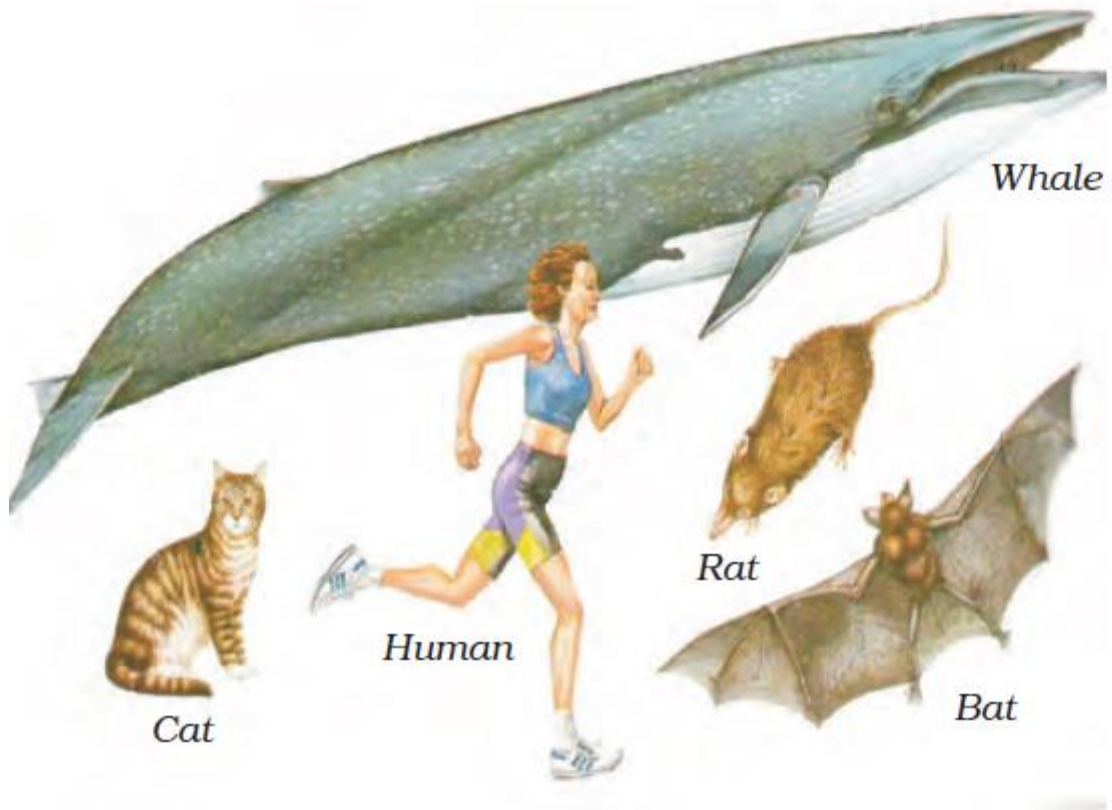
- These are warm-blooded animals and have a four-chambered heart.

- They lay eggs. There is an outside covering of feathers, and two forelimbs are modified for flight. They breathe through lungs.



Mammals

are warm-blooded animals with
four-chambered hearts.
They have mammary glands for the production of milk to nourish their young.
Their skin has hairs as well as sweat and oil glands.
Most mammals familiar to us produce live young ones.
However, a few of them, like the platypus and the echidna lay eggs, and some, like kangaroos give birthto very poorly developed young ones.


Whale
Rat
Human
Bat
Cat

Carl Linnaeus

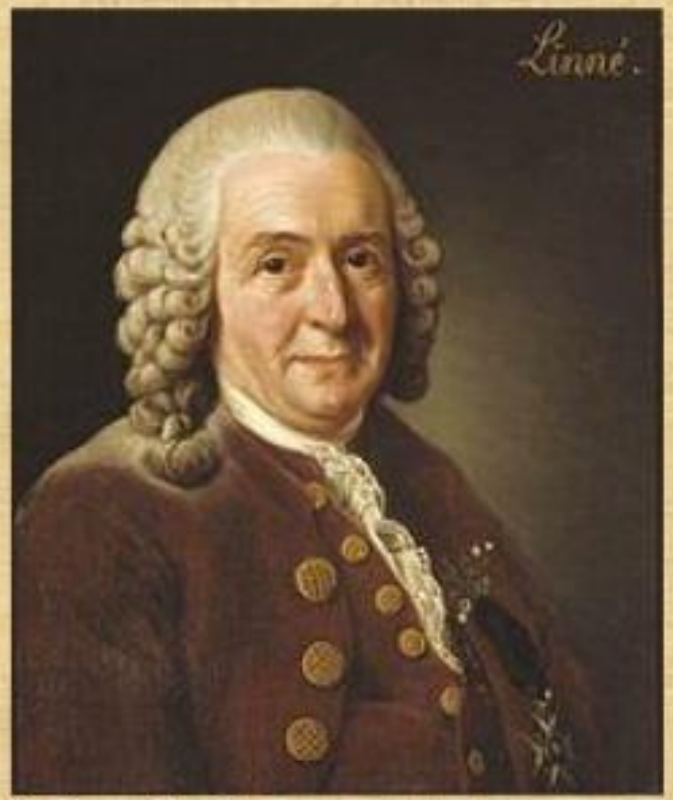
(Swedish naturalist, 1707-1778)

Start of modern taxonomy

- Nature organized as nested hierarchy of ranks
- Binary species names replaced phrase names
- Based plant classification on sexual characters

<u>Linnaean Ranks</u>

Kingdom
(Phylum)
Class
Order
Family
Genus
Species

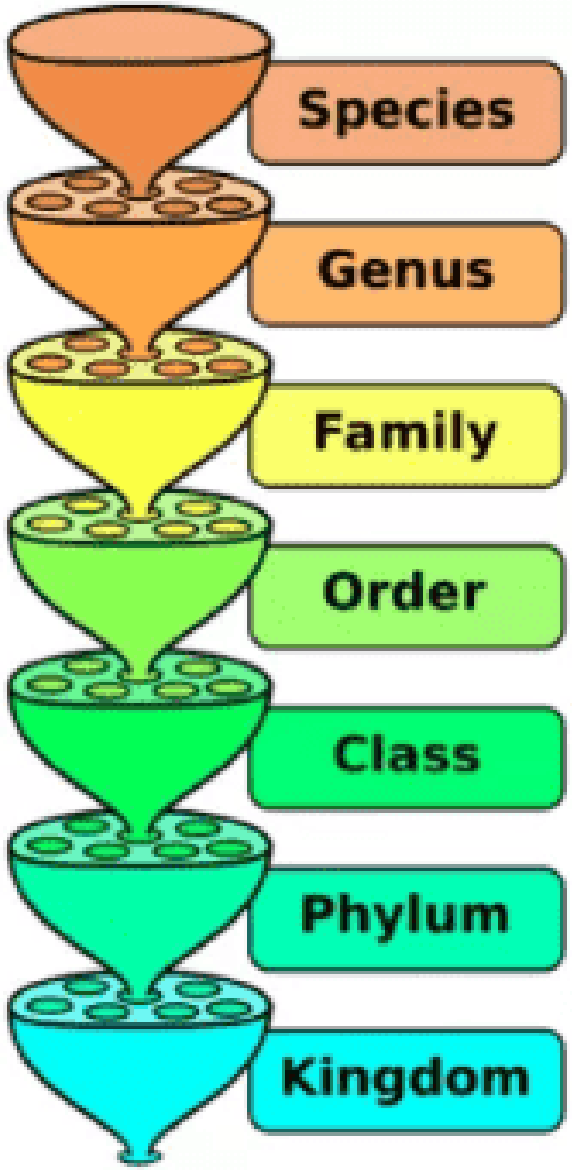


Carl von Linné
Alexander Roslin, 1775

Nomenclature

- The system of scientific naming or nomenclature we use today was introduced by Carolus Linnaeus in the eighteenth century.

- The scientific name of an organism is the result of the process of classification which puts it along with the organisms it is most related to.



Homo sapiens
Members of the genus Homo with a hightforehead and thin skull bones.

Homo
Hominids with upright posture and large brains.

Hominids
Primates with relatively flat faces and three-dimensional vision.

Primates
Mammals with collar bones and grasping fingers.

Mammals
Chordates with fur or hair and milk glands.

Chordates
Animals with a backbone.

Animals
Organisms able to move on their own.

THANKYOU....