YOUTH COMPETITION TIMES

B.Sc. Nursing

&

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For All India State/Central University's & Medical College

■ Biology ■ Physics ■ Chemistry ■ Nursing Aptitude

Entrance Exam

CHAPTERWISE

STUDY MATERIAL & QUESTION BANK

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CONTENT

BIOLOGY

PHYSICS

CHEMISTRY

Unit-I: Physical Chemistry

Unit-II: Inorganic Chemistry

Unit-III: Organic Chemistry

01.

Diversity in Living World

What is Living?

The characteristics of living organism are :

- **Growth** is shown by living organism by an increase in mass and an increase in the number of individual.
- **Reproduction :** The process of producing offspring possessing features similar to those of their presents is known as reproduction. It takes place by sexual or asexual mode.
- **Metabolism** comprises of both anabolism and catabolism continuously occurring in the body.
- **Cellular organisation :** The cells are the building blocks of all living organisms may it be plants, animals or humans.
- **Consciousness :** The ability of living organism to sense their surroundings or environment and respond to these environmental stimuli is known as consciousness.

Diversity in the Living Word :

Binomial Nomenclature :

- In binomial system, each name is expressed in two parts i.e. **generic** name and **specific** name.
- For example, scientific name of wheat is ***Triticum aestivum***. Here the generic name of wheat plant is Triticum and the specific name is aestivum.

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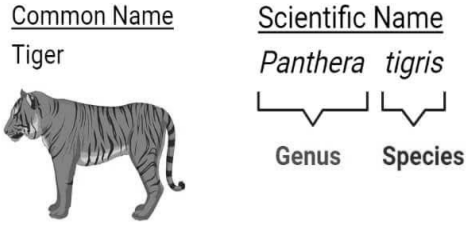
BINOMIAL NOMENCLATURE



Taxonomic Categories is system of arranging different categories on ranks convenient categories based on some easily observable characters.

Taxonomic Classification of Humans

• Kingdom	Animalia
• Phylum	Chordata
• Class	Mammalia
• Order	Primates
• Family	Hominidae
• Genus	*Homo*
• Species	*sapiens*

(i) Kingdom is highest taxonomic category. All plants are included in kingdom plantae. All animals are included in kingdom animalia.

(ii) Division or Phylum is used for animals while division is commonly employed for plats.

(iii) Class is made of one or more related orders.

(iv) Order are identified based on the aggregates of characters.

(v) Family is a group of related genera having several common characters.

(vi) Genus is a group of closely related species that are alike in broad features of their organisation.

(vii) Species is the basic unit of evolution. Species is defined as "the smallest real basic unit of taxonomy which is reproductively isolated from other group of individuals".

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- **Herbarium** is a collection of pressed and dried plant specimens that are preserved on paper sheets.

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- **Botanical garden** various plants groups are grown for scientific study, conservation, public education, aesthetics, and recreation. The famous botanical gardens are at Kew (England). Indian Botanical Garden, Howrah (India) and at National Botanical Research Institute, Lucknow (India).

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- **Museum** is a building used for the preservation, storage and exhibition of inanimate objects. Biological museums have collections of preserved plant and animals specimens.
- **Zoological park** is a place where wild animals are kept in protected environment under human care. These animals are kept for public exhibition.

Characteristics of the Five Kingdoms :

	Five Kingdoms				
	Monera	**Protista**	**Fungi**	**Plantae**	**Animalia**
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Non-cellulosic (Polysaccharide + Amino acid)	Present in some	Present with chitin	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organization	Cellular	Cellular	Multicellular/ Loose tissue	Tissue/ organ	Tissue/organ / organ system
Mode of nutrition	Autotrophic (chemosynthetic and photosynthetic) and Heterotrophic (saprophytic/ parasitic)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic/ parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic/ saprophytic etc.)

Kingdom Monera : It comprises of bacteria (mycoplasma, archaebacteria, eubacteria, actinomycetes, etc.) and cyanobacteria.

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- There are different shapes of bacteria like spherical, cocci, rod-shaped, comma shape and spiral-spirilla.

Archaebacteria :

- Most archaea live in environments that are extreme in one way or another. temperature, salinity, oxygen concentration, or pH. It lacks peptidoglycan in their cells walls.
- Methanogens are present in gut out several ruminant animal.
- They are responsible for the production of the biogas.

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Bacteria :

- Bacterial cell contains a single chromosomes (nuclear material) that is not enclosed in a nuclear membrane.
- Bacteria is characterized by presence of a rigid cell wall and if motile, a flgellum.

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- **Photosynthetic autotrophs** include cyanobacteria (blue-green algae). Some of these organisms can fix atmospheric nitrogen in specialized cells called as heterocysts, for example Nostoc and Anabaena.

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- **Chemosynthetic autotrophs** get energy for ATP generation from oxidation of various inorganic substance like ammonia and nitrates.

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- **Heterotrophic** are most abundant in naturem, majority are important decomposers. Many are helpful in making curd from milk, production of antibodies and fixing nitrogen in legume roots.

Kingdom Protista include all unicellular eukaryotic microorganisms. There are 4 major group of Protista.

Chrysophytes are a group of diatoms (Triceratium, Pieurosigma, Navicuia, Cymbella, Amphipleura) and golden algae.

- Diatoms are producer in ocean chief.

Dinoflagellates are mostly marine and photosynthetic.

- They are of different colors depending upon the pigment present in cell.
- **Euglenoids** includes Euglena-like flagellates which have plant like characteristics, they ingest food particles and carry on photosynthesis.
- **Slime Moulds** are unicellular, saprophytic organism that lack cell walls and have the plasma membrane as their outer covering.
- **Protozoans** are heterotrophs and live as a predators or parasites. There are four major group of protozoans.
- **Amoeboid Protozoans** are characterized by presence of pseudopodia that are used for movement and catching of prey, ex.Amoeba.

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- **Flagellelated Protozoans** are characterized by presence of flagella. Some of them causes diseases like Trypanosoma.
- **Ciliated Protozoans** have cilia on their body surface. They have a cavity known as gullet that opens to the outside of cell surface.
- **Sporozoans** are characterized by formation of spores like state in their life-cycle. The most famous example Plasmodium.

Kingdom Fungi :

- Fungi are achlorophyllus organisms and hence they live as heterotrophs i.e., as parasites and saprophytes. In true fungi the plant body is **thallus**. It may be non-mycelial or mycelial.

Classification of Fungi

Group	Example	Morphology	Asexual Reproduction	Sexual Reproduction	Miscellaneous Inforamation
Phycomycetes	Black bread mould (Rhizopus), Albugo (I)	Coenocytic hyphae, mycelium is aseptate	By zoospores or by aplanospores	Sexual reproductive is by zygospore or oospore	Decaying matter, aquatic habitat or parasite on plants
Ascomycota	Sac fungi, yeast, Penicillium	Septate hyphae, chitin cell walls, some unicellular	By conidia	By ascospores	Used in biochemical and genetic work.
Basidiomycota	Club fungi, mushrooms, puffballs, shelf fungi, rusts	Dikaryotic hyphae, mycelium extensive	Asexual spores are not found	By basidiospores	Edible mushrooms, plant parasites
Deutueromycota	Fungi imperfecti Alternaria Trichoderma	Moulds, rapidly growing hyphae	By conidia	No sexual stage	Some members are saprophytes or parasite

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Kingdom Plantae :

- Main characters of kingdom plantae are :
  - Cellulosic cell wall.
  - Presence of chloroplasts.
  - Photosynthetic mode of nutrition, e.g., different types of algae (green, brown, red algae), bryophytes, pteridophytes, gymnosperms and angiosperms.
  - Both asexual and sexual reproduction.
  - Show alternation of generation.

Kingdom Animalia

- The organisms are made up of heterophic eukaryotic cells.
- The cell do not contain cell wall, but contain only cell membrane.

Viruses, Viroids, Linchens and Prions

- **Viruses** are obligate parasites, i.e., can live inside living host only.
- They have either RNA or DNA.
- They have character of both living and non-living.
- **Viroids** smaller than viruses.
- It contain only very low molecular weight RNA and not protein coat.
- **Lichens:** They show symbiotic relationships.
- There are 2 components in lichen i.e., algal partner called phycobiont and fungal partner called mycobiont.
- They are very good pollution indicators as they do not grow in polluted areas.

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- **Artificial classification system** was used by **Linneaus.** It was based on vegetative characters or on the androecium structure.

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- **Natural classification system** was based on natural affinities among organisms. It was used by George **Bentham** and **Joseph Dalton Hooker.** Both external and internal features were taken into account.
- **Phylogenetic classification system** is based upon evolutionary relationship and uses morphological characters, origin and evolution of the different organisms. It was proposed by **Adolf Engler and Karl Prantl.**

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- **Cytotaxonomy** is based on cytological information like chromosome number, structure, behaviour and **chemotaxonomy** uses the chemical constituents of the plant to resolve confusions, are also used by taxonomists these dyas.

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- **ALGAE** are chlorophyll-bearing, simple, thalloid, autotrophic and largely aquatic (both fresh water and marine) organisms. Some of them also occur in association with fungi (lichen) and animals (e.g., on sloth bear).

- Size ranges from the microscopic unicellular forms like *Chlamydomonas*, to colonial forms like *Volvox* and to the filamentous forms like *Ulothrix* and *Spirogyra.* A few of the marine forms such as kelps, form massive plant bodies.
- Algae reproduce by vegetative, asexual and sexual methods.

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- **Bryophytes** are also called amphibians of the plant kingdom. They usually occur in damp, humid and shaded localities.
- It is thallus-like and prostrate or erect, and attached to the lack true roots, stem of leaves. They may possess root-like, leaf-like or stem-like structures.
- The main plant body of the bryophyte is haploid, it produces gametes, hence is called a **gametophyte.**

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Liverworts (Marchantia) grow in moist, shady habitats such as banks of streams, marshy ground, damp soil, bark of trees and deep in woods.

- The plant body is haploid (n), gametophytic, small, dorsoventrally flattened, thallose, dichotomously branched fixed by unicellular, unbranched rhizoids.

Moss (Funaria) found in moist, shady places in patches on damp soils, moist rocks, burnt humid soil, damp walls or on tree trunks.

- The predominant stage of the life cycle of a moss is the gametophyte which consists of two stages. The first stage is the protonema stage and the second stage is the leafy stage.
- Common examples of mosses are Funaria, Polytrichum and Sphagnum.

Pteridophyta are the first terrestrial plants to possess vascular tissues – xylem and phloem.

- The main plant body is a sporophyte which is differentiated into true root, stem and leaves. These organs possess well-differentiated vascular tissues.
- The leaves in pteridophyta are small (microphylls) as in Selatginella or large (macrophylls) as in ferns.

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Gymnosperms are plants which bear naked seeds *i.e.,* the ovules and the seeds that develop from these ovules after fertilization are no enclosed in fruit wall.

- They are heterosporous; they produce haploid microspores.
- The male or female cones or strobili may be borne on the same tree *(pinus)* or on different trees (*Cycas*).

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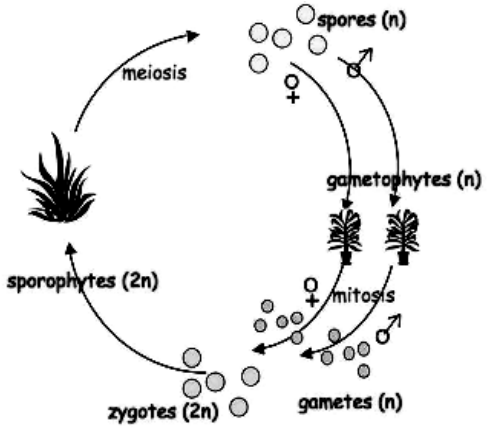
Angiosperms (Flowering Plants) are seed bearing, flowering vascular plants in which seeds are enclosed in fruits. The term angiosperm means 'enclosed seeds' as seeds (ovules) are fond enclosed in the ovary wall.

- The male sex organ in a flower is the stamen.
- The female sex organ in a flower is the pistil or the carpel.

Plant Life Cycle And Alternation Of Generation :

- In plants, both haploid and diploid cells can divide by mitosis. The life cycle of any sexually reproducing plant consists of two morphological phases *i.e.*, haploid **gametophyte** and diploid **sporophyte** that regularly alternate with each other, which is termed as **alternation of generation.**



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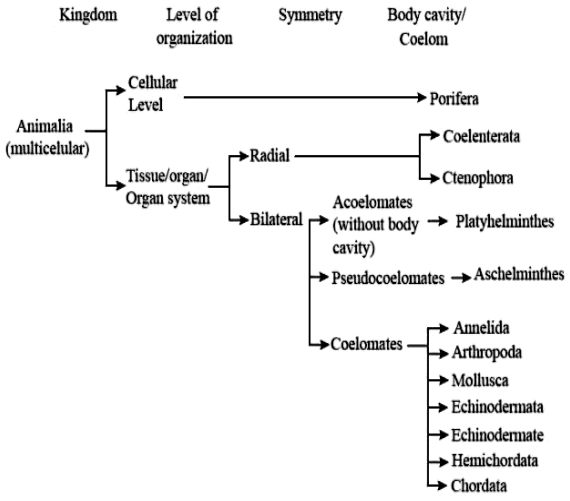
Basis of classification :

Levels of Organization :

- Cellular level : example – Sponges.
- Tissue level : example – Coelenterates.
- Organ level : example – Member of Platyhelminthes.
- Organ-system level : example – Annelids,Arthropods, Molluscs, Echinoderms and Chordates.



The digestive system is of two types :

(a) Incomplete digestive system : Only single opening to the outside of the body that serve as both mouth and anus *ex.Hydra*.

(b) Complete digestive system : Two openings mouth and anus *ex.*Human.

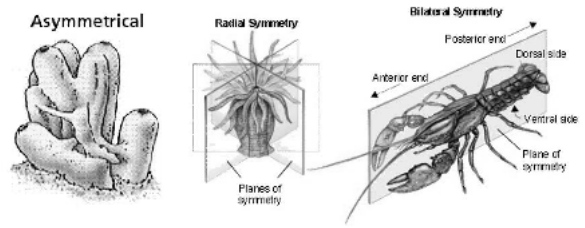
The circulatory system is also of two types.

(a) Closed blood vascular system: The blood circulates inside the blood vascular without ever coming in direct contact with the body cells, *e.g.*, Annelids, Chordates.

(b) Open blood vascular system: The blood flows in open spaces like lacunae and sinuses. It baths the cells directly, *e.g.*, Arthropods, Mollusks.

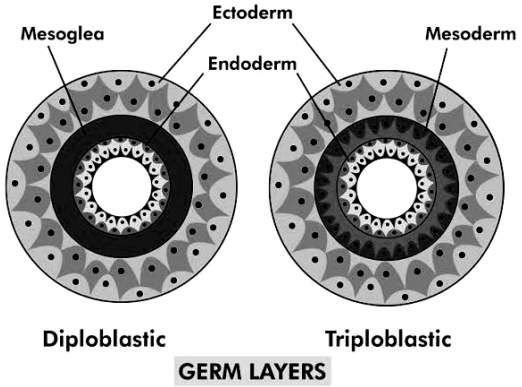
Symmetry :

- **Asymmetrical :** Body cannot be divided in two equal halves on any plane through the centre, *ex.*Amoeba.
- **Radial symmetry:** Any plane passing through a central axis of the body divides the organism into two identical halves for example Coelenterates, Ctenophores and Echinoderms.
- **Bilateral Symmetry :** Body can be divided into two equal halves on only one plane for examples Annelids, Arthropods, Human etc.



Diploblastic and triploblastic Organisation :

- **Diploblastic animals :** here the cells are arranged in two embryonic layers, an external ectoderm and internal endoderm *ex.*Coelenterates, Sponges.
- **Triploblastic animals** are those in which developing embryo has the third germinal layers, mesoderm, in between the ectoderm and endoderm are called triploblastic animals. *e.g* Platyhelminthes to Chordates.



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Coelom is the cavity between body wall and alimentary canal lined with mesodermal epithelia on both sides.

- **Acoelomates** are the animals which do not have coelom *e.g.*, Sponges, Coelenterates, Ctenophorans and Flatworms.

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- **Pseudocoelomates,** in this body cavity is not lined by mesoderm continuously, but it is present as scattered pouches in between the ectoderm and endoderm. Aschelminthes (round worms) are psuedocoelomates.
- **Eucoelomates** are the animals which possess true coelom. True coelom is found in Annelids, Echinoderms and Chordates.

Notochord :

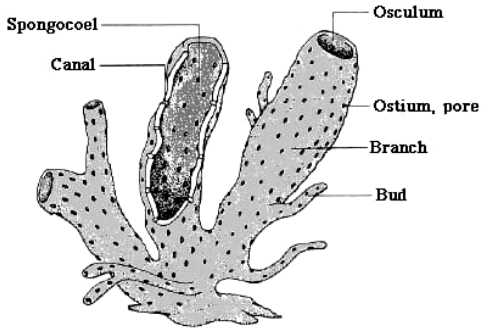
- Animals having notochord are known as chordates and those animals which do not form this structure are known as non-chordates, *e.g*, Porifera to Echinoderms.

CLASSIFICATION OF ANIMALS :

Phylum-Porifera :

- Sponges are aquatic, mostly marine, solitary of colonial and sessile.

  The body is porous having two types of pores such as (i) ostia, which is inhalant pores (ii) osculum, which is exhalent pores.
- Most of the sponges are asymmetrical.
- The canal system in Sponges helps in nutrition, excretion, circulation, transport of gametes and fertilization.
- Sexes are not separate (hermaphrodite).
- Examples of some sponges are : *Sycon* (scypha),*Spongilla* (fresh water sponge) and *Euspongia* (bath sponge)



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Phylum-Coelentrata (Cnidaria):

- They are aquatic, mostly marine, with Hydra being the freshwater exception.

- They can be solitary or colonial, sessile or free swimming.
- They are diploblastic and reproduce both sexually and asexually.

  For example, Physalia, Adamsia, etc.

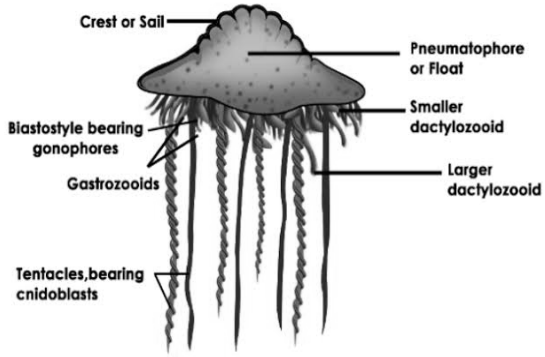

Fig : *Physalia*

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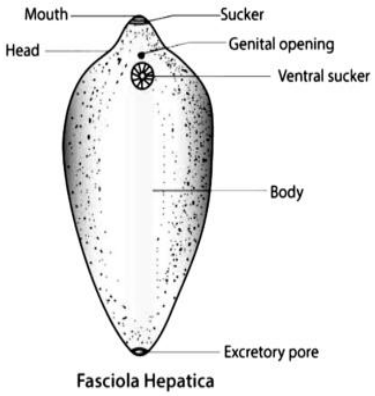
Phylum-Ctenophora :

- There are diploblastic, radial symmetrical animals with tissue level of organization, reproduction takes place only by sexual means.
- Fertilisation is external with indirect development. For examples – *Pleurobranchia* (Tape worm), *Fasciola* (liver fluke).

LIVER FLUKE



Fasciola Hepatica

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Phylum-Platyhelmithes :

- Mostly endoparasites, Bilaterally Symmetrical, Triploblastic and Acoelomate.
- They have an organ level of organization and use flame cells for excretion.

  For example, Taenia (Tapeworm), Fasciola (Liver fluke).

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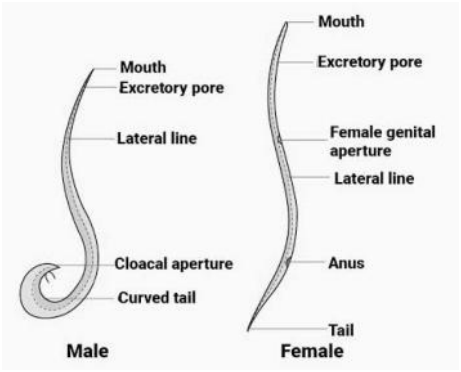
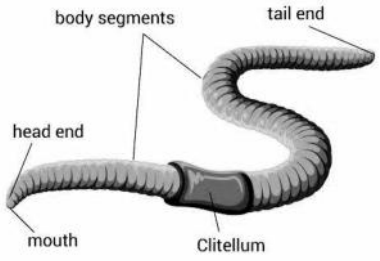
Phylum-Aschelminthes :

- May be free-living, aquatic and terrestrial or parasitic in plants and animals.
- They have organ-system level of body organisation, bilaterally symmetrical, triploblastic and pseudocoelomate animals. For example Ascaris.



Phylum-Annelida :

- They are characterized by metameric segmentation forming ring like segments.
- They are bilaterally symmetrical, triploblastic, coelomate animals with organ-level of organisation.
- Example : *Neries, Pheretima* (Earthworm) and *Hirudinaria* (Blood sucking leeach).



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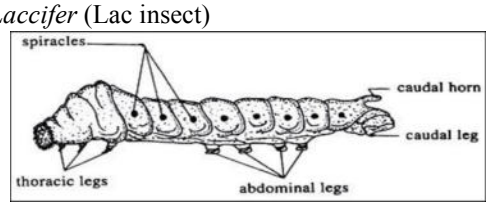
Phylum-Arthropoda :

- It is the largest phylum of animalia which include insect.
- They have bilateral symmetry, triploblastic animals, which have organ-system level of organisation.
- Respiratory organs are gills or book gills tracheae or book-lungs. Excretory organs are either green glands of malpighian tubules.
- Sensory organs like antennal and eyes are present. Example; *Apis* (Honey bee), *Bombyx* (Silkworm), *Laccifer* (Lac insect)



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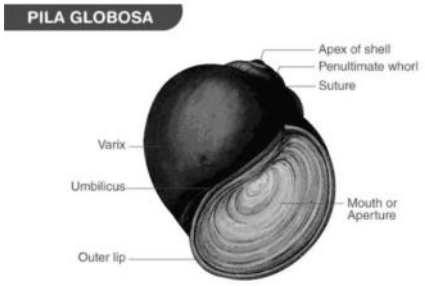
Phylum-Mollusca :

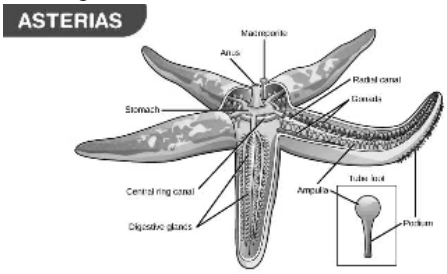
- Mostly aquatic (marine or fresh water), or terrestrial having an organ-system level of organisation.
- Molluscs body is unsegmented with a distinct head, muscular foot and visceral hump. It is covered by a calcareous shell.
- Example. *Pila* (apple snail) *Octopus* (devil fish), *Loligo* (sea squid).



Phylum-Echinodermata :

- They are marine animals, usually found on the sea floor.
- In their larval stage, they have bilateral symmetry, but as adults, they have radial symmetry.
- They are triploblastic and have an organ-system level of organization. They have an open circulatory system.

  For example : Starfish, Sea cucumber.



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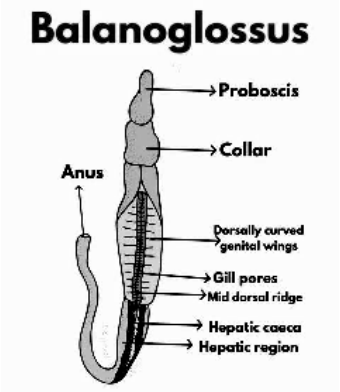
Phylum-Hemichordata :

- They are bilaterally symmetrical, triploblastic, and entrocoelous animals.
- The excretory organ is proboscis gland.
- For example : *Balanoglossus* (acorn worm or tongue worm), *Saccoglossus.*



Phylum-Chordata:

- They have notochord, a dorsal hollow nerve cord, paired pharyngeal gill slits and post anal tail either in the embryonic or adult stage.
- It is bilaterally symmetrical, triploblastic and coelomate with organ system level of organisation.
- The posses a closed circulatory system.
- Phylum Chordata is divided into three sub-phylums:

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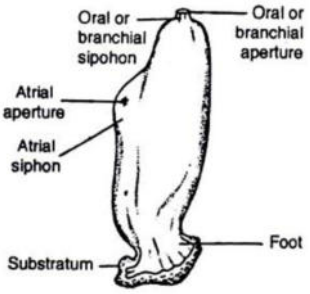
Sub-Phylum 1: Urochordata or Tunicate :

- Notochord (a flexible rod) is found only is the tail of the larva, but it disappears in the adult stage.

  For example: Ascidia, salpa, Doliolum.

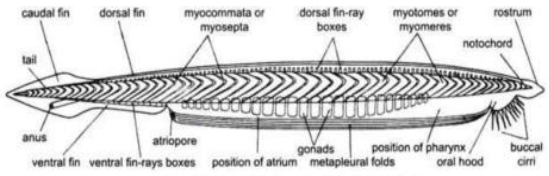


Ascidia

Sub-Phylum 2: Cephalochordata:

- The larva and the adult, both are motile.
- Larva develops into a more advanced adult through a process called progressive metamorphosis.

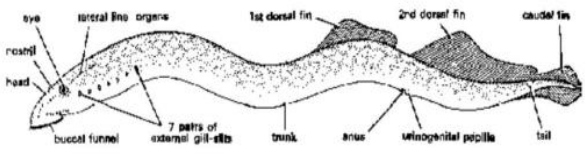
  Example : Branchiostoma.



Branchiostoma.

Sub-Phylum 3: Vertebrata or Craniata :

- The notochord is only present in the embryonic stage, which is replaced by a cartilaginous or bony vertebral column in the adult forms.
- Heart is ventrally situated with two, three or four chambers.
- The circulatory system is closed type consisting of blood and lymphatic systems.
- Example: Agnatha (The jawless vertebrates).



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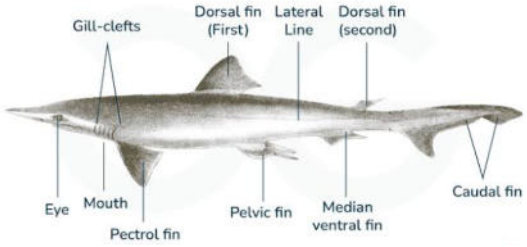
Class : Cyclostomata :

- Their mouth is jawless suctorial and round.
- Their body is devoid of scales and have paired fins.
- Example: **Gnathostomata (The jawed vertebrates).**

MP PNST 08.07.2023 Shift-II

Class : Chondrichthyes :

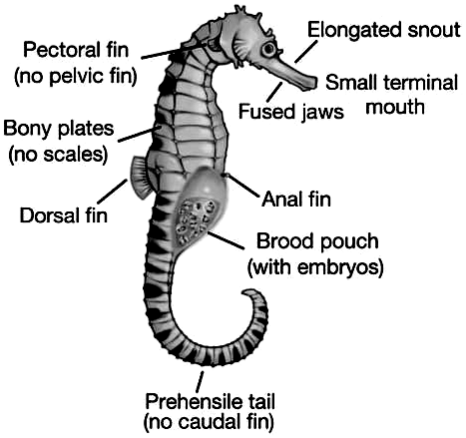
- Cartilaginous skeleton is present.
- Air bladder is not present in these animals. Therefore, they have to swim constantly to avoid sinking.
- Cold-blooded (poikilothermous) animals.
- They are oviparous or ovoviviparous.
- Examples: *Scoliodon* (Dog fish), *Trygon* (Sting ray).



MP GNTST/PNST 08.07.2019 Shift-II

Class : Osteichthyes :

- Bony skeleton is present.
- Air baldder is present which regulates buoyancy.
- They are mostly oviparous.
- Examples : Marine–*Exocoetus* (Flying fish), *Hippocampus* (Sea Horse), Fresh water fishes – *Labeo* (*Rohu*), *Catla* (katla).



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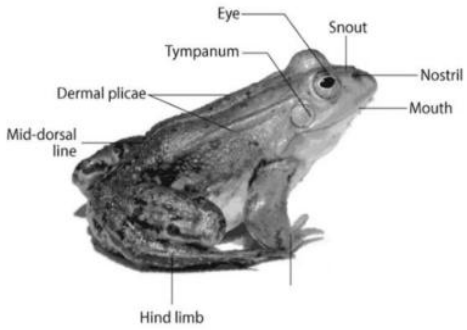
Class : Amphibia :

- They are adapted for both water and land life.
- Respiration occurs by gills, skin, lungs and buccal epithelium.
- Heart is 3 chambered.
- They are oviparous.

  Exambles: *Bufo* (Toad), *Rana* (Frog), *Ichthyophis* (Limbless amphibila) etc.

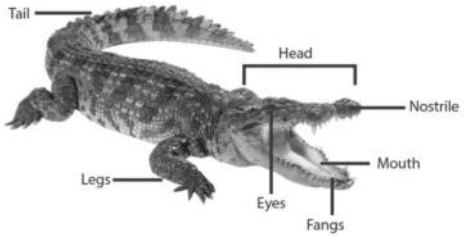
RANA TIGRINA



Class : Reptilia :

- They have dry and horny skin with epidermal scales which prevents loss of water from the body. Snakes and lizards shed their scales as skin cast.
- Heart is 3 chambered but 4 chambered in crocodiles; separation of ventricle is only partial.
- They do not have external ear openings.
- They are oviparous.

  Examples: *Crocodilus* (Crocodile), *Bangarus* (Krait)



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Class : Aves :

- They are bipedal feathered animals.
- They are warm-blooded (homoiothermous).
- Fore-limbs are modified into wing for flight except some flightless bird such as Ostrich.
- Respiration is by lungs, heart is four-chambered.

  Examples: *Corvus* (crow), *Pavo* (Peacock)

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MP GNTST/PNST 07.07.2023 Shift-II

MP GNTST/PNST 07.07.2019 Shift-I-

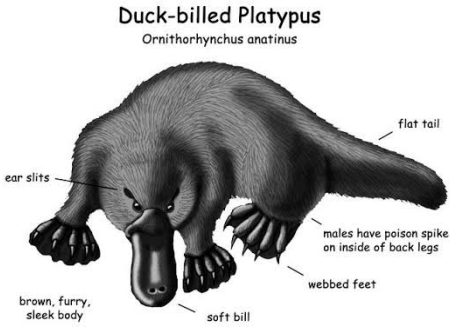
Class : Mammalia :

- They are warm blooded (homiothermous) animals having hair and mammary glands.

- Heterodont teeths are present and are embedded in the sockets of jaws (thecodont).
- External ears or pinnae are present.
- Respiration is by lungs.
- Heart is four chambered. Red blood corpuscles are without nucleus.

Example :

- Oviparous – *Ornithorhynchus* (Platypus).



- Viviparous – *Pteropus* (flying fox),*Camelus* (Camel), *Macaca* (Monkey), etc.

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Multiple Choice Question

1. Potato and Brinjal differ in this taxon
(a) Species (b) Genus
(c) Family (d) Order

2. Binomial system of nomenclature was given by
(a) Linnaeus
(b) Theophrastus
(c) Hooker
(d) Bentham

3. The taxonomical aid used for identification of organisms based both similarities and differences is
(a) Herbarium (b) Key
(c) Museum (d) Flora

4. Highest unit of classification
(a) phylum (b) kingdom
(c) class (d) series

5. Who suggested the third kingdom Protista?
(a) R.H. Whittaker
(b) Carl Linnaeus
(c) Haeckel
(d) Carl Woese

6. Which one of the following is not a criterion for classification of fungi?
(a) Morphology of mycelium
(b) Mode of nutrition
(c) Mode of spore formation
(d) Fruiting body

7. Classification of Virus is done by _____
(a) IBTV
(b) ICBN
(c) ICTV
(d) ICZN

8. The virus which causes Bird flu is
(a) H_1N_1
(b) H_3N_2
(c) H_5N_1
(d) H_2N_2

9. Which of the following divide during binary fission of Euglena?
(a) Nucleus, flagellum and stigma
(b) Nucleus, kinetosomes and contractile vacuole
(c) Nucleus, stigma and chromatophores
(d) Nucleus, kinetosomes and chromatophores

10. Single chromosome with circular DNA as genetic material occurs in____
(a) E. Coli
(b) Chlamydomonas
(c) AIDS virus
(d) Yeast

11. Smallest bacterial genome is seen in _____.
(a) *Methanococcus jannaschii*
(b) *Mycobacterium genitalium*
(c) *Heamophilus influenzae*
(d) *Saccharomyces cerevisiae*

12. Who proposed the sexual system of classification?
(a) N. Grew
(b) Marcello Malpighi
(c) Carolus Van Linnaeus
(d) Robert Hooke

13. Who proposed the sexual system of classification?
(a) N. Grew
(b) Marcello Malpighi
(c) Carolus Van Linnaeus
(d) Robert Hooke

14. Eggs of reptiles are
(a) Microlecithal and cleidoic
(b) Mesolecithal and telolecithal
(c) Megalecithal and cleidoic
(d) Mesolecithal and Isolecithal

15. Excretory organs in adult molluscs are
(a) Malpighian tubules
(b) Green glands
(c) Coxal glands
(d) Pericardial glands

Answer Key

1 (a)	**2. (a)**	**3. (b)**	**4. (b)**	**5 (c)**	**6. (b)**	**7. (c)**	**8. (c)**	**9. (d)**	**10. (a)**
11. (b)	**12. (c)**	**13. (c)**	**14. (c)**	**15. (d)**					

02.

Morphology of Flowering Plants

- The study of external features, forms and relative position of plant organs is called morphology.
- **The Root** is the underground system , usually below the soil and originates from the radical.
- **Tap Root System:** Primary roots and its branches (secondary tertiary roots) constitute the tap root system. It is seen in dicot plants eg. Mustard plant.

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- **Adventitous Root System:** They are produced from any other part of the plant, except the radical or its branches are called adventitious roots.

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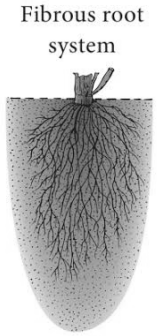
- **Fibrous Root System:** In monocotyledonous plants, the primary root is short-lived and is replaced by large number of roots, which originate from the base of system and constitute the fibrous root system as seen in wheat, rice, corn etc.



Region of the root:

- **Root cap (calyptras):** It is derived from calyptrogen. It covers root tip and protects it against friction from soil particles.
- **Region of active cell division or meristematic region:** It is the growing point produces new cells for root cap and basal parts.
- **Region of elongation :** Cells elongate rapidly due to vacuolization, which is responsible for growing of root in length.
  In case of dicotyledonous plants, primary root elongates and bear lateral roots of several orders known as secondary or tertiary roots.
- **Region of cell maturation :** It is the outermost layer of this region have thick wall or impermeable cells. Its only function is to anchor the plant firmly in the soil.
- **Region of root hair :** It is outer cell just above the region of elongation, give rise to lobular unbranched unicellular root hairs for increasing absorptive area.

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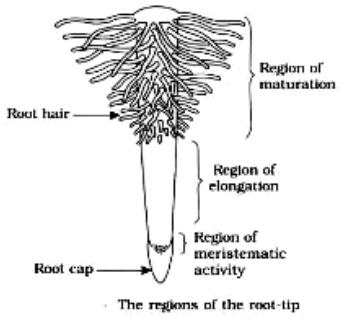
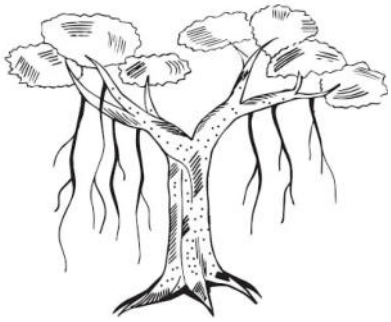


The regions of the root-tip

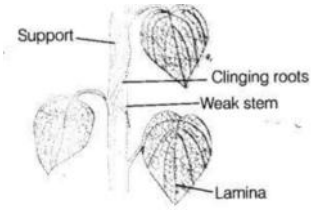
MODIFICATION OF ROOTS :

- **Prop root :** ex. Radish, Banyan.

(Prop or Stilt Roots of Banyan)

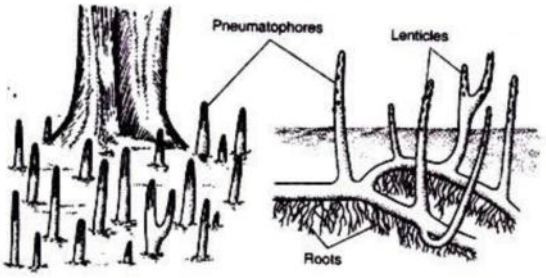


- **Stilt root :** ex. Screwpine.
- **Climbing root :** ex. Betel.



Betel (*Piper betel*)

- **Pneumatophores :** Also known as respiratory roots are short, vertical and negatively geotropic (grow in an upward direction) that occur in certain halophytes, which grow in saline marshes (mangroves). ex. rhizophora.



Pneumatophores of mangrove plant.

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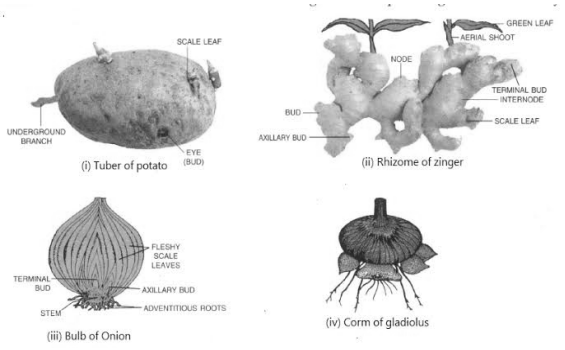
THE STEM

The Modified Stems

Underground Stems :

- **Tuber :** ex. Potato.
- **Bulb :** ex. Onion.
- **Rhizome :** ex. Ginger.
- **Corm :** ex. Amorphophallus.



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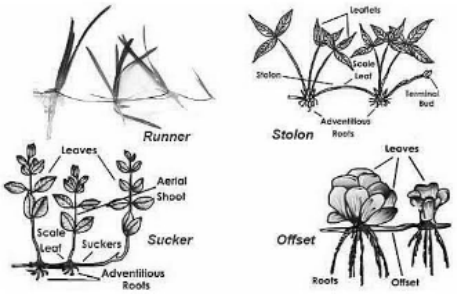
Sub-aerial Stems:

- **Runner :** ex. Oxalis.
- **Offset :** ex. Pistia.
- **Stolon :** ex. Mentha.
- **Sucker :** ex. Chrysanthemum.
- **Bulbil :** ex. *Oxalis, Dioscorea etc.*



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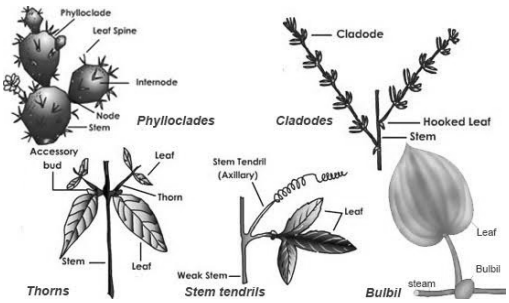
Aerial or Metamorphosed Stems:

- **Thorn :** ex. *Duranta.*
- **Stem-tendril :** ex. Grape.
- **Phylloclade :** ex. Opuntia.



■ **LEAF** is a green, flat lateral appendages located on node of stem, which is exogenous in origin. Leaves are mainly involved in photosynthesis and axillary buds found in their axil.

- **Leaf Base** is the point of attachment of the leaf petiole to the stem.
- **Petiole** is the stalk of the leaf. Sessile leaves do not possess petiole.

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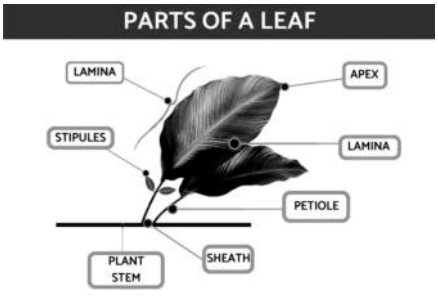
- **Lamina** is usually flattened green photosynthetic part of leaf.



Venation :

- **Reticulate Venation :** Here the veins are arranged in a net -like manner, ex. Dicots.
- **Parallel Venation :** Here the veins are arranged parallel-to each other, ex. Monocots.

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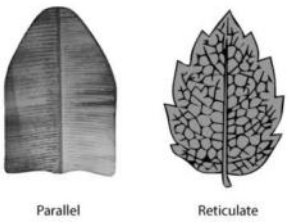
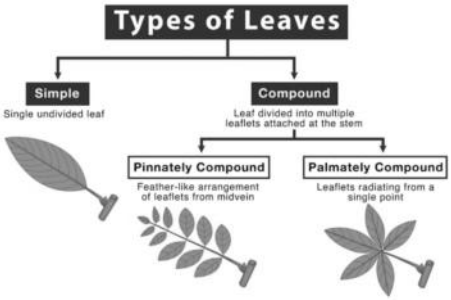
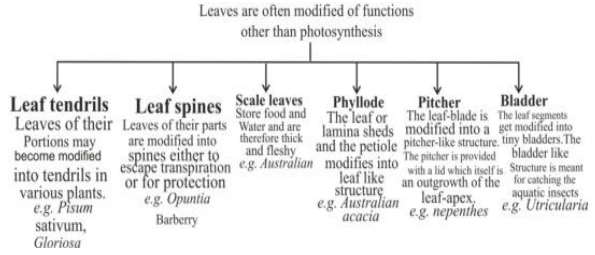


Types of the Leaves :



- **Simple leaf :** Lamina is not divided completely into distinct leaflets.
- **Compound :** Incision of leaf blade goes down to the rachis so the leaf is broken up into number of segments called **leaflefs.** They are of two types- pinnate and palmate.

MODIFICATIONS OF LEAVES



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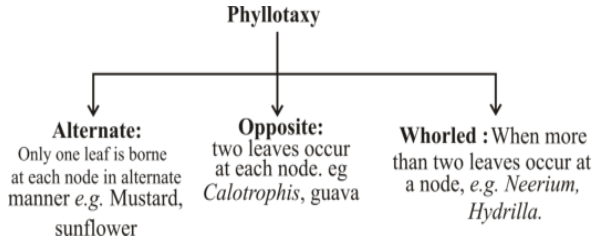
Phyllotaxy :

- It is the arrangement of mature leaves on the stem or its branches is called phyllotaxy. It is of three types:



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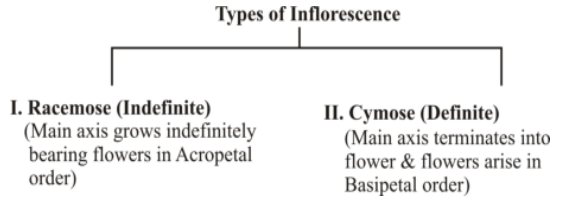
INFLORESCENCE :

- It is the mode of arrangement of flowers on peduncle or mother axis.



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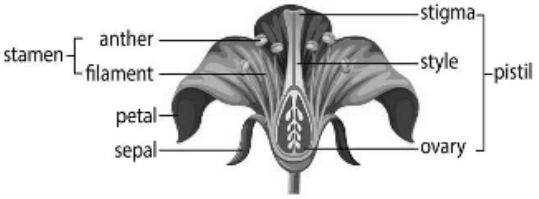
FLOWER :

- It is the reproductive unit in the angiosperms. which is meant for sexual reproduction. Morphologically, it is considered as a shoot bearing nodes and modified floral leaves.
- It is either unisexual (having either stamen of pistil) or bisexual (having both stamen and pistil).
- Based on the number of floral appendages present a flower may be **trimerous, tetramerous** or **pentamerous.**



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Symmetry of Flower :

- **Actinomorphic or regular flower :** *ex.*Malvaceae.

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- **Zygomorphic or irregular flower :** *ex.*Papilionaceae, Compositeae, Caesalpinaceae Poaceae.

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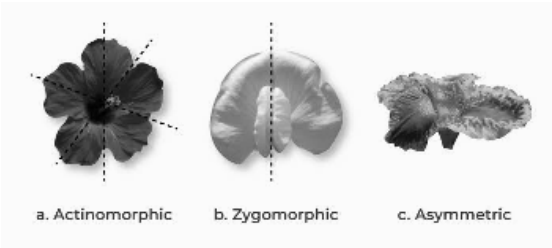
- **Asymmetric flower:** ex. Orchid.



PARTS OF FLOWER :

- A typical flower consist of four distinct parts i.e. **calyx, corolla, androecium** and **gynoecium.**
  Calyx : It is the outermost part, having sepals.
- **Polysepalous :** Sepals are free.
- **Gamosepalous :** Sepals are wholly or partially united.

Corolla:

- It is the whorl of brightly colored petals to attract insects for pollination. They are either fused (gamopetalous) or free (polypetalous).

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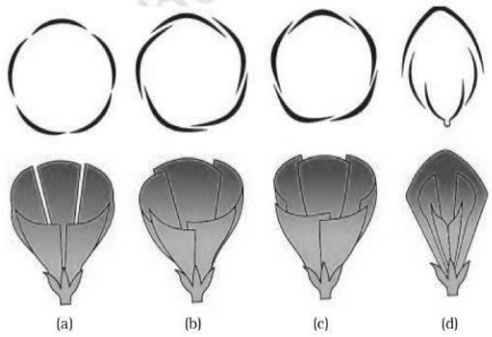
- **Aestivation** is the arrangement of sepals or petals in relation to one another in a floral bud.
- **Valvate** is the arrangement without overlapping *e.g.*, Custard apple. *Acacia.*
- **Twisted :** All are in or out, *e.g.*, china-rose.
- **Imbricate :** In this, one sepal/petal completely external, one is completely internal and test overlap one another *e.g.*, *Cassia.*
- **Vexillary** or **Descending Imbricate :** It consists of 5 petals. It overlaps a pair of smaller lateral petals, which in turn overlap a boat shaped keel *e.g*, Pea.



Types of aestivation in corolla : (a) Valvate (b) Twisted (c) Imbricate (d) Vexillary

Androecium :

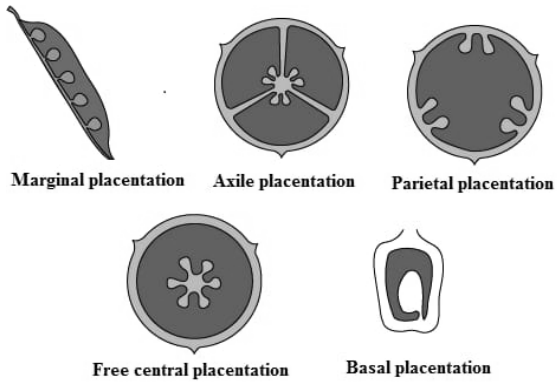
- It is male reproductive part of flower. Each stamen consist of a filament and an anther.

Gynoecium :

- It is a female reproductive part of flower consisting of the receptive and sticky stigma, the elongated slack style and the enlarged base ovary the bear ovules.

Placentation is the arrangement of ovules within the ovary.

- **Marginal :** *ex.*pea.
- **Parietal :** ex.Papaya, mustard.
- **Axile :** *ex.*china-rose, *Petunia.*
- **Free central :** *ex.*Primrose.
- **Basal :** ex.Compositeae, poaceae.



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FRUIT is the mature ovary developed after fertilization,which consist of pericarp and seeds.

- Parthenocarpic fruits develop from the ovary without fertilization.

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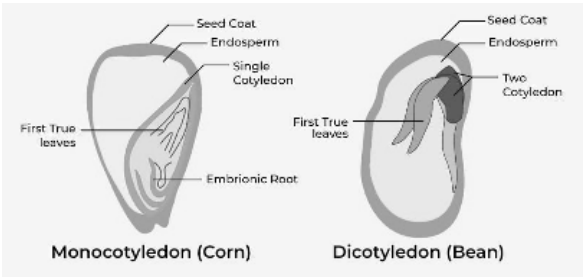
THE SEED :

- It is the ripened ovule which contains an integumented embryo or miniature plant with adequate reserve food for future development of the embryo.



Structure of Dicotyledonous seed :

- It is the outer or the only seed coat (if one is present) is called **testa,** while the inner on is named as **tegmen.** The surface of the seed possesses a fine pore at one end is called **micropyle,** behind the micropyle is present a dark spot called **hillum,** which is a scar left on the seed coat when it is detached from the fruit wall.

Structure of Monocotyledonous Seed :

- In maize grain the seed coat is fuse with the **preicarp.**
- The endosperm has one to three layered peripheral proteins layer called aleurone layers which separates the embryo with endosperm. The cotyledon is also called **scutellum** in cereals. The lower end of the axis is called the **radical** which has a protective sheath termed **coleorhizae.** The upper end of the axis is called the **plumule** which is covered by **coleoptile.**

DESCRIPTION OF SOME IMPORTANT FAMILIES

FABACEAE:

- They are commonly called as legume family. It is 4th largest and 2nd most valuable family of plant kingdom that provides maximum timber.
- **Habit –** Annual or biennial, herb, shrub or tree.
- **Root –** Tap root system.
- **Stem –** Erect or creeping, solid or weak.
- **Leaf –** Alternate or whorled, stipulate, compound, reticulate venation.

Floral characters :

- **Inflorescence :** Racemose
- **Flower :** Bisexual zygomorphic
- **Calyx :** Sepals five, gamosepalous; imbricate aestivation.