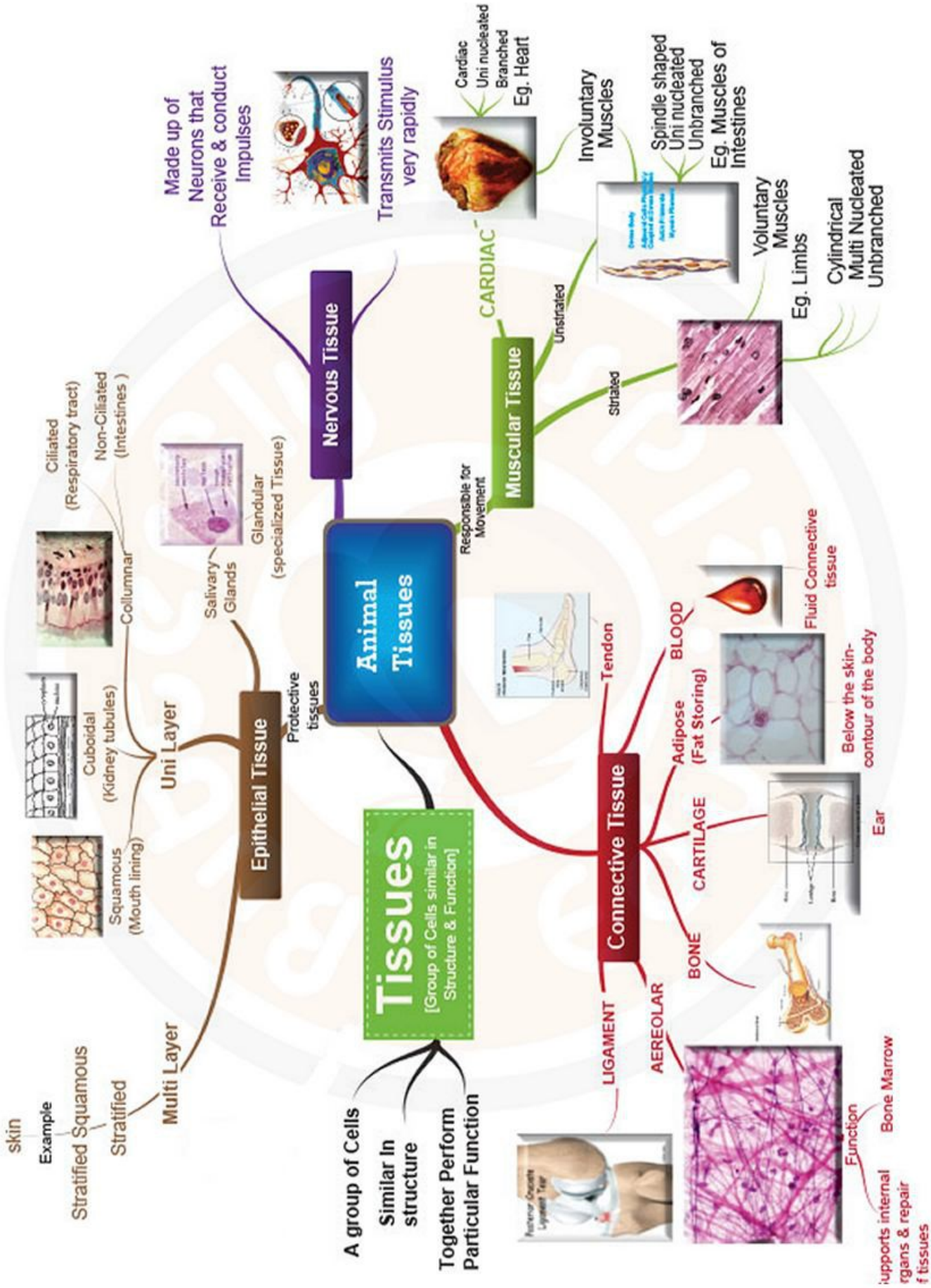
CLASSIFICATION OF ANIMAL TISSUE



CHAPTER – 7

DIVERSITY IN LIVING ORGANISMS

CLASSIFICATION

Biodiversity: The variety of living beings found in geographical area is called biodiversity of that area. Amazon rainforests is the largest biodiversity hotspot in the world.
Need for Classification: Classification is necessary for easier study of living beings. Without proper classification, it would be impossible to study millions of organisms which exist on this earth.

BASIS OF CLASSIFICATION

Ancient Greek thinker Aristotle classified living beings on the basis of their habitat. He classified them into two groups, i.e. those living in water and those living on land. But his classification was too simple to justify inclusion of a particular organism into a particular group.
Some examples of scientific bases of classification are as follows:
Organization of nucleus: Nucleus may or may not be organized in an organism. On this basis, organisms can be divided into two groups, viz. prokaryotes and eukaryotes.

(a) Prokaryotes:
When nucleus is not organized, i.e. nuclear materials are not membrane bound; the organism is called prokaryote.
(b) Eukaryotes:
When nucleus is organized, i.e. nuclear materials are membrane bound; the organism is called eukaryote.

Number of cells: An organism can be composed of a single cell or many cells. An organism with a single cell is called unicellular organism. On the other hand, an organism with more than one cell is called multicellular organism.

Mode of Nutrition

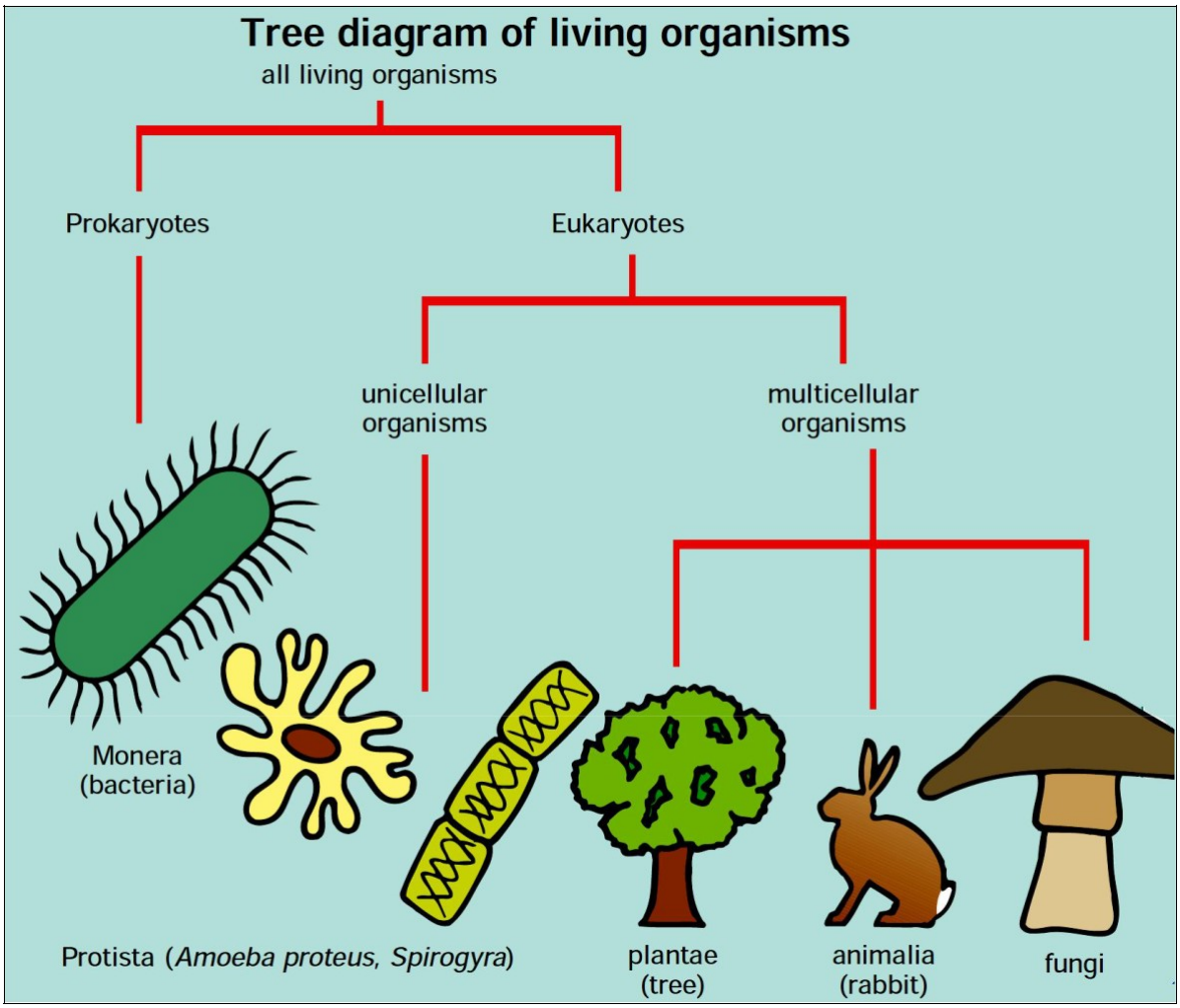
On this basis, organisms can be divided into two broad groups, i.e. autotrophs and its heterotrophs. An autotroph makes own food, while a heterotroph depends on other organisms for food.

Level of Organisation

Even in case of multicellular organisms, there can be different levels of organization. When a cell is responsible for all the life processes, it is called cellular level or organization. When some cells group together to perform specific function, it is called tissue level of organization. When tissues group together to form some organs, it is called organ level of organization. Similarly organ system level of organization is seen in complex organisms.

Classification and Evolution

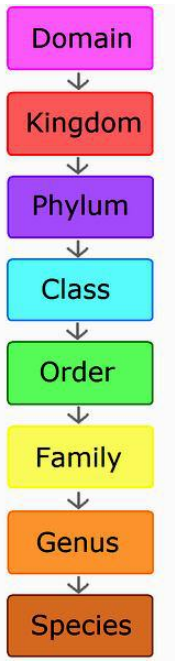
It is a well established fact that all the life forms have evolved from a common ancestor. Scientists have proved that the life begun on the earth in the form of simple life forms. During the course of time, complex organism evolved from them. So, classification is also based on evolution. A simple organism is considered to be primitive while a complex organism is considered to be advanced.



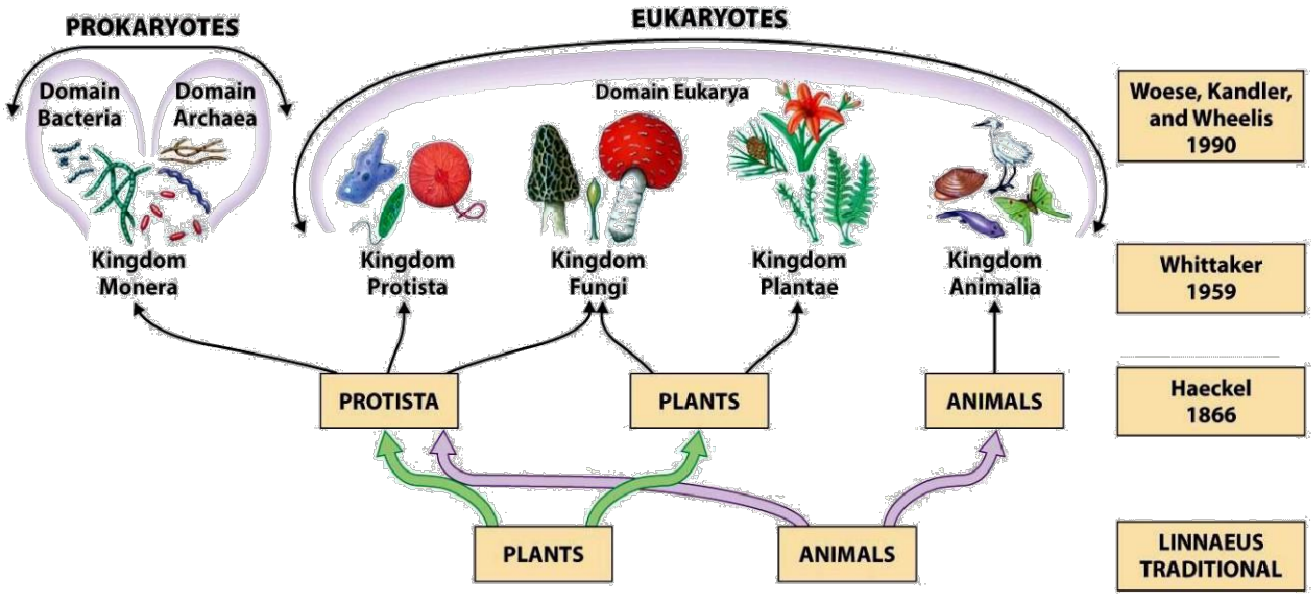
FIVE KINGDOM CLASSIFICATION BY ROBERT WHITTAKER (1959)

This is the most accepted system of classification.

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

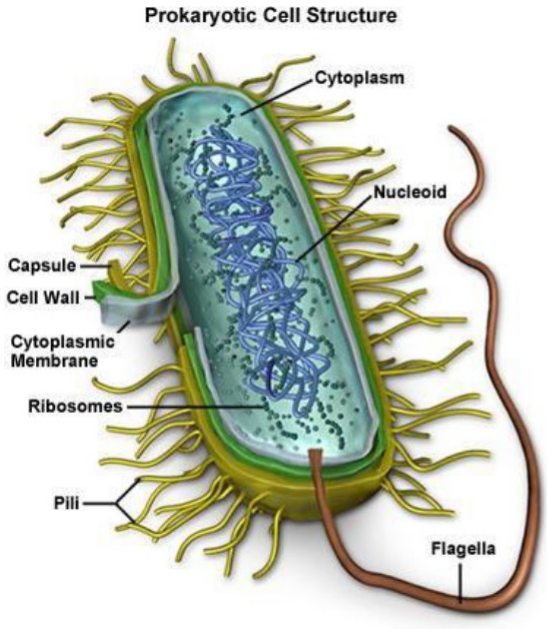


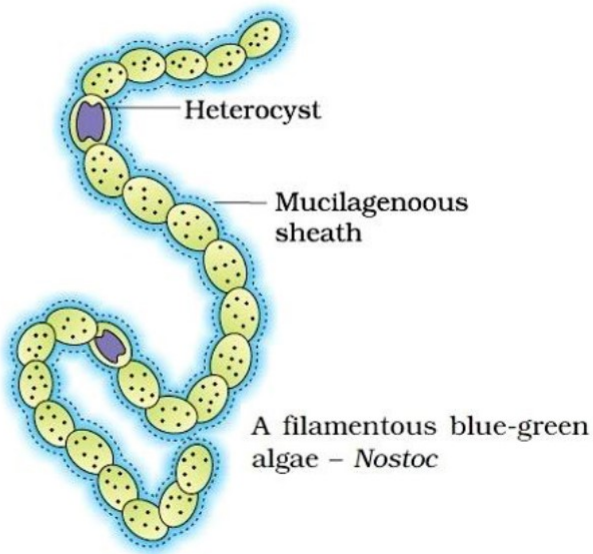
Thus, by separating organisms on the basis of a hierarchy of characteristics into smaller and smaller groups, we arrive at the basic unit of classification, which is a 'species'. The important characteristics of the five kingdoms of Whittaker are as follows:



1. MONERA

These are prokaryotes; which means nuclear materials are not membrane bound in them. They may or may not have cell wall.
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).
All organisms of this kingdom are unicellular. Examples: bacteria, blue green algae (cyanobacteria) and mycoplasma.





2. PROTISTA

These are eukaryotes and unicellular. Some organisms use cilia or flagella for locomotion.
They can be autotrophic or heterotrophic. Examples: unicellular algae, diatoms and protozoans.

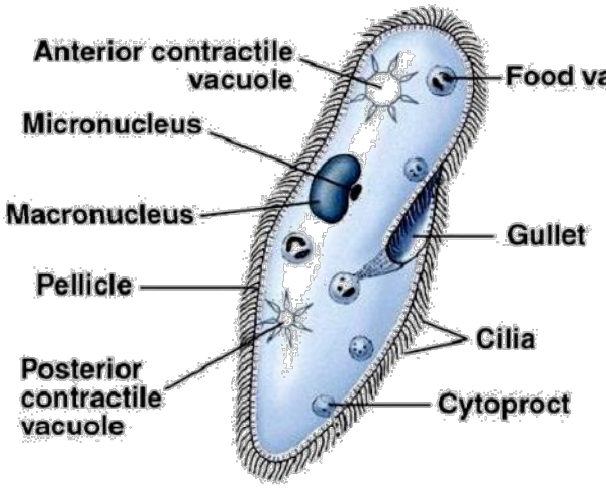
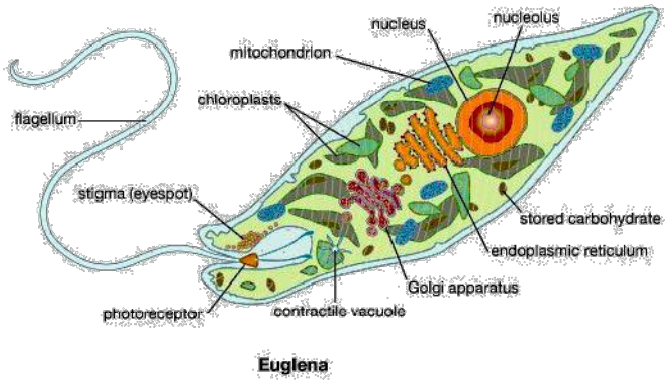


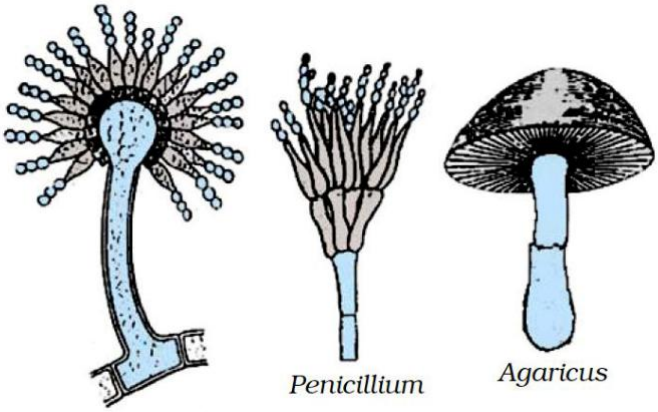
Fig. Paramecium



Euglena

3. FUNGI

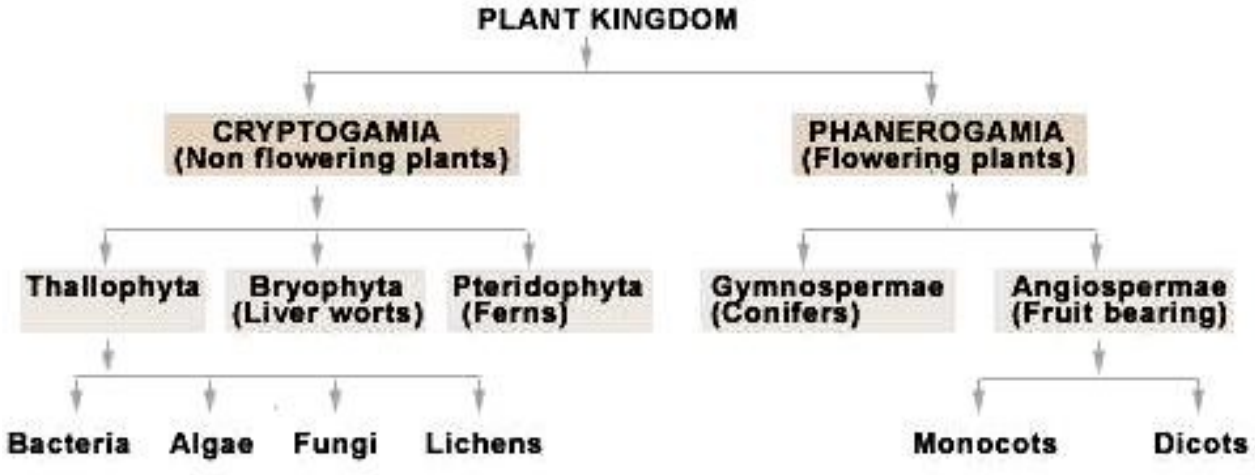
These are heterotrohic and have cell wall. The cell wall is made of chitin. Most of the fungi are unicellular. Many of them have the capacity to become multicellular at certain stage in life. They feed on decaying organic materials. Such a mode of nutrition is called saprophytic. Some fungi live in symbiotic relationship with other organisms, while some are parasites as well. Examples: yeast, penicillum, aspergillus, mucor, etc.



Aspergillus *Penicillium* *Agaricus*

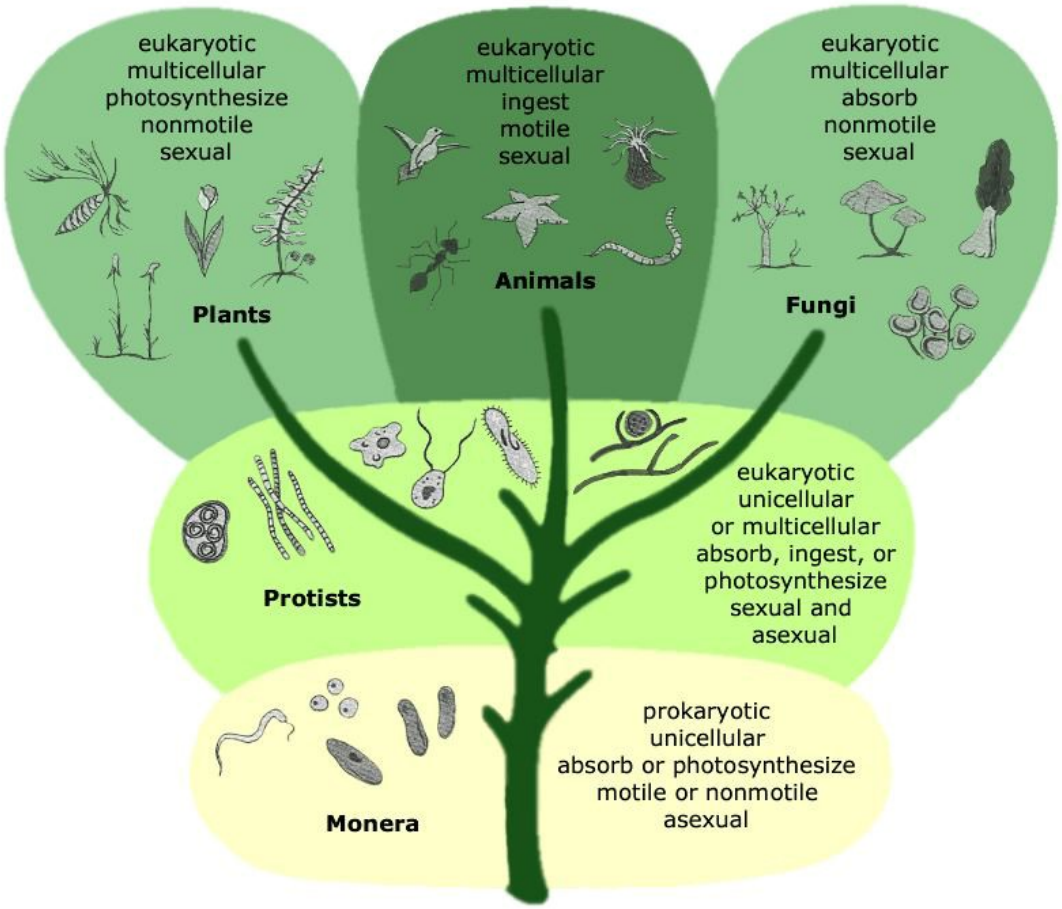
4. PLANTAE

These are multicellular and autotrophs. Presence of chlorophyll is a distinct characteristic of plants, because of which they are capable of doing photosynthesis. Cell wall is present.



5. ANIMALIA

These are multicellular and heterotophs. Cell wall is absent.



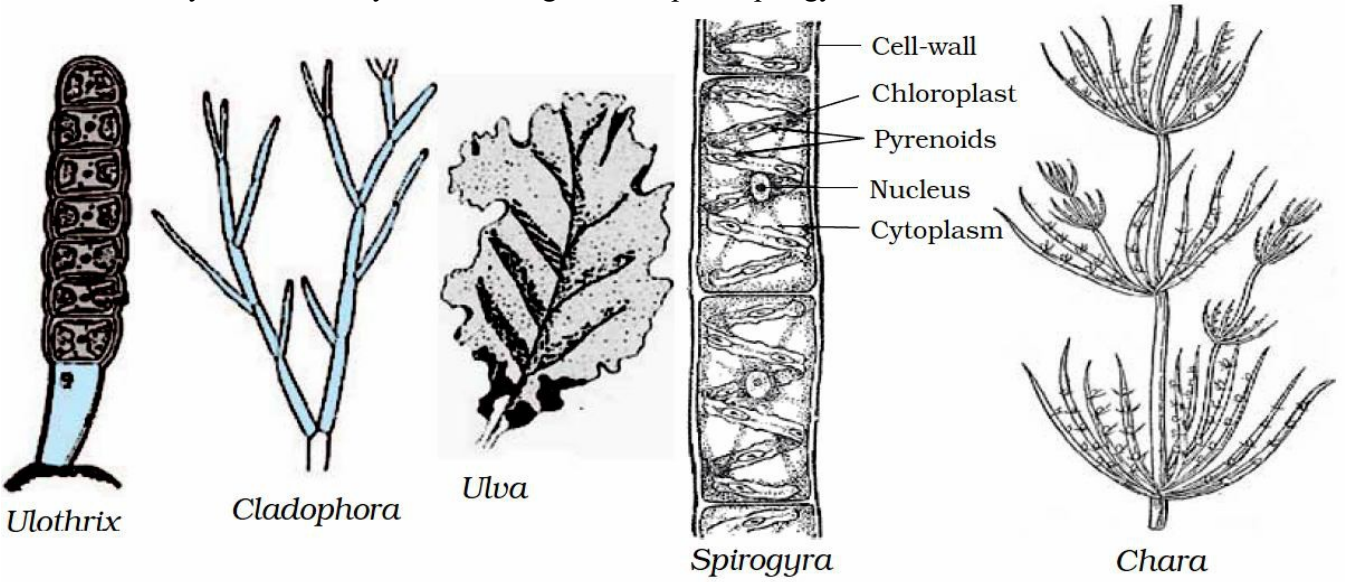
The Five-kingdom System of Classification

PLANTAE (PLANT KINGDOM)

The Plant Kingdom can be further classified into five divisions. Their key characteristics are given below:

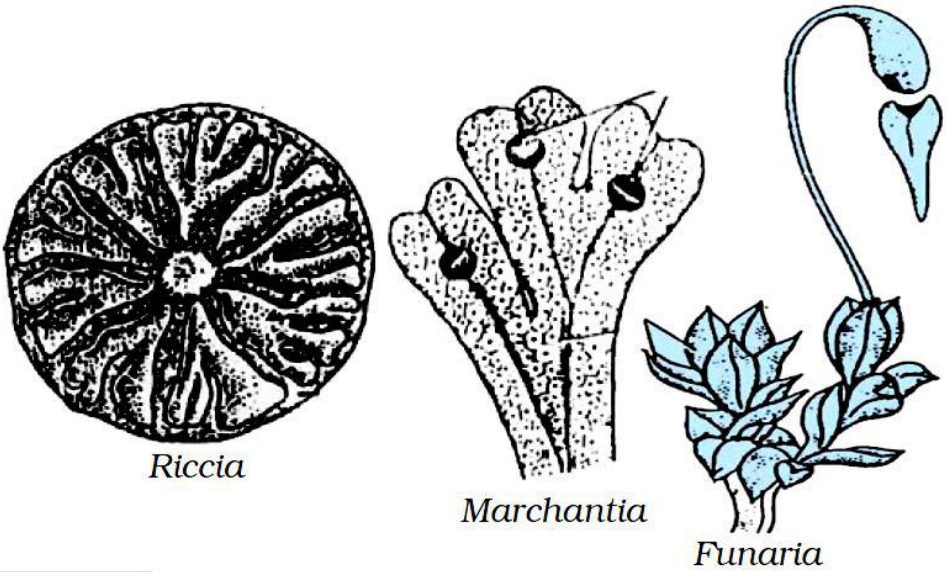
1. THALLOPHYTA

The plant body is simple thallus type. The plant body is not differentiated into root, stem and leaves. They are commonly known as algae. Examples: Spirogyra, chara, volvox, ulothrix, etc.



2. BRYOPHYTA

Plant body is differentiated into stem and leaf like structure. Vascular system is absent, which means there is no specialized tissue for transportation of water, minerals and food. Bryophytes are also known as the amphibians of the plant kingdom, because they need water to complete a part of their life cycle. Examples: Moss, marchantia.



3. PTERIDOPHYTA

Plant body is differentiated into root, stem and leaf. Vascular system is present. They do not bear seeds and hence are called cryptogams. Plants of rest of the divisions bear seeds and hence are called phanerogams. Examples: Marsilear, ferns, horse tails, etc.

The **primary root** is **short-lived** and is soon replaced by **adventitious roots**

Stem may be aerial or underground.

The **leaves** may be scaly *(Equisetum),*
simple and sessile *(Lycopodium)*
or large and pinnately compound *(Ferns).*

The leaves in pteridophyta are small**(microphylls)** as in *Selaginella* or large**(macrophylls)** as in *Ferns.*

In pteridophytes, the xylem consists of only **tracheids** and phloem consists of **sieve cells** only.
Secondary growth is not seen in Pteridophytes dueto **absence of cambium.**

4. GYMNOSPERMS

They bear seeds. Seeds are naked, i.e. are not covered. The word ‘gymnos’ means naked and ‘sperma’ means seed. They are perennial plants. Examples: Pine, cycas, deodar, etc.

The plant body i.e. sporophyte is differentiated into root, stem and leaves

ROOTS :
Specialized ***Coralloid roots of Cycas*** show association with N_2-*fixing blue-green algae* and
Pinus show association with ***endophytic fungi called mycorrhizae***

STEM :
The gymnospermic **stem** is mostly erect, aerial, solid and cylindrical.
In *Cycas*, it is *unbranched*, while in *Pinus, Cedrus and conifers* it is *branched*

LEAVES :
The **leaves** are dimorphic.
The **foliage leaves** are simple, needle like or pinnately compound
Scale leaves are small, membranous and brown.

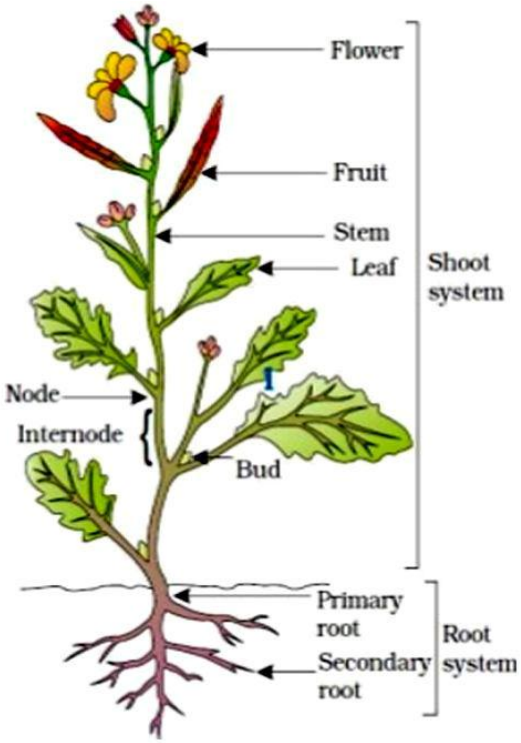
5. ANGIOSPERMS

The seeds are covered. The word 'angios' means covered. There is great diversity in species of angiosperm. Angiosperms are also known as flowering plants, because flower is a specialized organ meant for reproduction. Angiosperms are further divided into two groups, viz. monocotyledonous and dicotyledonous.

Most advanced division of the flowering plants

Highly evolved plants, primarily adapted to terrestrial habitat.
Wolffia is the **smallest** angiosperm, I mm in size and *Eucalyptus* grows to over 100 meters.

The plant body is differentiated into **root, stem** and **leaves.**
It has **flowers, fruits** and **seeds.**
Vascular tissues are well developed.
Xylem shows **vessels or tracheae** while phloem has **sieve tubes and companion cells.**

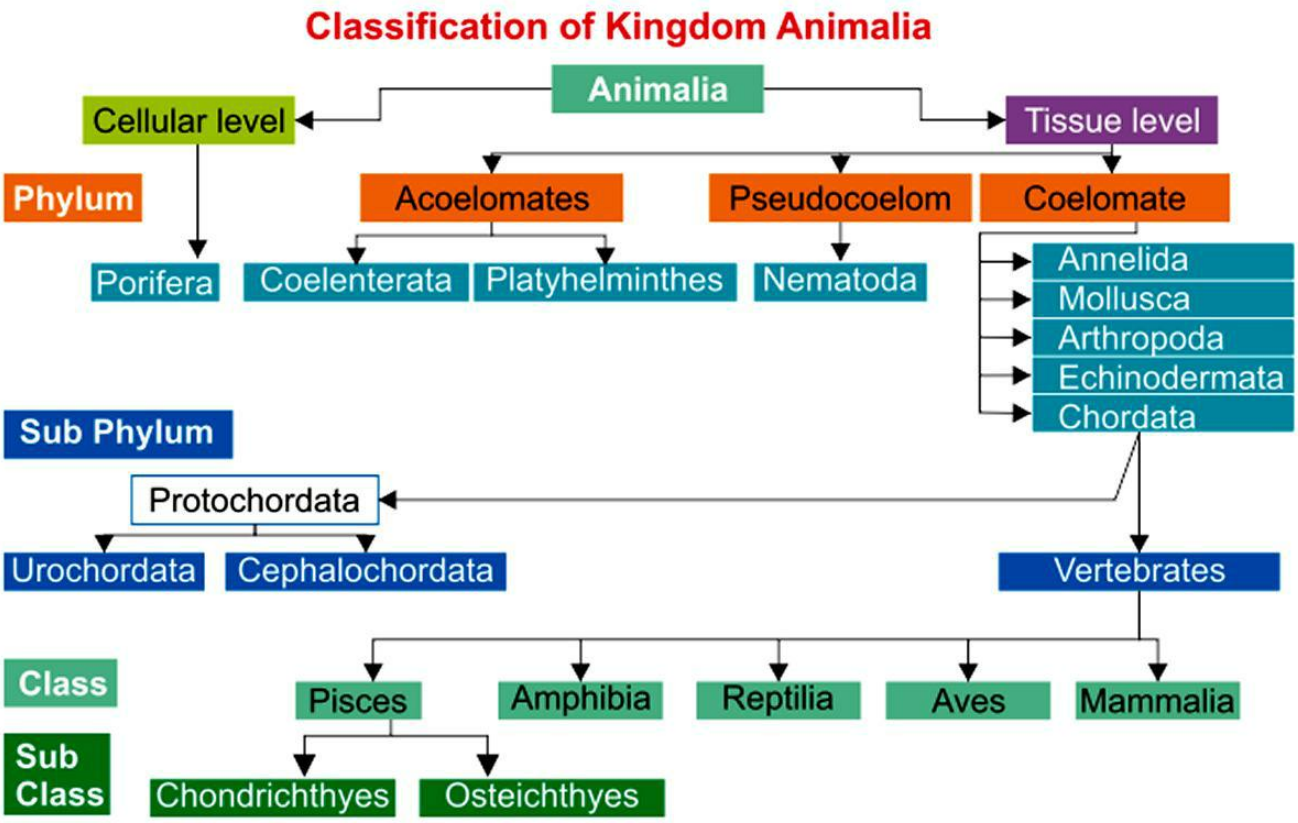


(a) Monocotyledonous
There is single seed leaf in a seed. A seed leaf is a baby plant. Examples: wheat, rice, maize, etc.

(b) Dicotyledonous
There are two cotyledons in a seed. Examples: Mustard, gram, mango, etc.

KINGDOM ANIMALIA

The animal kingdom is classified into different phyla. Their detail is given below:



1. PORIFERA

These animals have pores all over their body. The pores lead into the canal system. Water flows through the canal system and facilitates entry of food and exchange of other materials. The animal is not differentiated into tissues. The body is covered with a hard outer skeleton. These are commonly known as sponges. They are marine animals. Examples: Sycon, spongilla, euplectelea, etc.

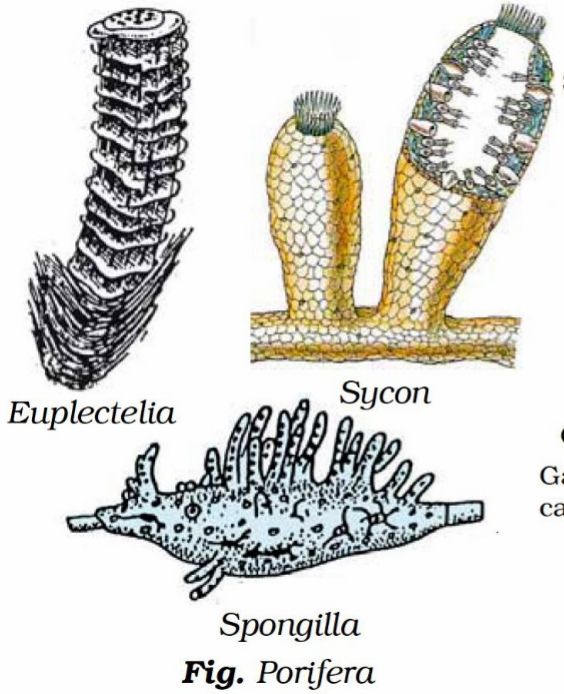


Fig. *Porifera*

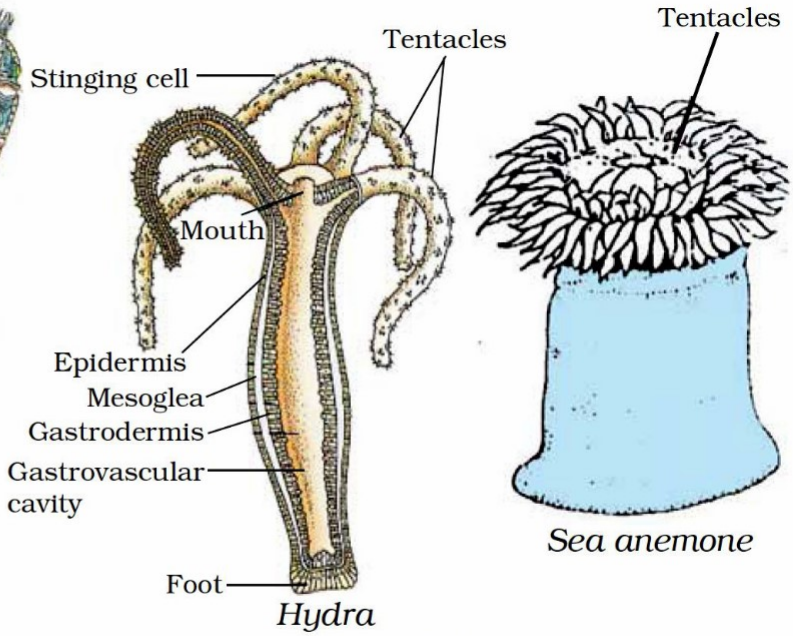


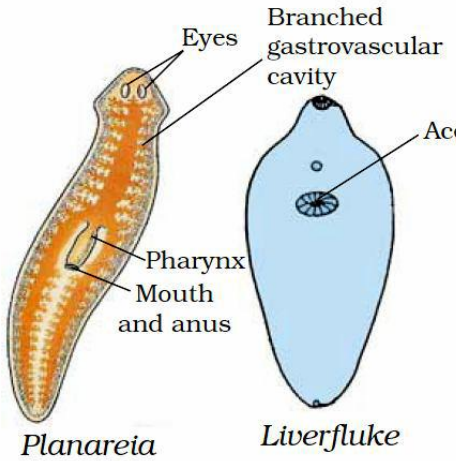
Fig. *Coelenterata*

2. COELENTERATA

The body is made up of a coelom (cavity) with a single opening. The body wall is made up of two layers of cells (diploblastic). Some of the species live a solitary life while others live in colonies. Examples: Hydra, Jelly fish, Sea anemone, etc.

3. PLATYHELMINTHES

The body is flattened from top to bottom and hence the name platyhelminthes. These are commonly known as flatworms. The body wall is composed of three layers of cells (triploblastic). Because of three layers, it is possible to form some organs as well. But a proper ceolom is absent in platyhelminthes and hence proper organs are absent. They are free-living or parasitic animals. Examples: Planaria, liver fluke, tapeworm, etc.



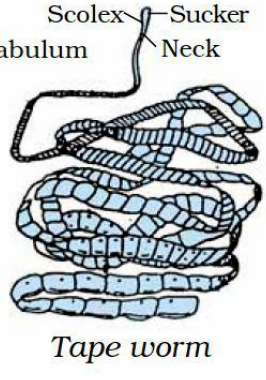


Fig. *Platyhelminthes*

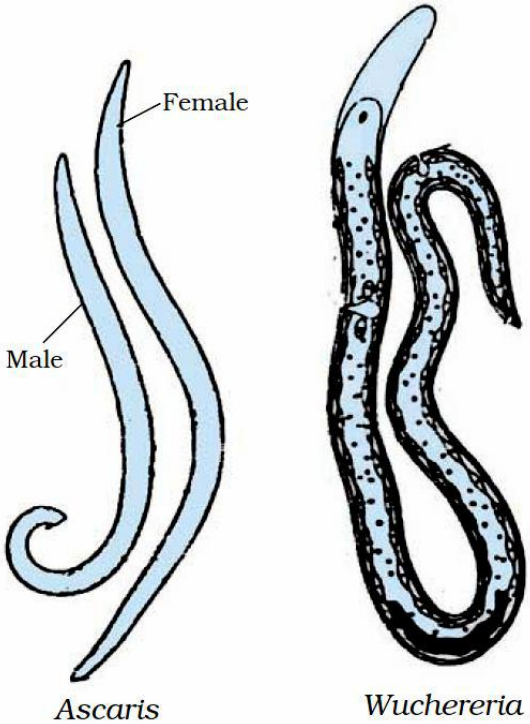
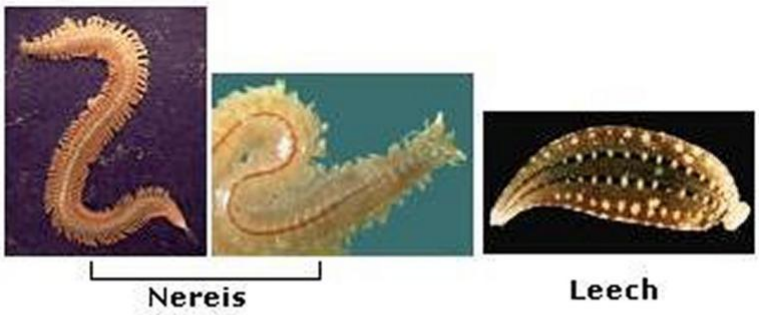


Fig. *Nematodes (Aschelminthes)*

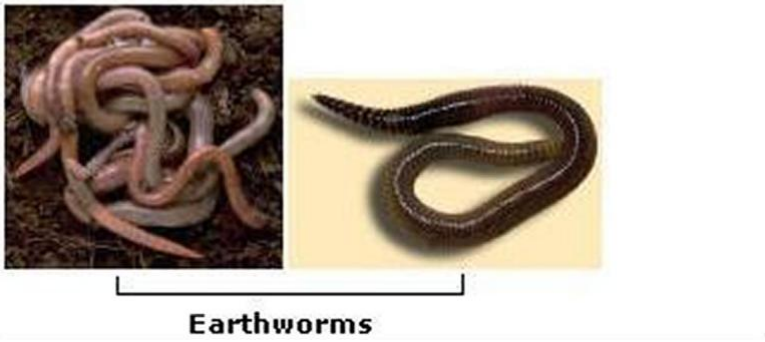
4. NEMATOHELMINTHES

The body is bilaterally symmetric and there are three layers in the body wall. Animals are cylindrical in shape. A pseudocoelom is present and hence organs are absent. Examples: Roundworms, pinworms, filarial parasite (Wuchereria), etc.



5. ANNELIDA

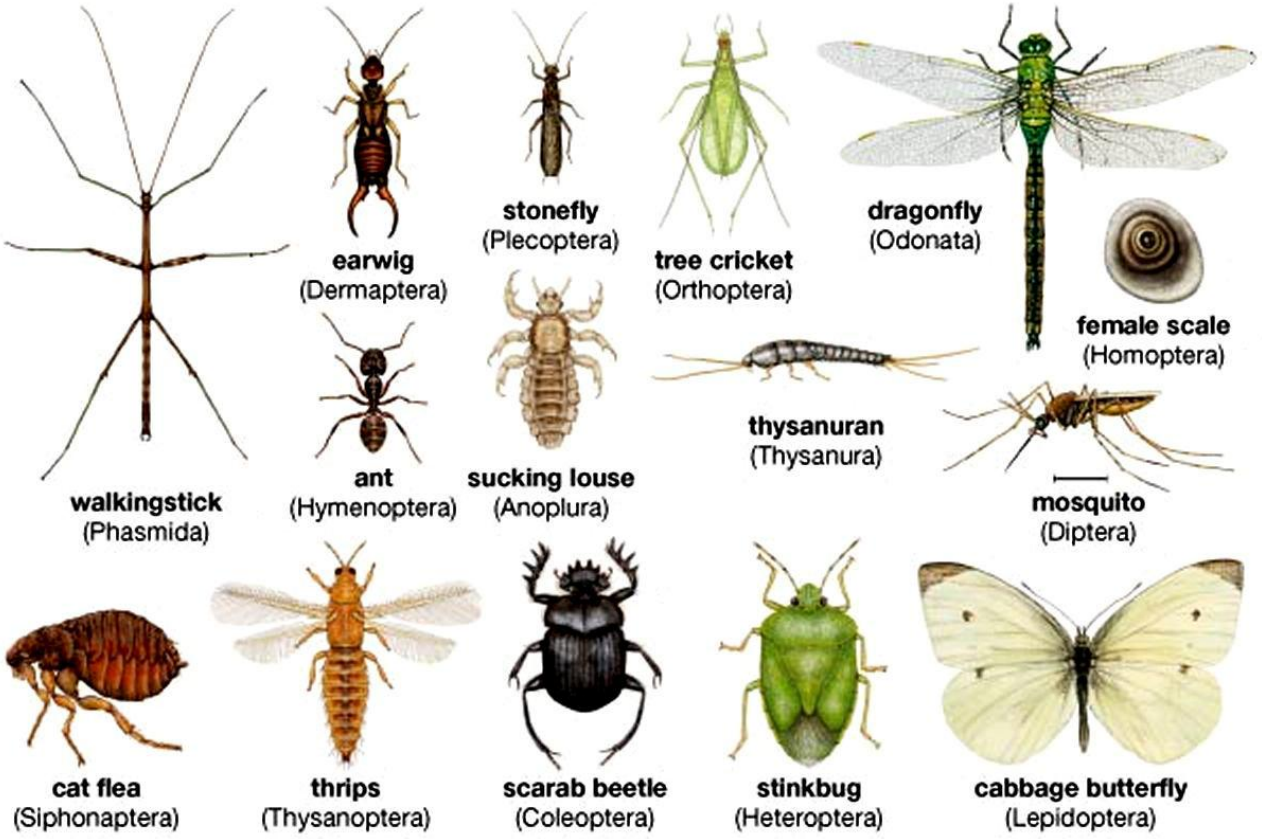
True body cavity is present in these animals. The body is divided into segments and hence the name annelida. Each segment is lined one after another and contains a set of organs. Examples: Earthworm, leech, Nereis, etc.



6. ARTHROPODA

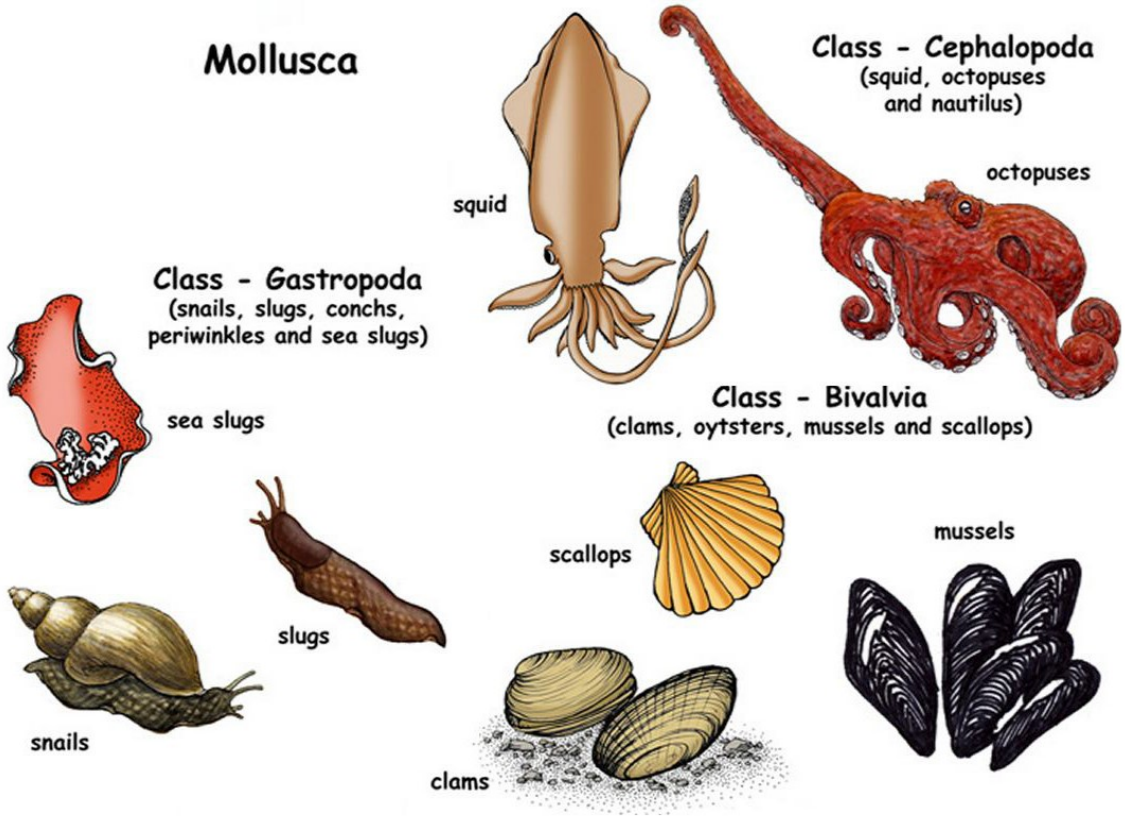
Animals have jointed appendages which gives the name arthropoda. Exoskeleton is present which is made of chitin. This is the

largest group of animals; in terms of number of species. Circulatory system is open, which means blood flows in the coelomic cavity. Examples: cockroach, housefly, spider, prawn, scorpion, etc.



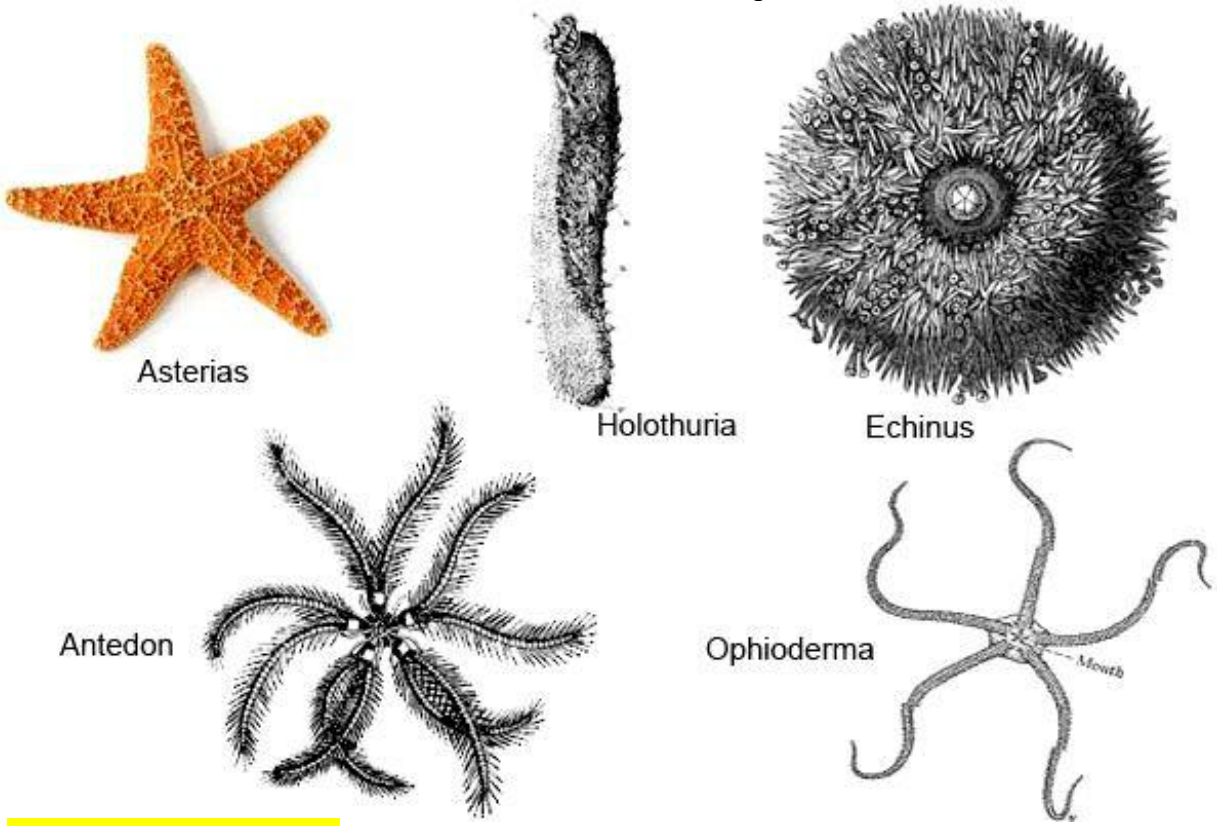
7. MOLLUSCA

The animal has soft body; which is enclosed in a hard shell. The shell is made of calcium carbonate. Circulatory system is open and kidney like organ is present for excretion. The body has well developed muscular feet for locomotion. Examples: Snail, mussels, octopus, etc.



8. ECHINODERMATA

The body is covered with spines, which gives the name echinodermata. Body is radially symmetrical. The animals have well developed water canal system, which is used for locomotion. Skeleton is made of calcium carbonate. Examples: Starfish, sea urchins, etc.



9. PROTOCHORDATA

Animals are bilaterally symmetrical, triploblastic and ceolomate. Notochord is present at least at some stages of life. Notochord is a long rod-like structure which runs along the back of the animal. This provides attachment points for muscles. It also separates the nervous tissues from the gut. Examples: Balanoglossus, herdmania, amphioxus, etc.

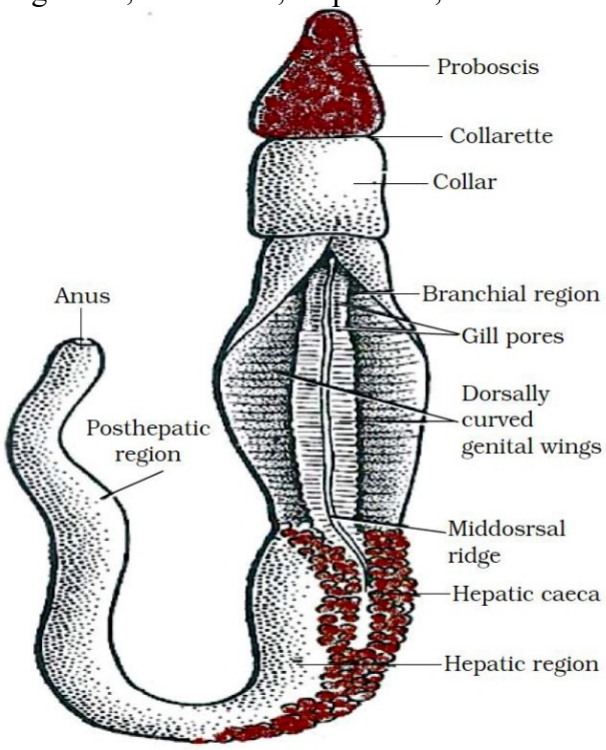


Fig. *A Protochordata: Balanoglossus*

10. VERTEBRATA:

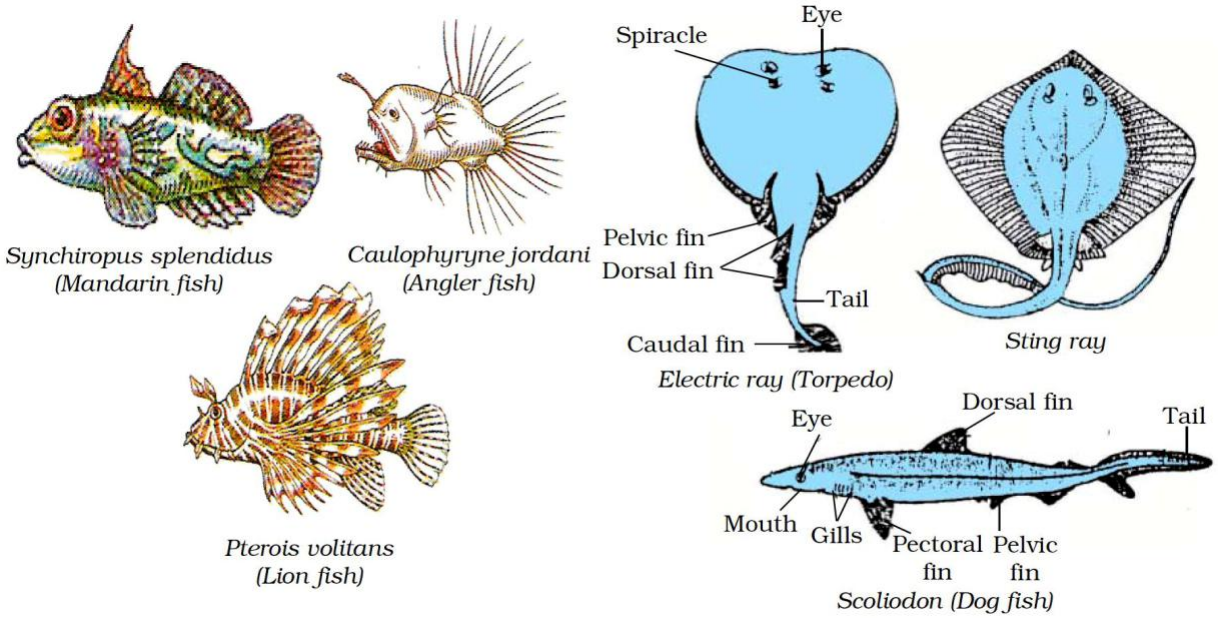
The notochord is replaced by a spinal column during embryonic stage. Following are the main characteristics of vertebrates:

Notochord present; which is replaced by spinal column.
Dorsal nerve chord is present.
Animals are triploblastic and coelomate.
Animals have paired gill pouches.

Vertebrates are divided into two super classes, viz. pisces and tetrapoda.

A. PISCES

They are commonly known as fish. The body is streamlined. Muscular tail is present which assists in locomotion. Body is covered with scales. Paired gills are present; which can breathe oxygen dissolved in water. They are cold-blooded animals. The heart has only two chambers. They lay eggs. Fishes can be bony or cartilaginous. Shark is an example of cartilaginous fish. Rohu and katla are examples of bony fish.



B. TETRAPODA

Animals have four limbs for locomotion and hence the name tetrapoda. Tetrapoda is divided into four classes, viz. amphibia, reptilia, aves and mammalia.

(1) Amphibia:

These animals are adapted to live both in water and land. Mucus glands on skin keep the skin moist. The animals breathe through skin when in water and through lungs when on land. The heart has three chambers. These are cold blooded animals. Examples: Frog, toad, salamander, etc.

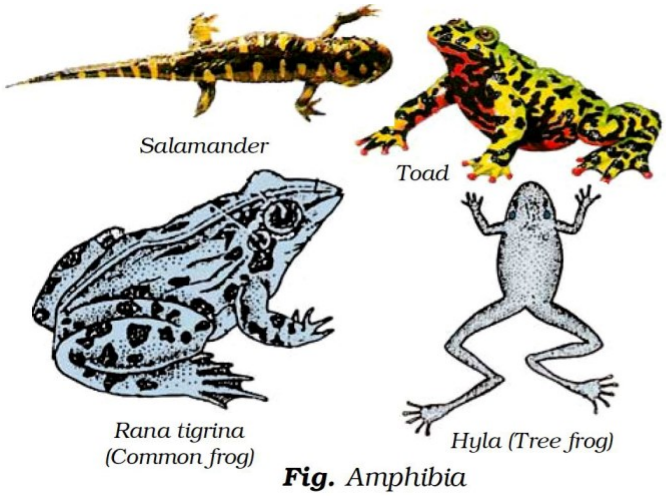


Fig. Amphibia

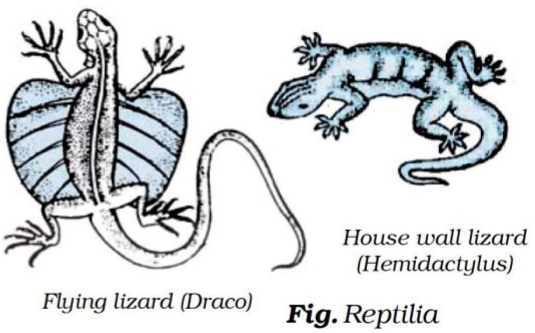
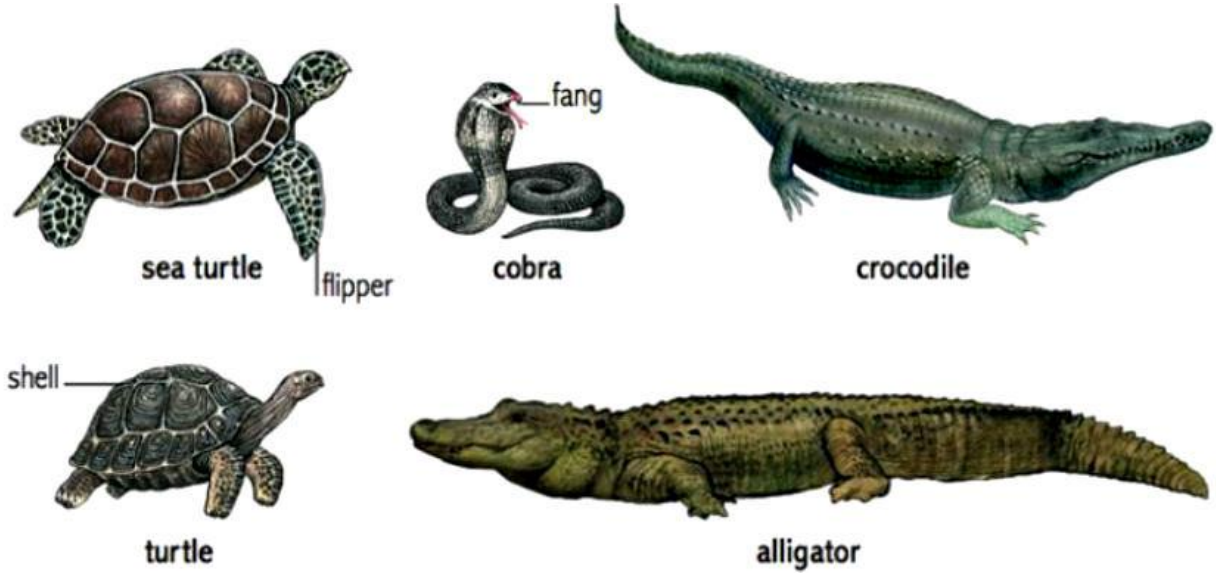


Fig. Reptilia

(2) Reptilia:

These animals show crawling movement for locomotion. Skin is hardened to form scales. Most of the reptilians have three chambered heart but crocodile has four-chambered heart. They don't need water to lay eggs, rather eggs are covered with hard shells and laid on land. Examples: snakes, lizards, crocodile, turtle, etc.



(3) Aves:

The body is covered with feathers. Forelimbs are modified into wings. These are warm-blooded animals. The heart has four chambers. Bones are hollow (pneumatic); which assists in flying. All the birds belong to this class.

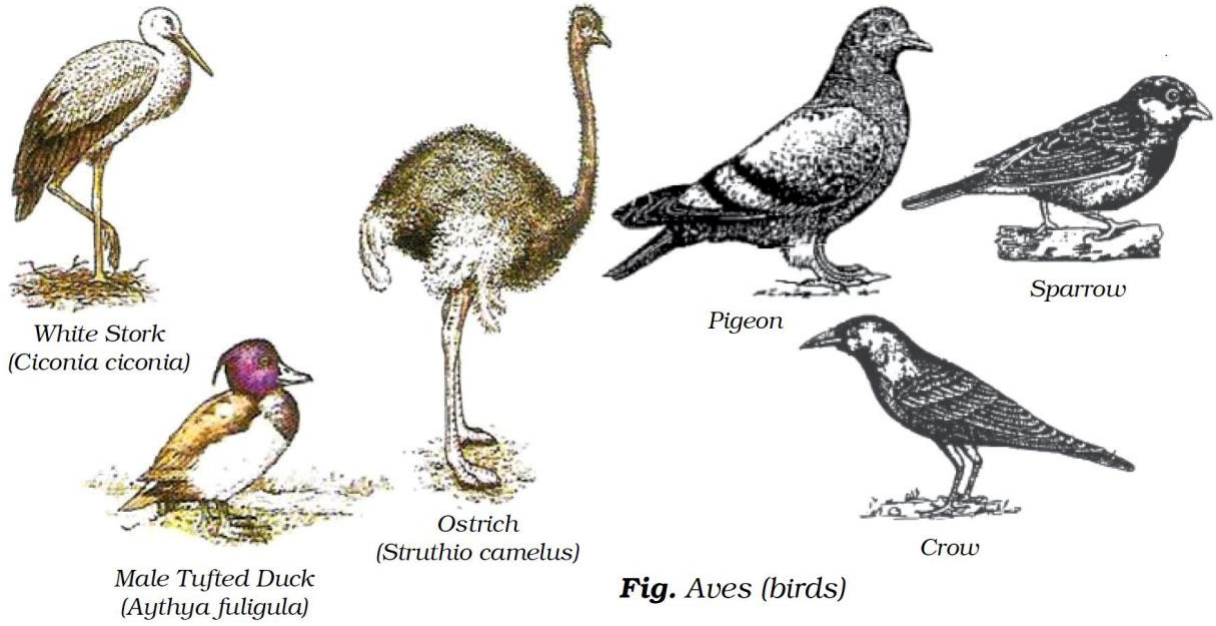
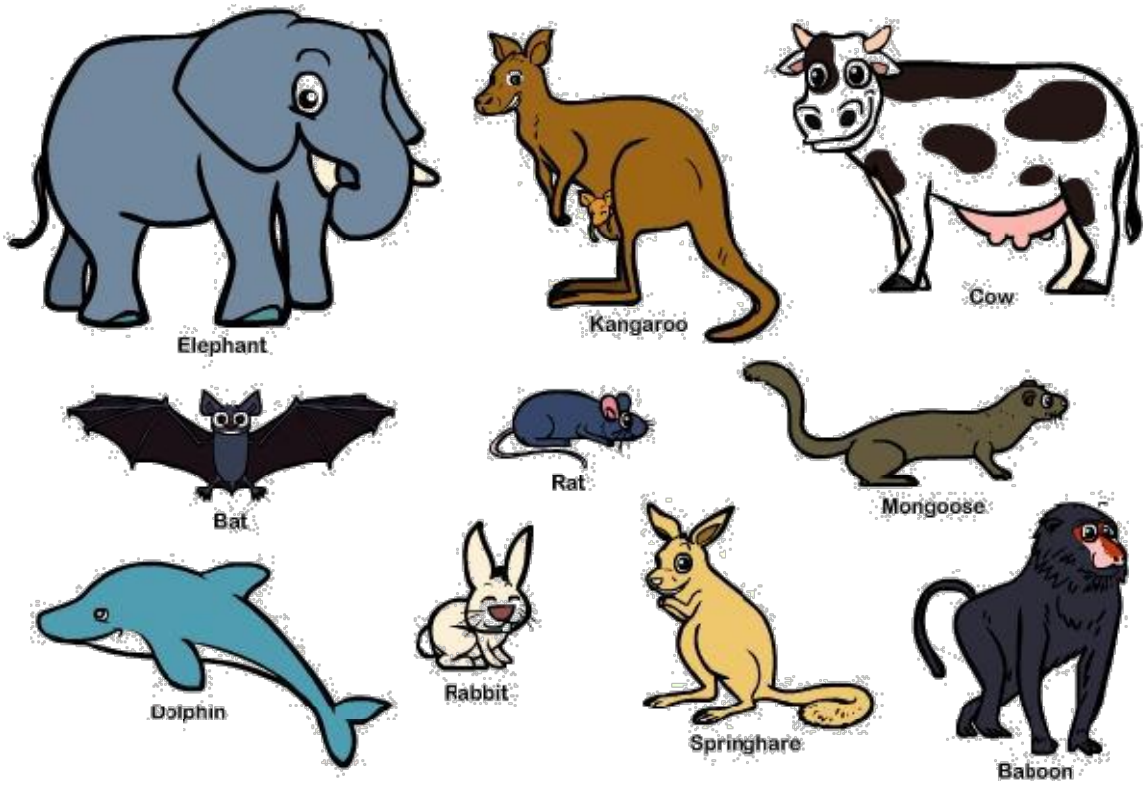


***Fig.** Aves (birds)*

(4) Mammalia:

The body is covered with hairs. Skin has seat glands and sebaceous glands. Mammary glands are present in females and are used for nourishing the young ones. Most of the mammalians give birth to young ones and are called viviparous. Some of the mammals lay eggs and are called oviparous. Examples: human, chimpanzee, lion, platypus, horse, etc.



BINOMIAL NOMENCLATURE OF ORGANISMS:

The system of binomial nomenclature was proposed by Carolus Linneaus (1707 – 1778). Conventions of writing biological name are as follows:

The biological name is composed of two terms. The first term is called genetic name and the second term is called species name.
The genus name starts with a capital letter, while the species name starts with a small letter.
In print, the scientific name is written in italics.
When handwritten, the genus name and species name need to be underlined separately.

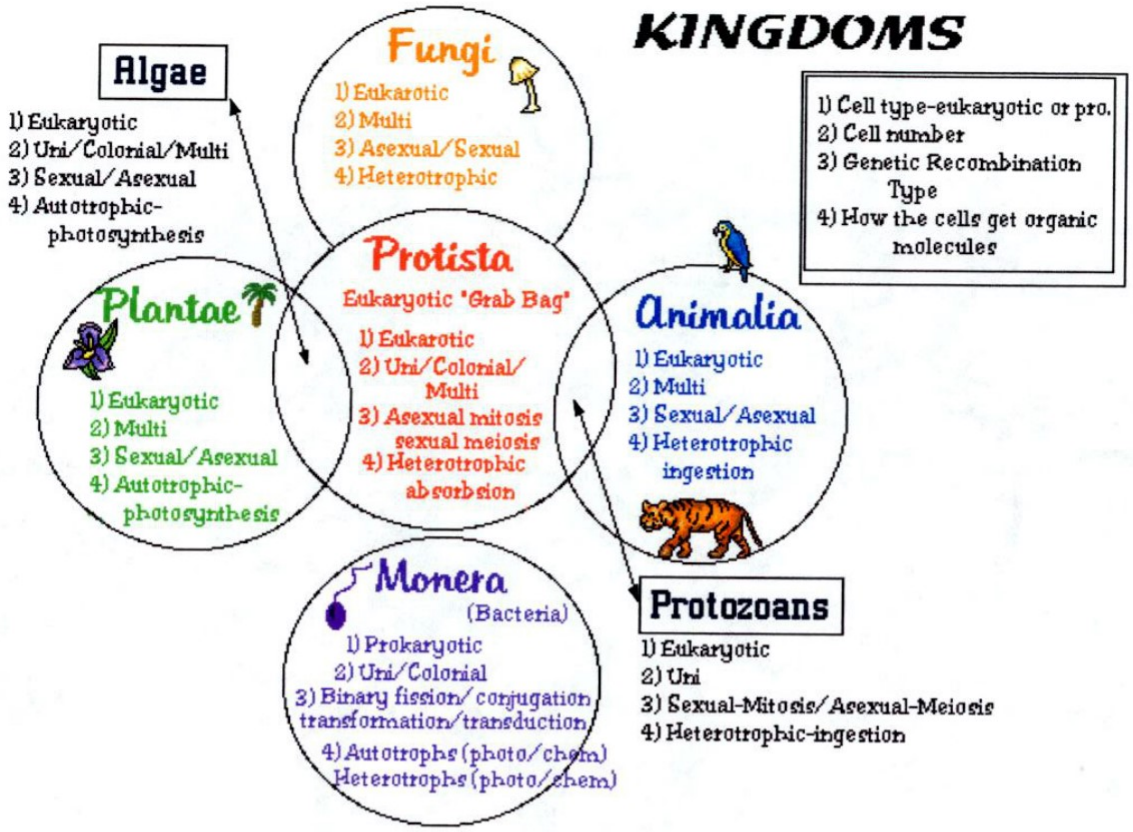
			
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Arthropoda
Class	Mammalia	Aves	Insecta
Order	Rodentia	Passeriformes	Odonata
Family	Castoridae	Icteridae	Gomphidae
Genus and species	*Castor canadensis*	*Icterus galbula*	*Gomphus spicatus*

- System of assigning scientific/binomial names to organisms designed by Carolus Linneaus in 18th century
- Based on idea that every species has a Latin name, made up of two parts
- First part is the name of the **genus**
- Second part specifies the **species**
- Name should be printed in italics (underlined if hand written) and first part capitalized

Example: Binomial name for Humans is ***Homo sapiens***

POINTS TO REMEMBER

FIVE CLASSIFCATION OF KINGDOM



The hierarchy of classification – Groups :-

Living organisms have been broadly classified into five main kingdoms. They are :-

i) Monera ii) Protista iii) Fungi iv) Plante v) Animalia

Each kingdom has been further classified into smaller sub - groups at various levels as :-

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

By arranging organisms on the basis of hierarchy and characteristics into smaller and smaller groups we arrive at the basic unit of classification called species.

Species :- is group of organisms which are similar enough to breed and perpetuate.

PLANT KINGDOM

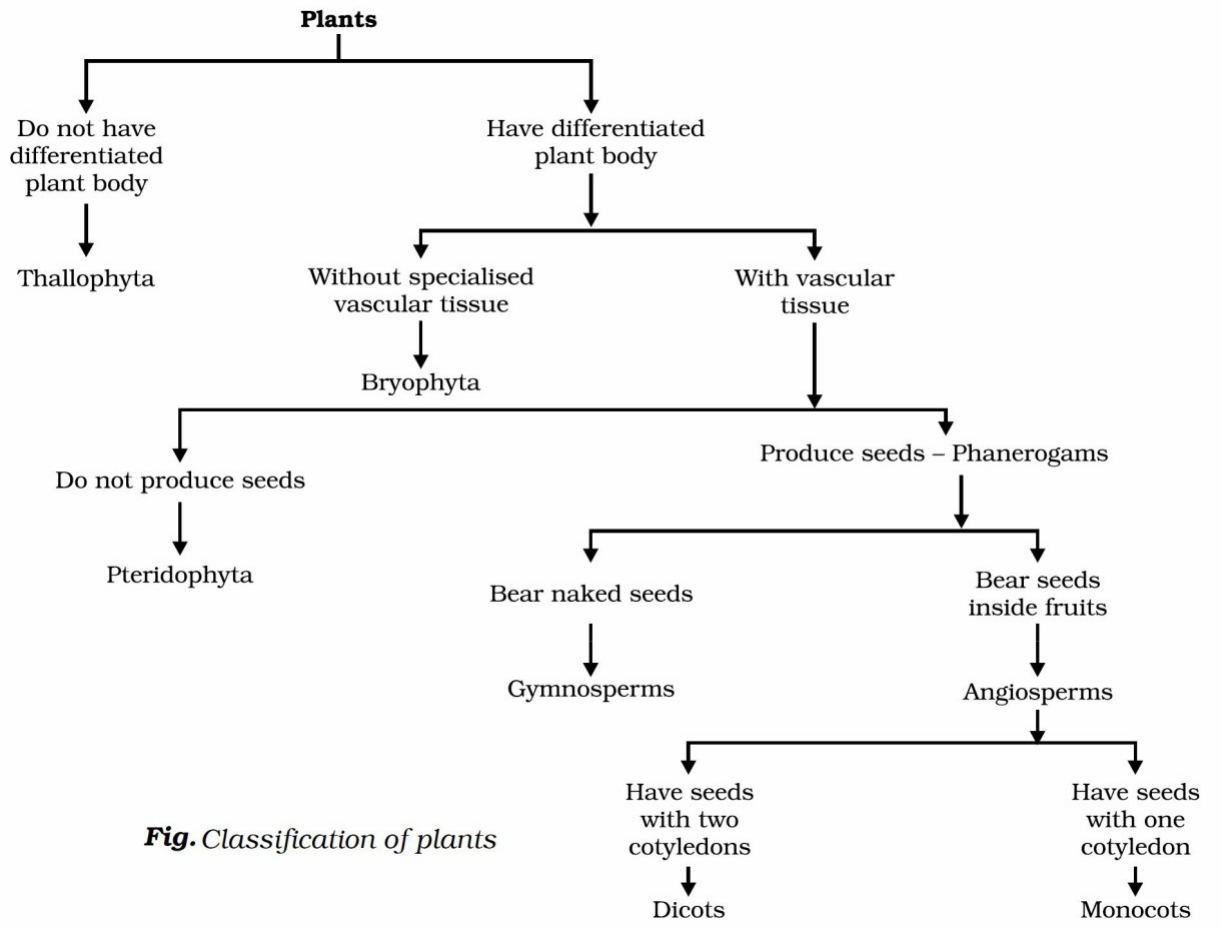
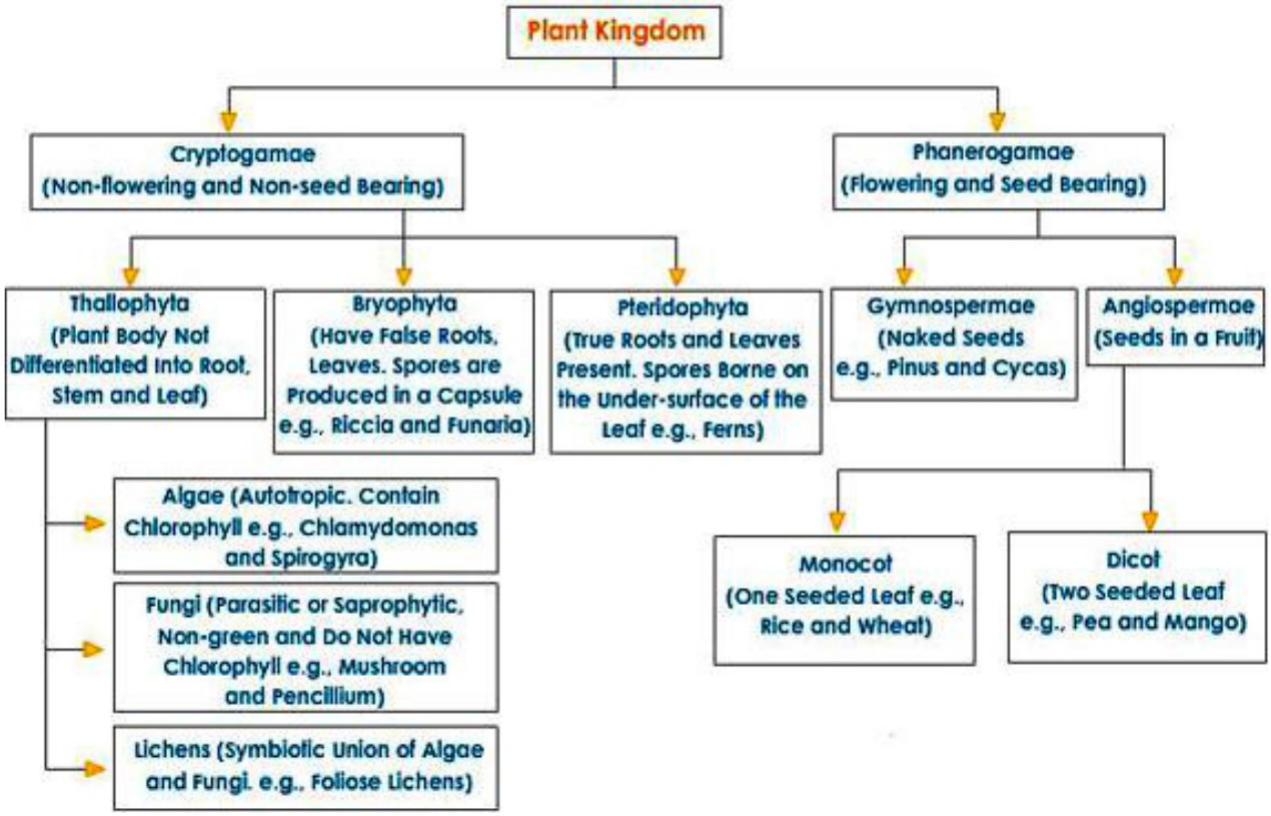
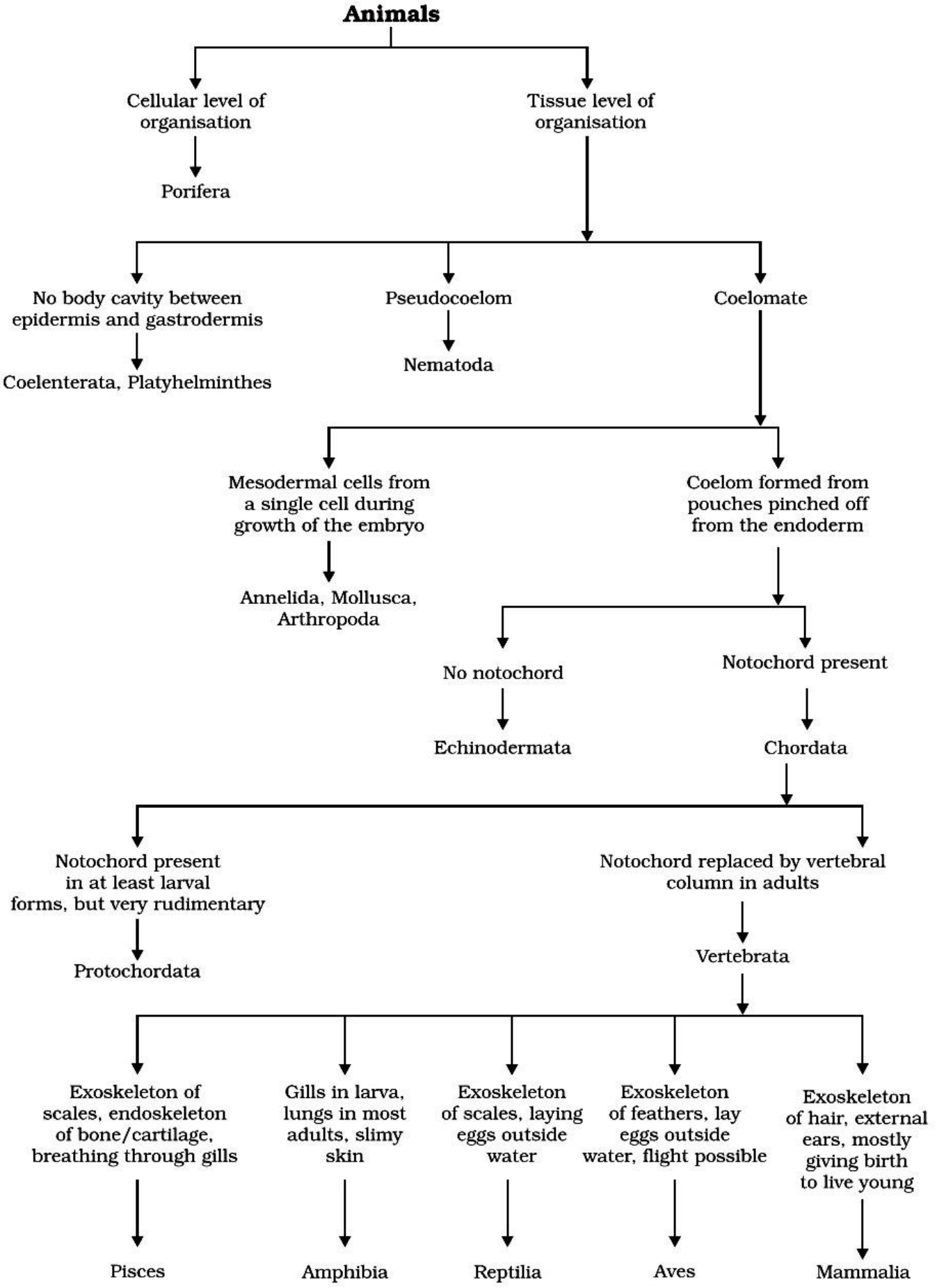
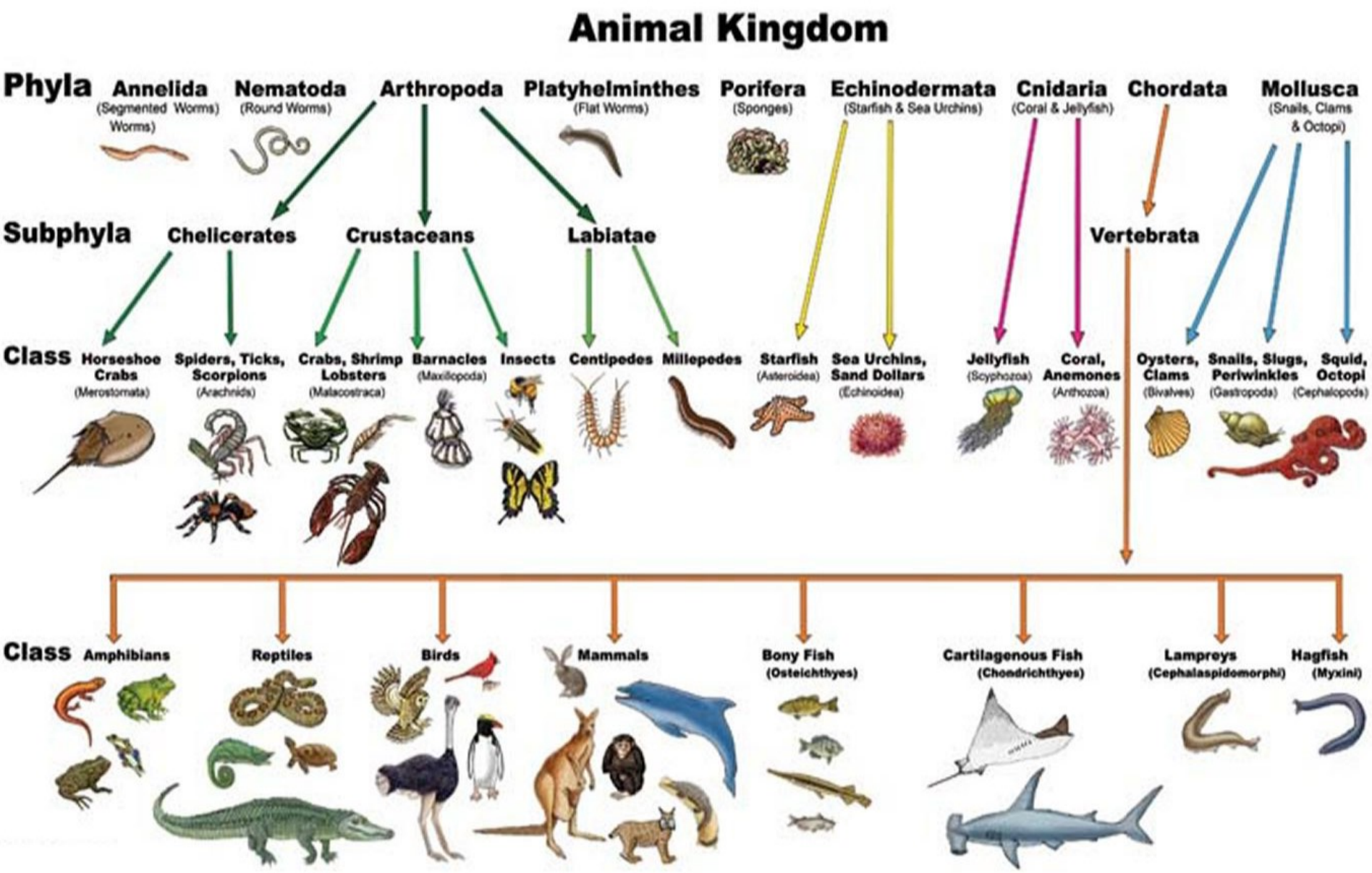


Fig. *Classification of plants*



ANIMAL KINGDOM




Animal Kingdom
Phyla
Annelida
(Segmented Worms)
Worms)
Nematoda
(Round Worms)
Arthropoda
Platyhelminthes
(Flat Worms)
Porifera
(Sponges)
Echinodermata
(Starfish & Sea Urchins)
Cnidaria
(Coral & Jellyfish)
Chordata
Mollusca
(Snails, Clams & Octopi)
Subphyla
Chelicerates
Crustaceans
Labiatae
Vertebrata
Class
Horseshoe Crabs
(Merostomata)
Spiders, Ticks, Scorpions
(Arachnids)
Crabs, Shrimp Lobsters
(Malacostraca)
Barnacles
(Maxillopoda)
Insects
Centipedes
Millepedes
Starfish
(Asteroidea)
Sea Urchins, Sand Dollars
(Echinoidea)
Jellyfish
(Scyphozoa)
Coral, Anemones
(Anthozoa)
Oysters, Clams
(Bivalves)
Snails, Slugs, Periwinkles
(Gastropoda)
Squid, Octopi
(Cephalopods)
Class
Amphibians
Reptiles
Birds
Mammals
Bony Fish
(Osteichthyes)
Cartilagenous Fish
(Chondrichthyes)
Lampreys
(Cephalaspidomorphi)
Hagfish
(Myxini)