

# BIOLOGICAL SCIENCE

VOLUME 1

# **BIOLOGICAL SCIENCE**

## **Volume 1**

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# BIOLOGICAL SCIENCE

## VOLUME 1

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# Preface

Thanks to Allah s.w.t for His grace, this book can be completed within the stipulated time frame. This book is a reference to students taking the Biological Science course at Polytechnic. For the first series we provide the first topic which is Introduction to Biological Sciences while the second topic is Agricultural Botany.

During the preparation of this book, there are many challenges and obstacles that need to be faced before it can produce a book that is very robust in terms of its delivery content. The book explains the concept and reality of human relations, animals, and plants in life. Biology is a field of knowledge that studies life, environment, and the interaction of life with the environment.

The study of biology allows the human being to understand oneself and the relationship between man and other organisms as well as the phenomena that occur because of such relationships. The application of biological knowledge and biological research has brought many benefits to human life. Rapid developments in the field of biotechnology, genetic engineering and food technology have brought many advances in medicine, agriculture, and industry.

Hopefully, writing about biology will benefit the students and if there are many flaws and shortcomings in this book, I accept with an open heart if there are any constructive views and comments on this book.

Wallahu'alam.

Thank you

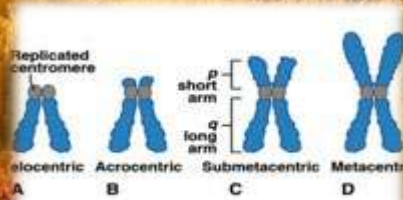
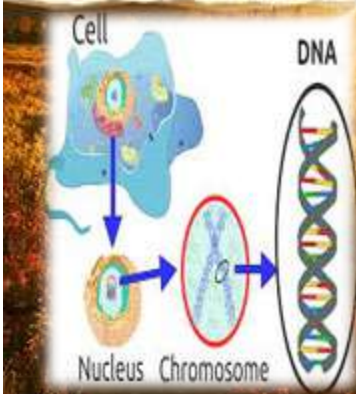
**Nor Azlan bin Ali**  
**Editor**

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# CHAPTER 1:

# INTRODUCTION TO BIOLOGICAL SCIENCE



## 1.1 Definition of Biological Science

What is Biology?

It is derived from 2 Greek words :

**Bios** | **logos**

life

The study of

*It's a scientific study*



*Biological Science is.....*

**The science that study of life or living things**

## 1.2 Characteristic of living thing

The characteristics of living things?

- Cell is basic unit of life.
- They are highly organized.
- They response to stimuli.
- Nutrition – they feed to obtain energy.
- Respiration – they break down food to obtain energy.
- Metabolism – they are capable of increasing in size and number.
- Reproduction – they produce offspring.
- Excretion – they expelled wastes.
- They are able to adapt to different environments.

## 1.3 Importance of biological science knowledge

### What is the importance of Biological Science in **LIFE** ??



- Improved understanding on functions of organisms.
- Improved understanding on causes of disease.
- Finding treatment for diseases.
- Improved understanding on ecology.
- Better management on environment problems.
- Improved quality and production of food.



### The importance of Biological Science in **AGRICULTURE**

- Increase high quality agricultural products.
- Increase nutritional qualities.
- Produce high yielding varieties of crops plant such as paddy, oil palm, etc.
- Disease resistant and pest resistant in crops.
- Biological control.
- Reduce the usage of pesticides.
- Reduce vulnerability of crops to environmental stress .
- Less cost
- Increase country's income







## The components in Biological Science

|                   |                |              |
|-------------------|----------------|--------------|
| Ornithology       | Botany         | Physiology   |
| Anatomy           | Cytology       | Microbiology |
| Molecular biology | Ecology        | Taxonomy     |
| Biotechnology     | Genetic        | Biochemistry |
| Histology         | Marine biology | Morphology   |

### 1.4 Jobs related to Biology

#### Job or Careers Related to Biology

*The following are all biologist in different ways:*

|                         |  |
|-------------------------|--|
| <b>Doctors</b>          | <b>Biotechnologists</b>                  |
| <b>Nurses</b>           | <b>Forensic Scientists</b>               |
| <b>Dentists</b>         | <b>Nutritionists</b>                     |
| <b>Physiotherapists</b> | <b>Farmers</b>                           |
| <b>Veterinarians</b>    | <b>Horticulturalists &amp; Foresters</b> |

# CHAPTER 2: AGRICULTURAL BOTANY



## 2.1 Definition of Agricultural Botany

### What is Agricultural Botany??

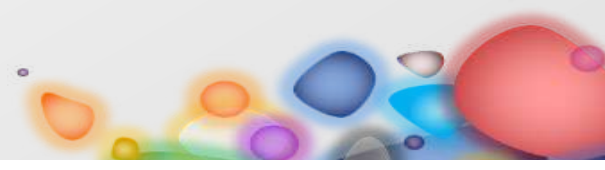
- The study of plants to improve the production of agriculture product.



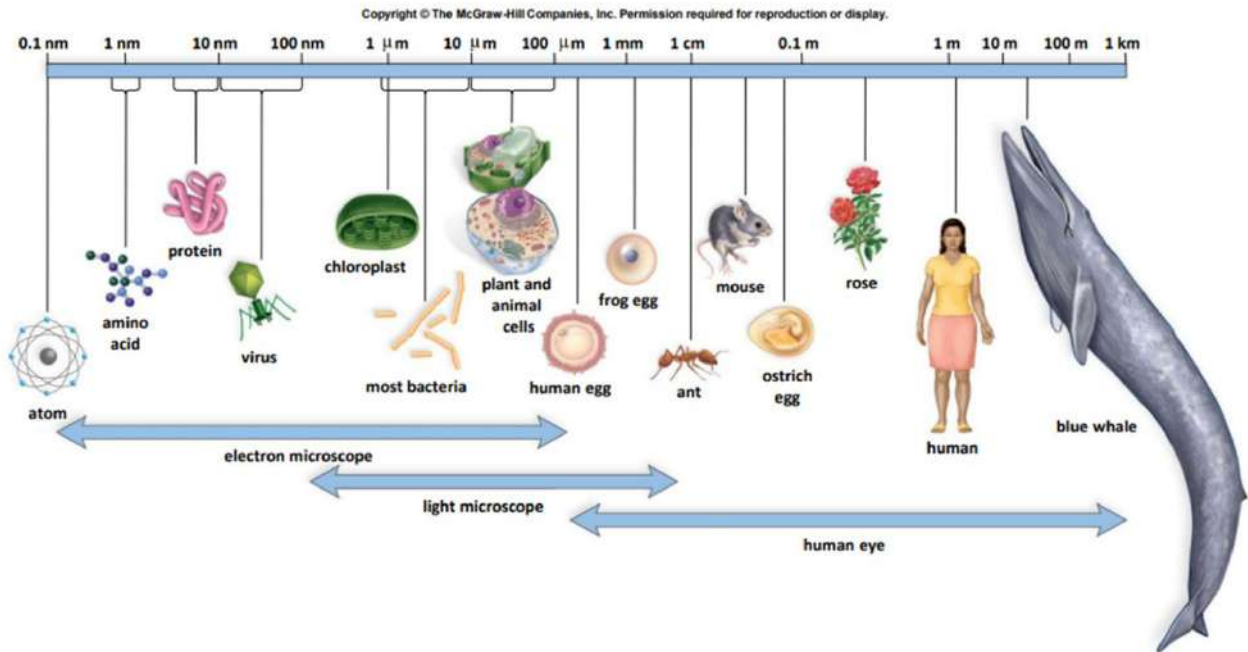
## 2.2 Cytology

### Cytology

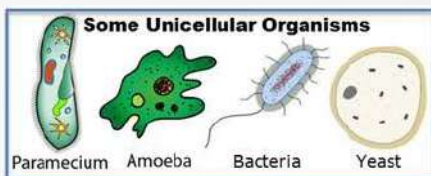
- A cell is a **basic unit of life**.
- All living organism are composed of cells and begin life from a single cell
- New cells are formed by the division of pre-existing cells

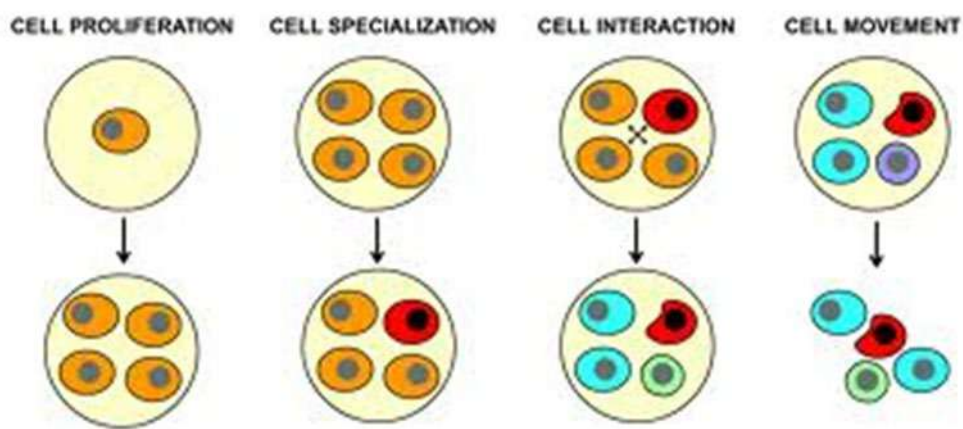
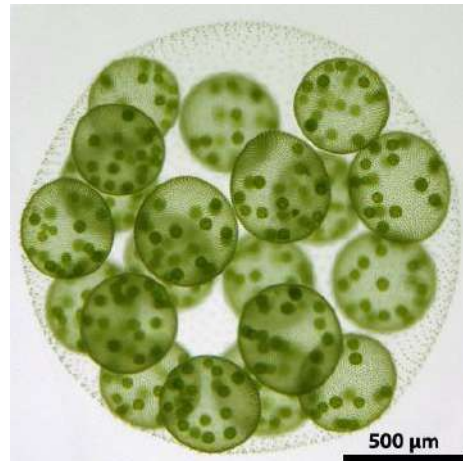


# CELL MEASUREMENT



- **All metabolic reaction** take part in cells
- **Unicellular organism** – made up of just one cells, example?
- **Multicellular organism** – consist of many cells, example?

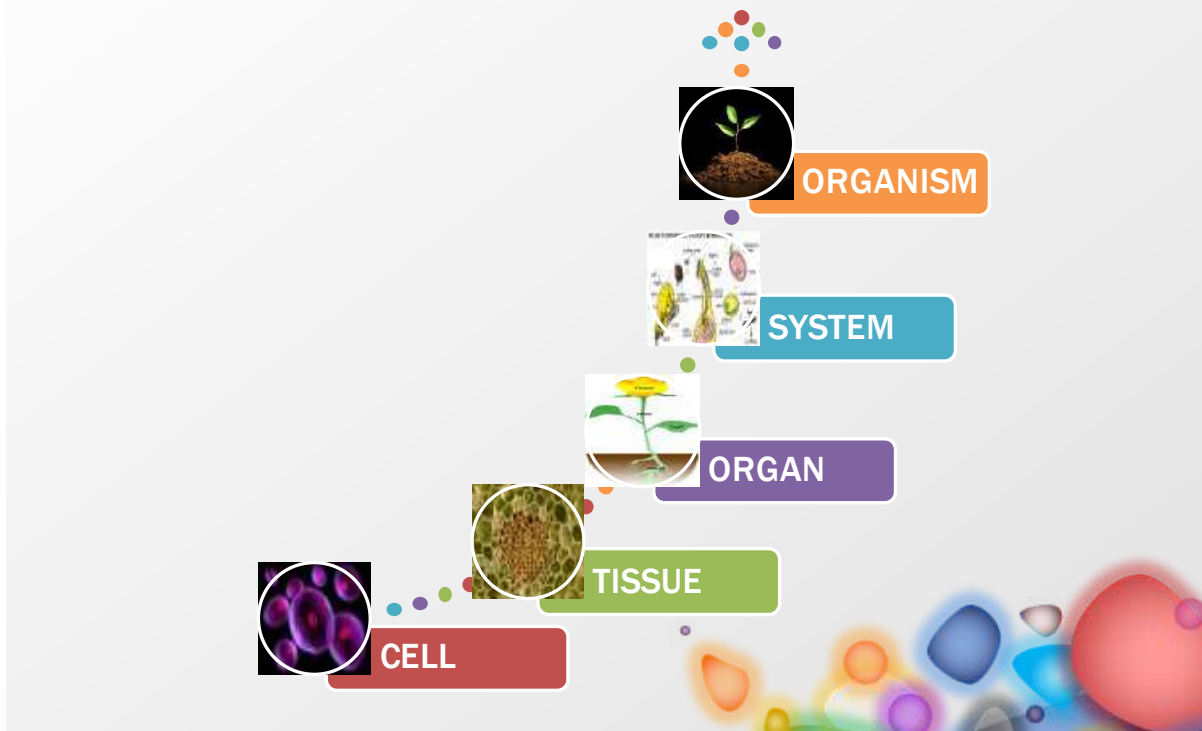




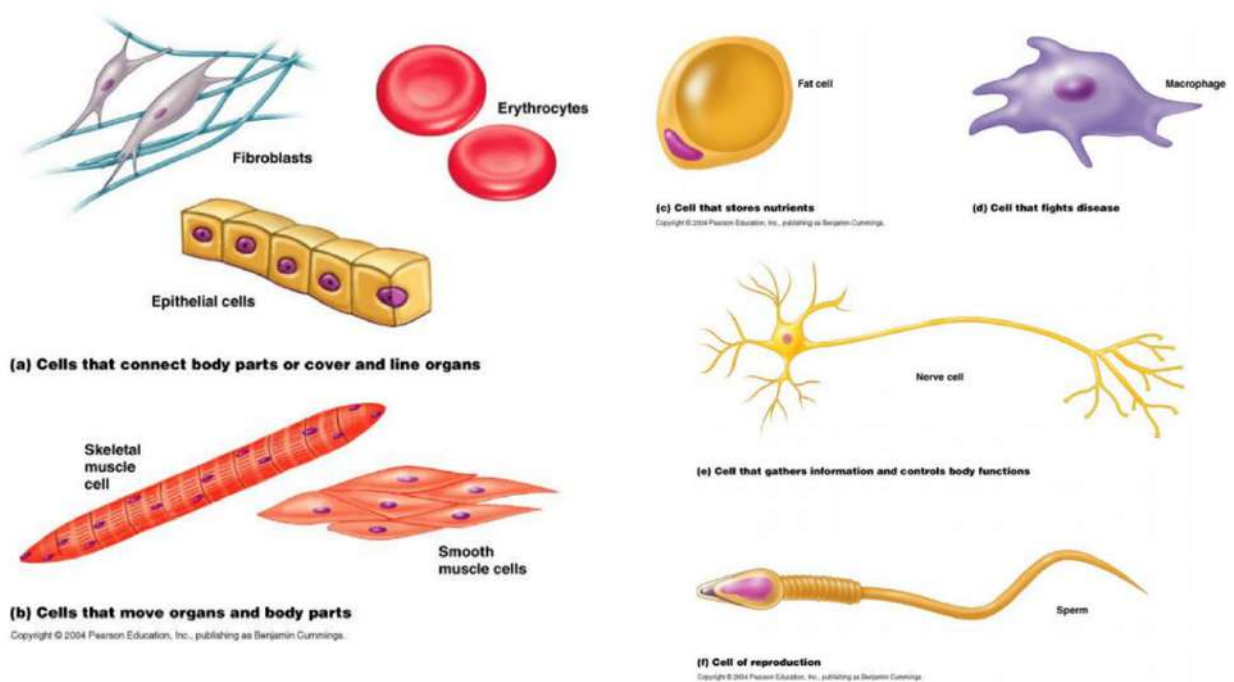
- A **tissue** consist of a group of **cells** and carry out a particular common function
- An **organ** consist of a number of different tissues working together as a functional unit
- Different organ work together as organ **systems**



# LEVEL OF ORGANIZATION



## TYPES OF CELL



# Comparison Between Prokaryotes and Eukaryotes

## PROKARYOTES

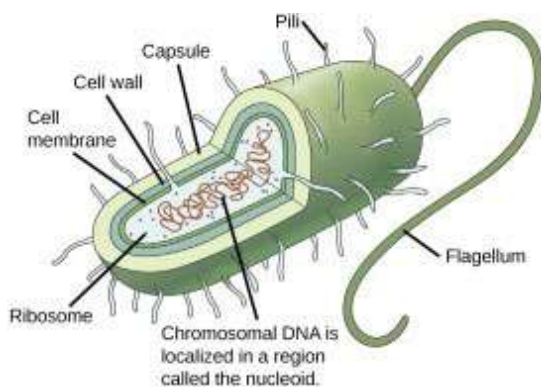
- 'Before Nucleus'
- No Internal Membrane bound structure
- Examples : only BACTERIA

## EUKARYOTES

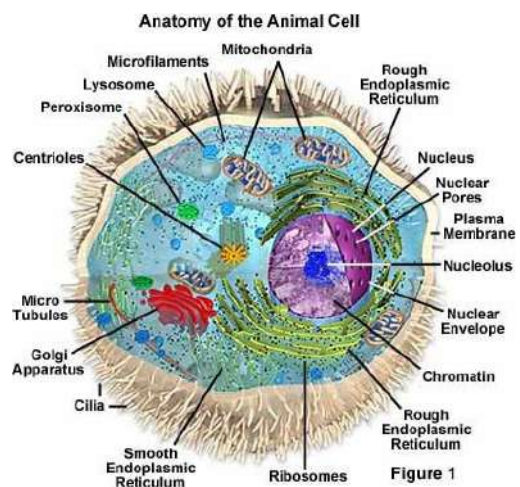
- 'True Nucleus'
- Have internal membrane bound structures
- Examples : protozoans, fungi, algae, animals, plants.

## DIAGRAM

### PROKARYOTIC CELL



### EUKARYOTIC CELL



# DIFFERENCES BETWEEN PROKARYOTIC AND EUKARYOTIC CELL

| FEATURES  | PROKARYOTIC CELL      | EUKARYOTIC CELL          |
|-----------|-----------------------|--------------------------|
| NUCLEUS   | • NO NUCLEUS          | • HAS NUCLEUS            |
| STRUCTURE | • SIMPLE STRUCTURE    | • COMPLEX STRUCTURE,     |
| SHAPE     | • APPEAR FLAT SHAPE   | • APPPEAR CIRCULAR SHAPE |
| DNA       | • DNA WITHOUT PROTEIN | • DNA WITH PROTEINS      |
| RIBOSOMES | • SMALL (70 S)        | • LARGE (80 S)           |

S = Svedberg unit

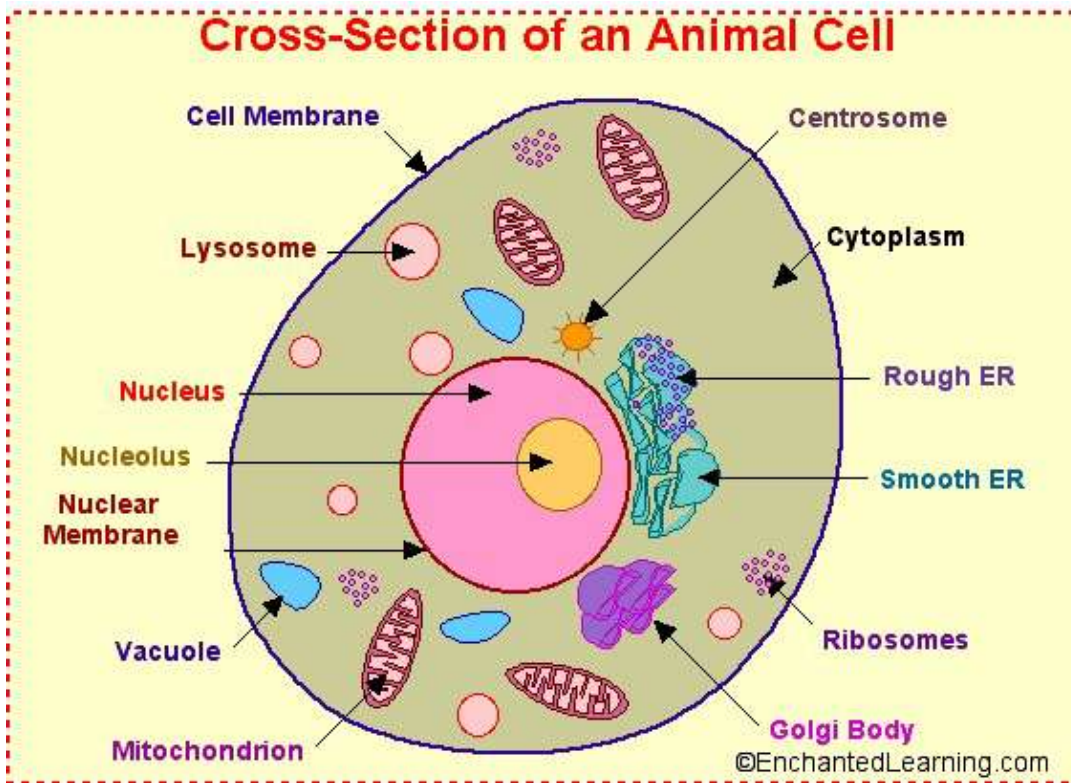


## ANIMAL CELL

- All animal cells are multicellular.
- They are eukaryotic cells.
- Animal cells are surrounded by plasma membrane and it contains the nucleus and organelles that are membrane bound.



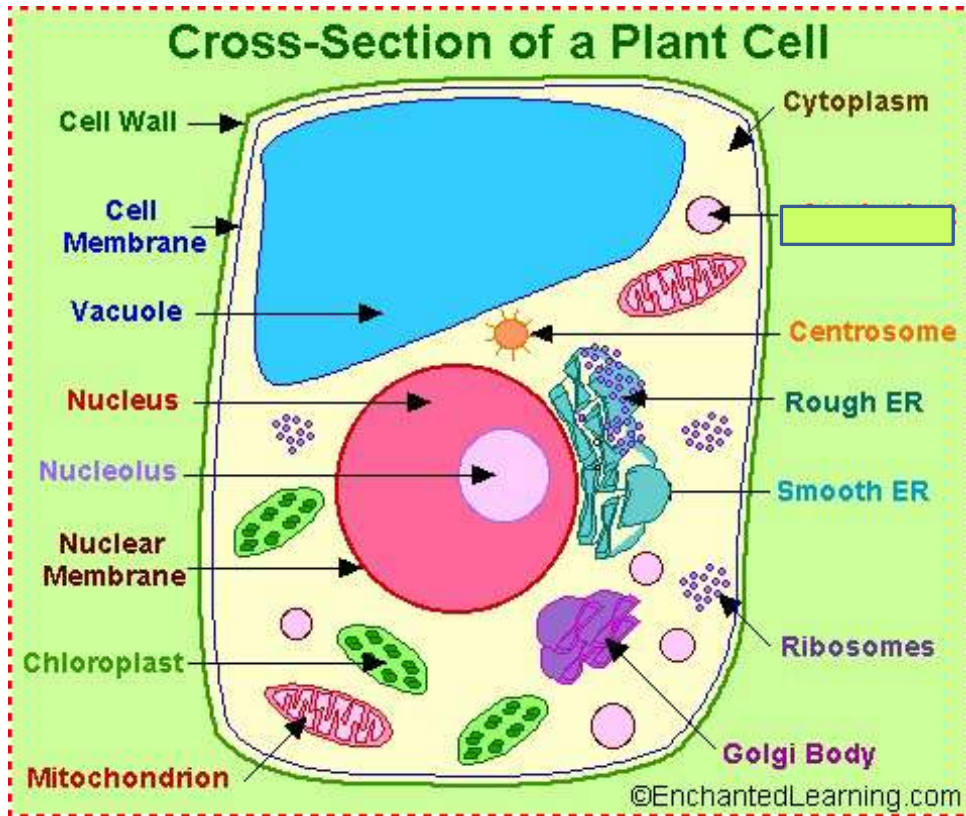




## PLANT CELL

- Plant cells are **eukaryotic cells**, or cells with a membrane-bound nucleus.
- Plant cells are similar to animal cells in that they are both eukaryotic cells and have similar organelles.
- Plant cells **are generally larger** than animal cells.
- A plant cell also contains structures not found in an animal cell:
  - Cell wall
  - Chloroplast

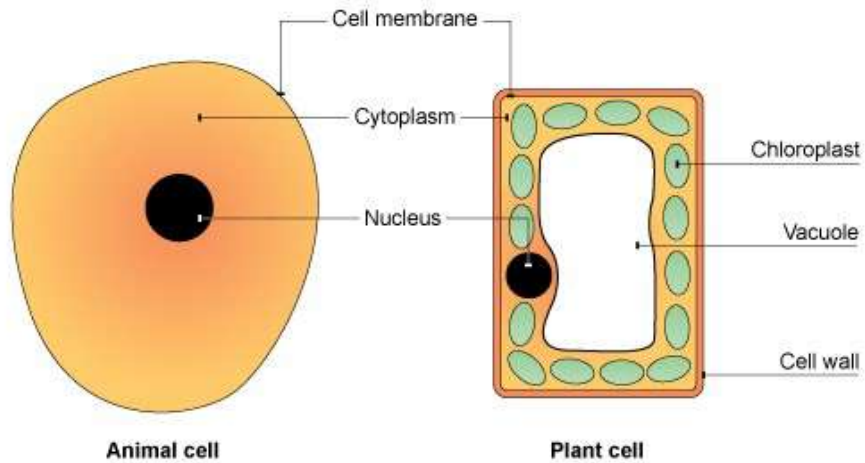




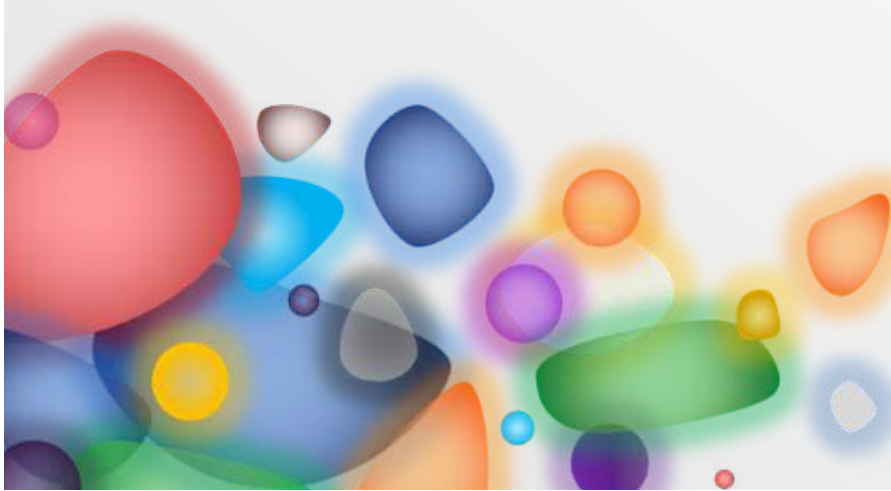
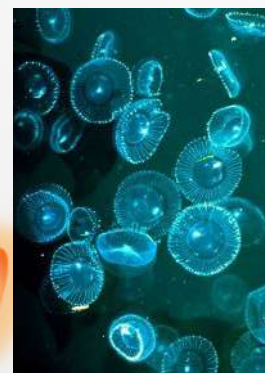
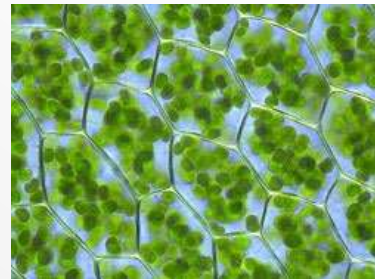
## COMPARISON BETWEEN ANIMAL CELLS & PLANTS CELLS

| ANIMAL CELL  | Similarities        | PLANT CELL             |
|--|---------------------|------------------------|
| <input type="checkbox"/> Both have a nucleus, cytoplasm, plasma membrane, Golgi apparatus, mitochondria, endoplasmic reticulum and ribosomes |                     |                        |
| ANIMAL CELL  | Differences         | PLANT CELL             |
| Do not have fixed shape  | <u>Shape</u>        | Have fixed shape       |
| Do not have cell wall  | <u>Cell wall</u>    | Have cell wall         |
| Do not have vacuoles (or small)  | <u>Vacuoles</u>     | Large vacuoles         |
| Do not have chloroplast  | <u>Chloroplasts</u> | Have chloroplasts      |
| Glycogen   | <u>Food storage</u> | Starch                 |
| Have centrioles  | <u>Centrioles</u>   | Do not have centrioles |

# COMPARISON BETWEEN ANIMAL CELL AND PLANT CELL

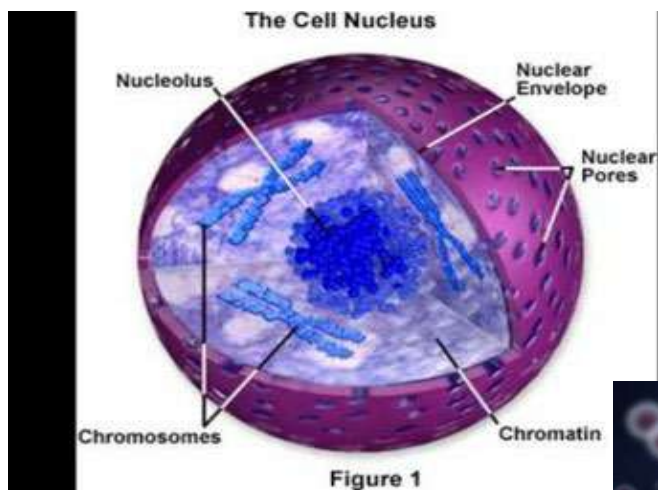


## FUNCTION OF ORGANELLES



# NUCLEUS

- The **largest** most **easily seen** organelle in eukaryote cell
- All living cells have nucleus except : **blood cell and sieve cell**
- Compose of several elements : **nuclear membrane/envelope, nucleoplasm, chromosome/DNA & nucleolus**
- Usually **round or oval shape**



## FUNCTIONS OF NUCLEUS:

- Control the cell activities
- Keep the genetic information
- Production of ribosome
- Sites for cell division



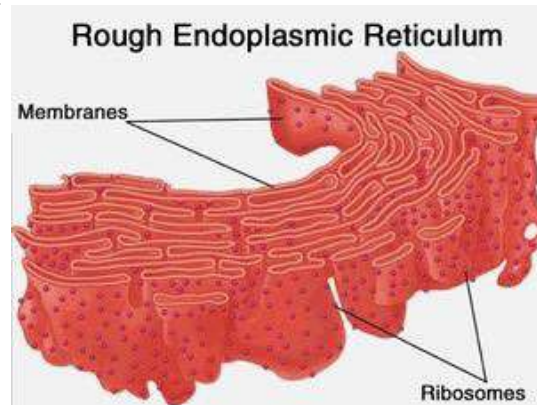
## ENDOPLASMIC RETICULUM

- There are **two types of ER** that differ in structure and functions:
  - Rough ER
  - Smooth ER



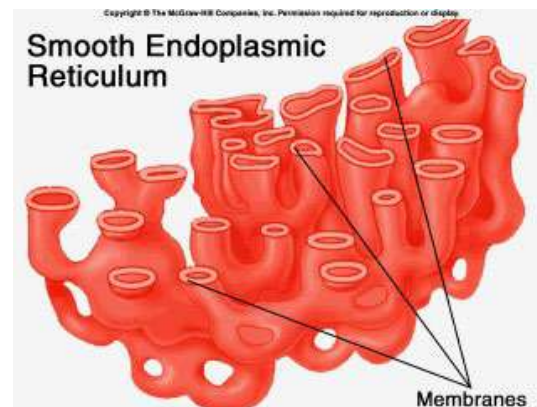
# ROUGH ENDOPLASMIC RETICULUM

- Has **RIBOSOMES** that attach to the outer membrane of RER
- **Function;**
  - **Synthesis, packing and transport of protein**



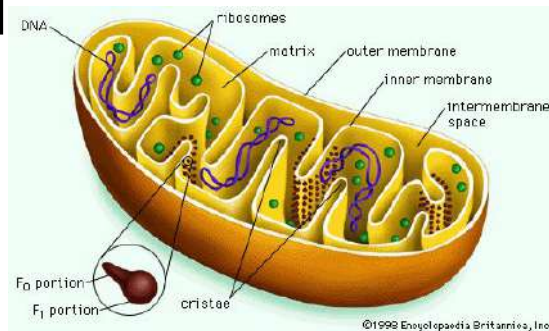
# SMOOTH ENDOPLASMIC RETICULUM

- Its outer space **LACKS** or **NO** ribosomes
- **Functions:**
  - **Synthesis and transport lipid**
  - **Metabolism of carbohydrates**
  - **Detoxification of drugs and poisons**



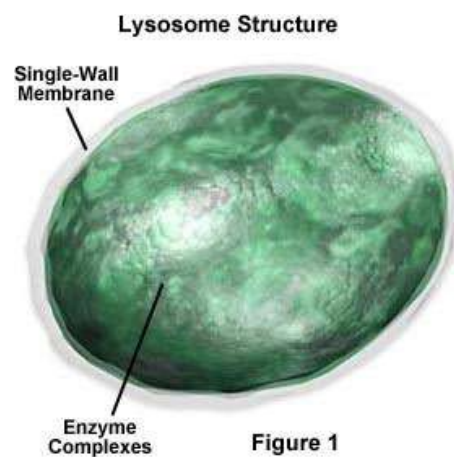
# MITOCHONDRIA

- Generally are rod shapes
- **Functions:**
  - **Synthesis of ATP**
  - **Site of cellular aerobic respiration**



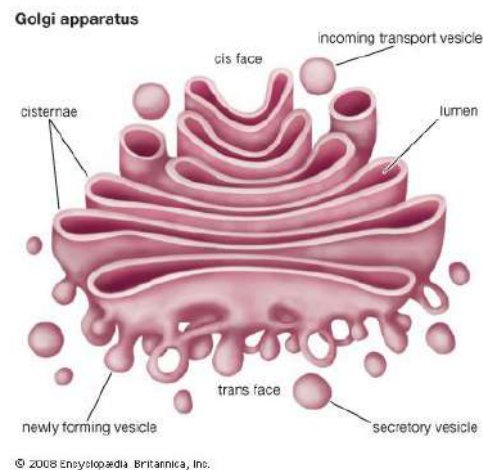
# LYSOSOMES

- A membranous sac of hydrolytic enzymes
- **Function:**
  - **Digest all kinds of macromolecules**



# GOLGI BODIES/GOLGI APPARATUS

- Consist of a stack of flattened, membrane-bound sacs called cisternae (look like pita kebab)
- **Functions:**
  - **Receives vesicles from ER**
  - **Stores and modified the protein**
  - **Transport their final destination inside and outside the cell**

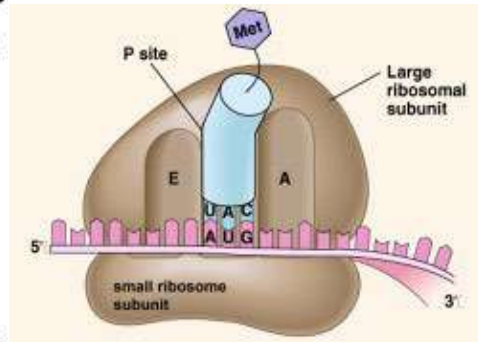
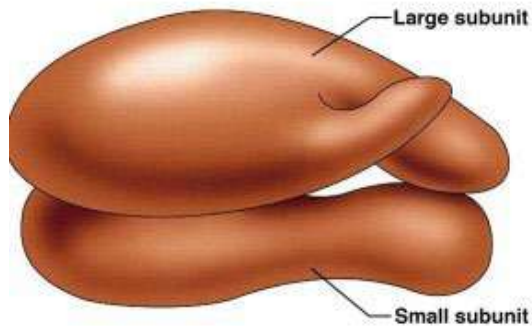


# RIBOSOMES

- Small, dense granules
- There are two types of ribosomes 70S & 80S
  - 70S are found in prokaryotic cells
  - Larger 80S are found in eukaryotic cells
- **Function:**
  - **Sites of proteins synthesis**

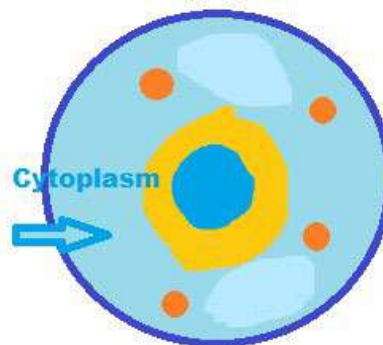


## Structure of a Eukaryotic Ribosome



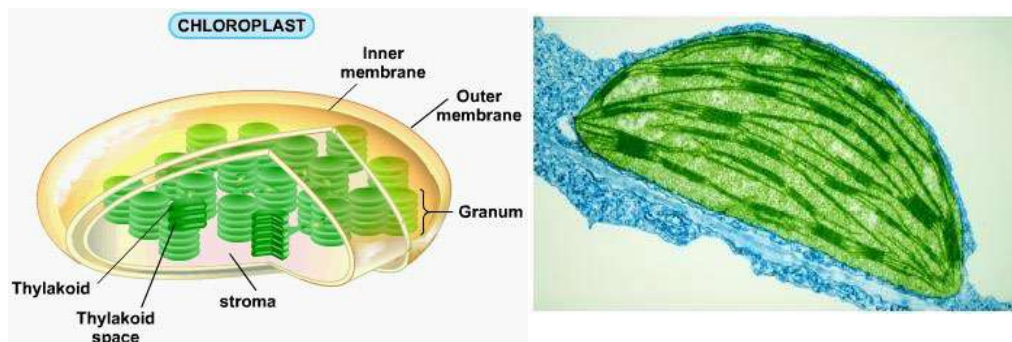
# CYTOPLASM

- the entire region between the nucleus and the plasma membrane.
- **Functions;**
  - Site for biochemical reactions, for example glycolysis
  - The place where the organelles scattered out



# CHLOROPLAST

- Green coloured plastids containing green pigment chlorophyll
- Thylakoid – interconnected sacs
- Grana (Granum) – The stack that bound the thylakoid
- Stroma – Fluid outside the thylakoid
- **Function:**
  - **Sites of Photosynthesis**



# VACUOLES

- Prominent organelle in older plant cells
- **Functions:**
  - storage/hold organic compound
  - disposal sites
  - contain pigments that colour cell
  - enlarge the plants cell as vacuole absorb water

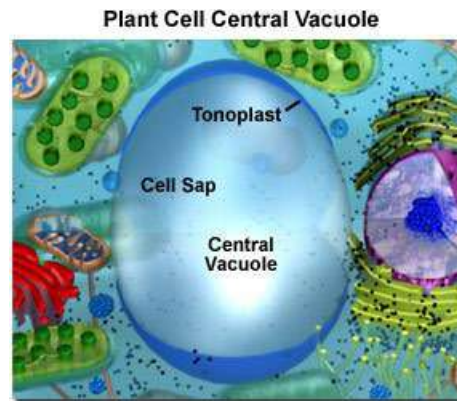
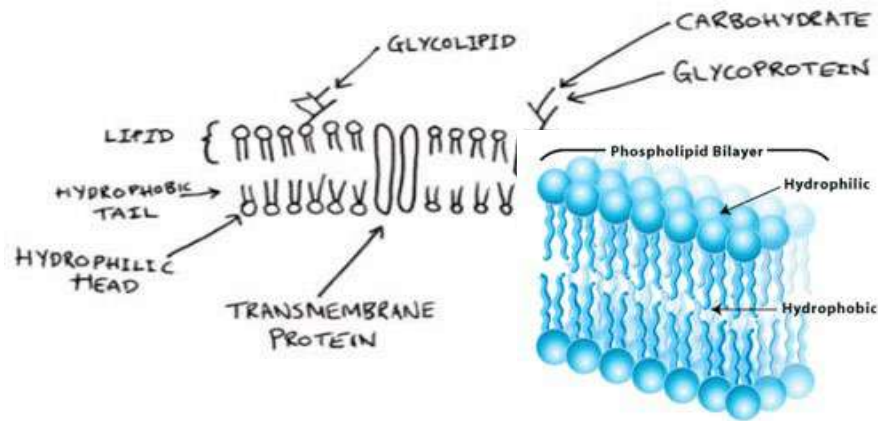


Figure 1

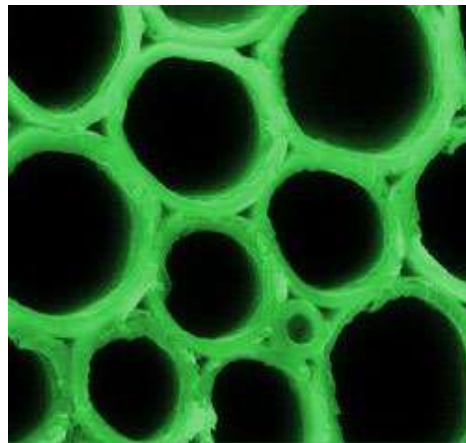
# PLASMA MEMBRANE

- A thin layer – separates cell contents from extracellular environment
- Consist of phospholipid bilayer (PB) – hydrophobic region & hydrophilic region
- **Functions:**
  - Separates cytoplasm from environment
  - Control traffic of molecules into and out of cells-it is selective permeable
  - Give shape, strength and protection of cells



## CELL WALL

- Found only in Plant Cell
- **Functions:**
  - Provide protection from physical injury
  - Support and mechanical strength
  - Maintaining/determining cell shape
  - Prevents the cell membrane from bursting in a hypotonic medium

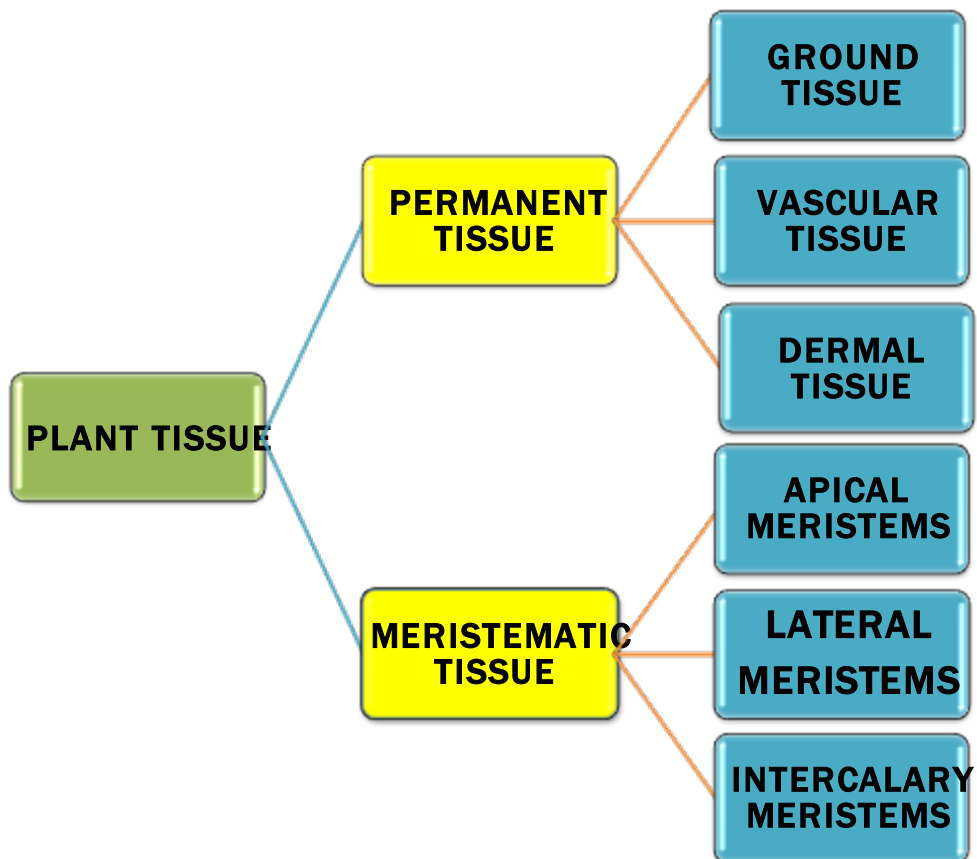


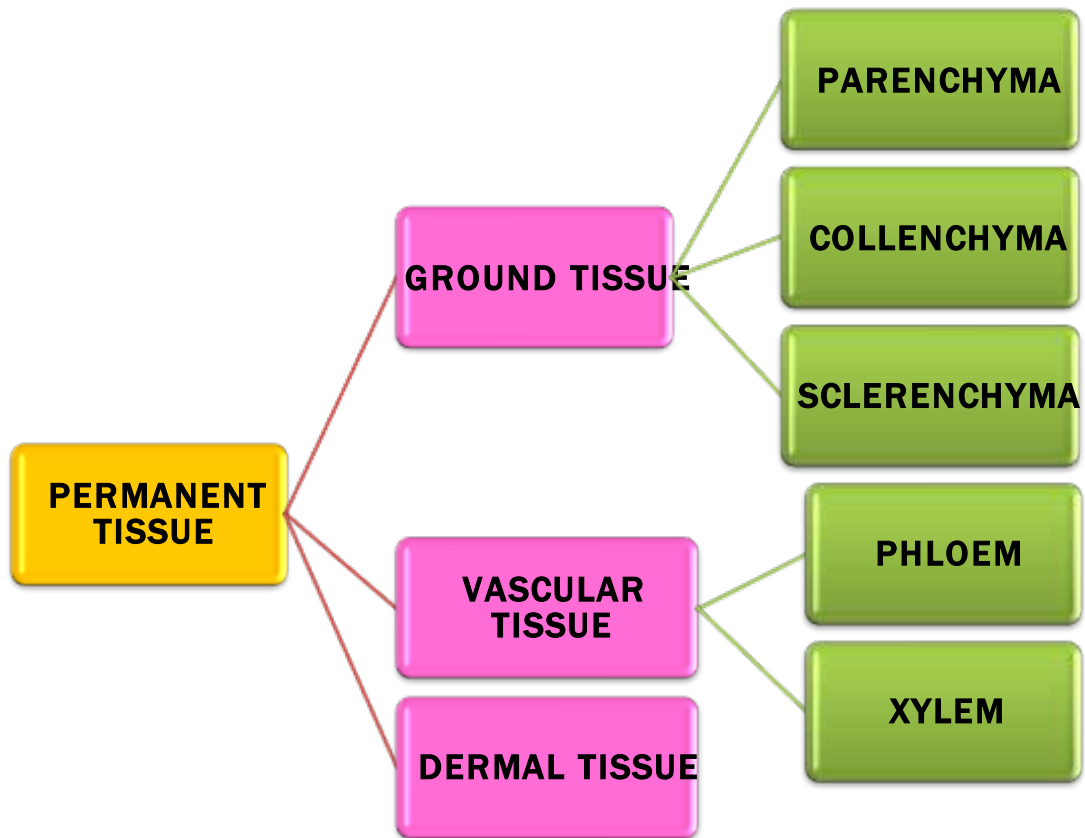
## 2.3 PLANT ANATOMY

### ❖ PLANT ANATOMY

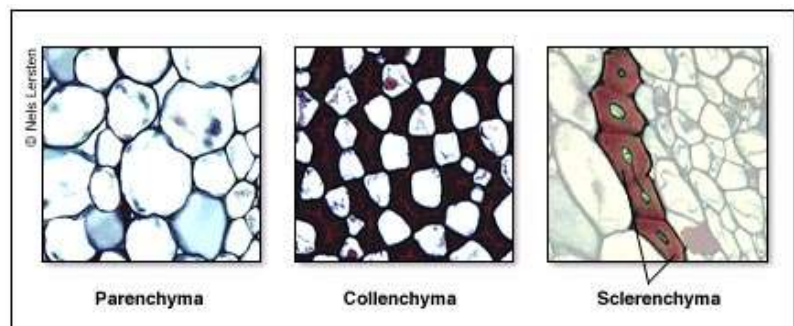
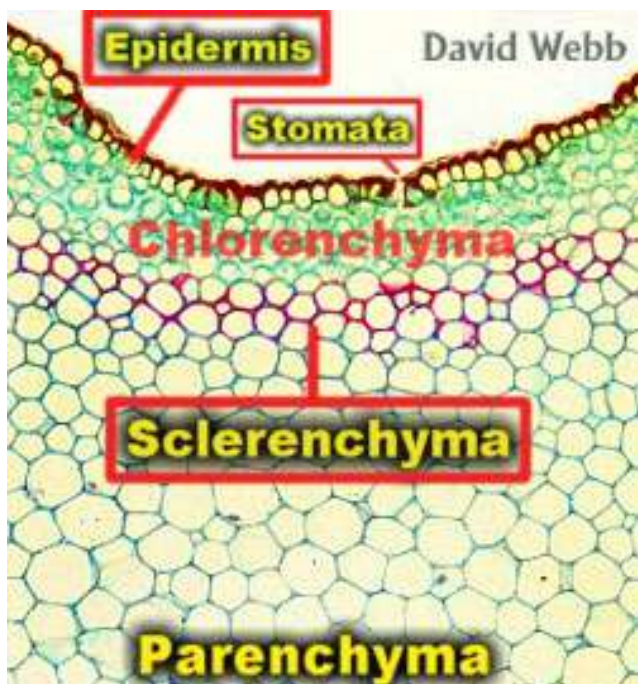
- PLANT TISSUE

- PLANT ORGAN



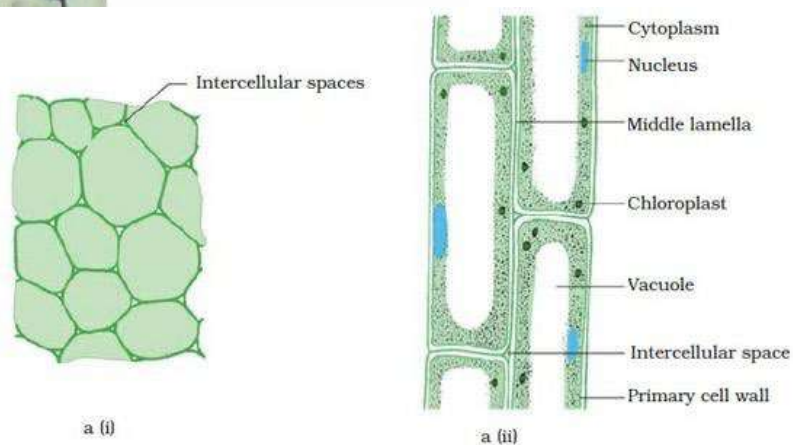
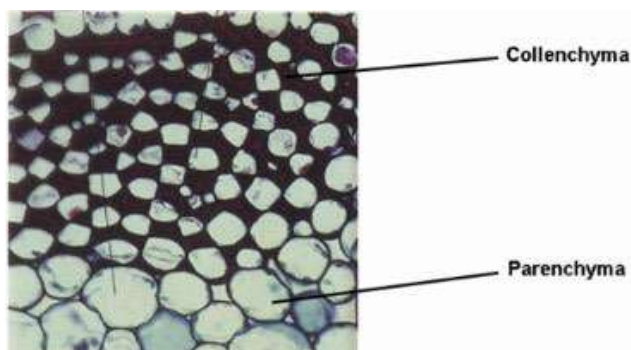


## GROUND TISSUE



# Ground Tissue - Parenchyma

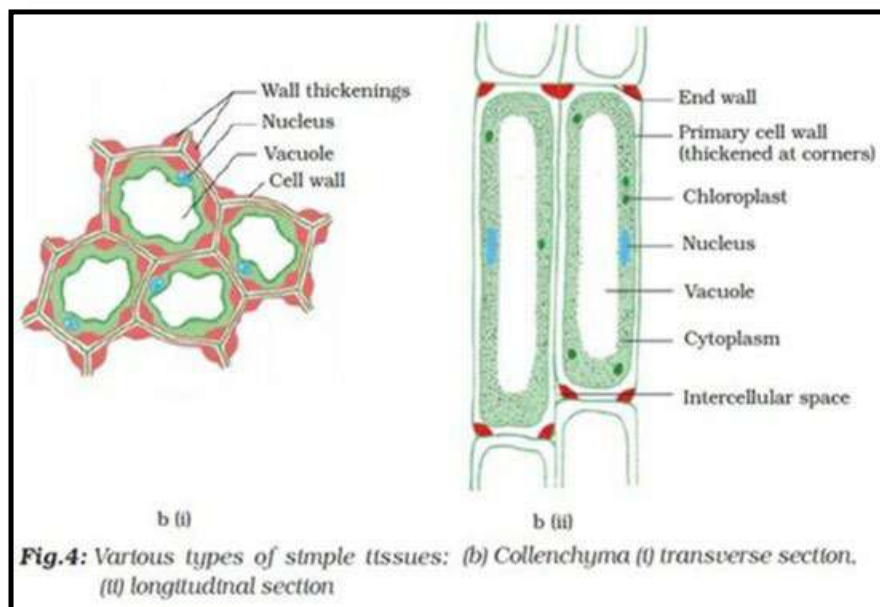
- Parenchyma is the most common plant tissue.
- It is relatively unspecialized and makes up a substantial part of the volume of a herbaceous plant and of the leaves, flowers and the fruits of woody plants
- Characteristics - thin-walled, large vacuoles and distinct intercellular spaces.
- **Functions:**
  - Storage of food and water
  - Gases exchange



**Fig.4:** Various types of simple tissues: (a) Parenchyma (i) transverse section, (ii) longitudinal section;

# Ground Tissue - Collenchyma

- Collenchyma cells have a primary wall that remains thin in some areas but becomes thickened in other areas
- Characteristics :
  - thick cellulose cell walls which thickened at the corners.
  - Intercellular air spaces are absent or very small.
  - contain living protoplasm.
  - sometimes contain chloroplasts
- **Function:**
- **provide support in young parts of plant**





# Ground Tissue - Sclerenchyma

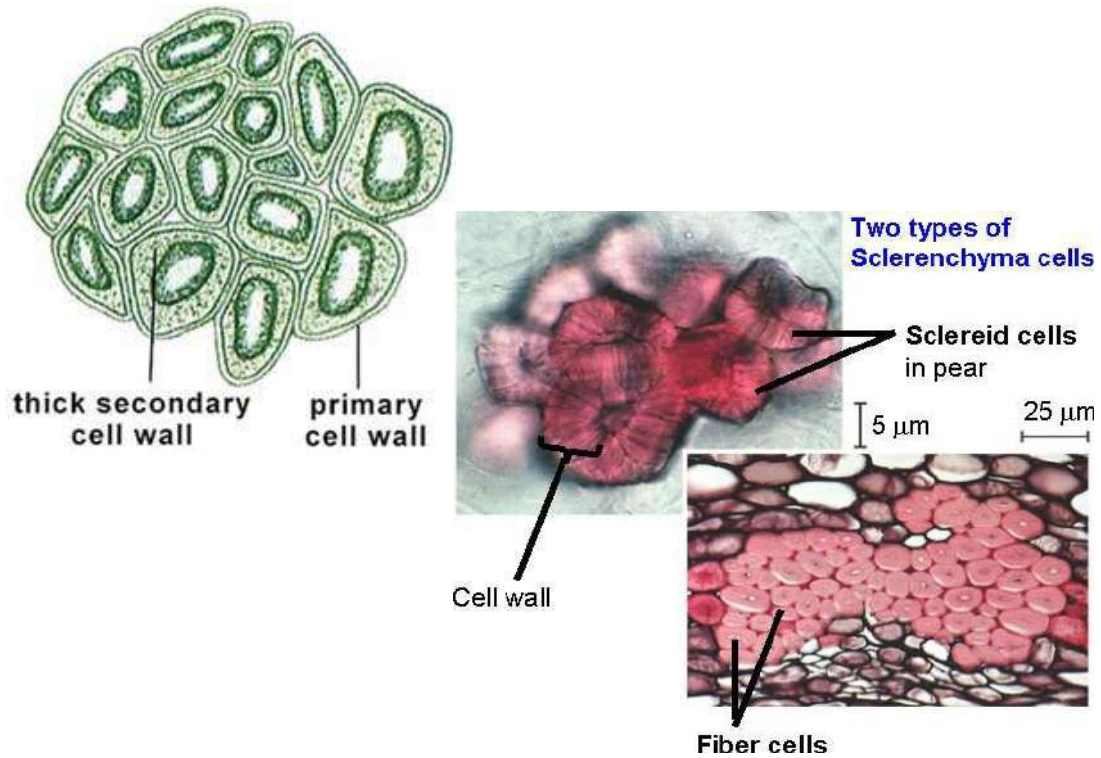
- **Function :**
- **supporting and protection tissue in plants.**
- **Characteristics:**
  - Dead cells with extremely thick cell walls
  - Cell walls consists of cellulose, hemicellulose and lignin.
- **Consist TWO types:**
  - Sclereids
  - Fibers

## SCLEREIDS

- Shorter and irregular shape
- Have very thick, lignified secondary walls
- Impart the hardness to nutshells and seed coat
- And the gritty texture to pear fruits

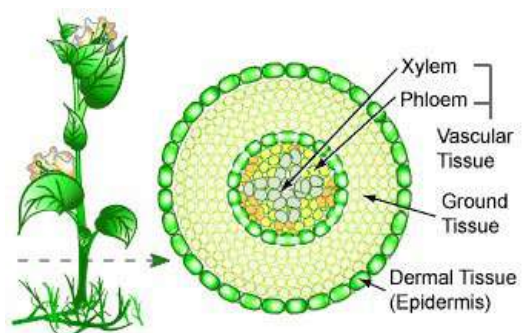
## FIBERS

- Arranged in threads
- Long, slender and tapered
- Used as hemp fibers for making rope and flax fibers for weaving into linen



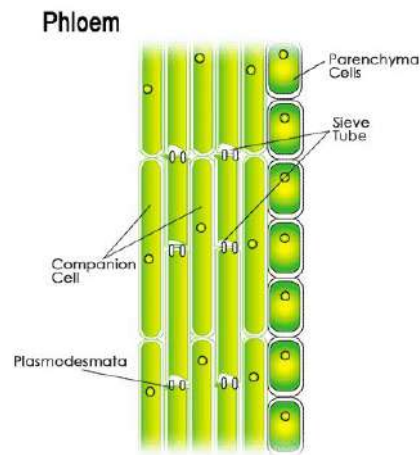
## VASCULAR TISSUE

- **Function :**
- **the distribution of nutrients, water and the product of photosynthesis**
- **Consist:**
  - **Phloem**
  - **Xylem**



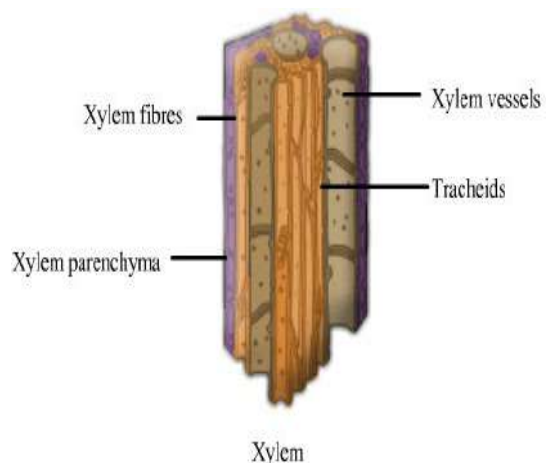
# Vascular Tissue - Phloem

- **Function:**
  - **Transport organic nutrients to other parts of plant**
- **Parts of phloem:**
  - **Sieve tube**
    - **Transport nutrient**
  - **Companion Cell**
    - **Provide support to sieve tube**



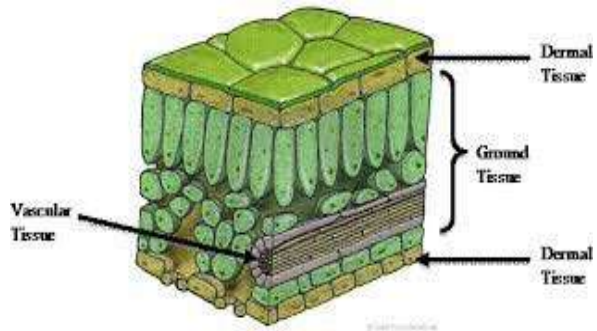
# Vascular Tissue - Xylem

- **Function :**
- **Conveys water and dissolved minerals from roots into the shoots**
- **Parts of xylem:**
  - **Vessels**
    - **Enables water to flow freely**
  - **Tracheids**
    - **Water moves from cell to cell through pits**



# DERMAL TISSUE

- **Function:**
- **Outer protective covering**
- In non woody plants – consists single layer of tightly packed cells called **EPIDERMIS**
- Woody Plants – protective tissues called **PERIDERM**



# MERISTEMATIC TISSUE

## STRUCTURE

- The cells are small, thin-walled, have a central large nucleus and dense cytoplasm with small vacuole.
- The cells are rectangular and closely packed with no intercellular air spaces.

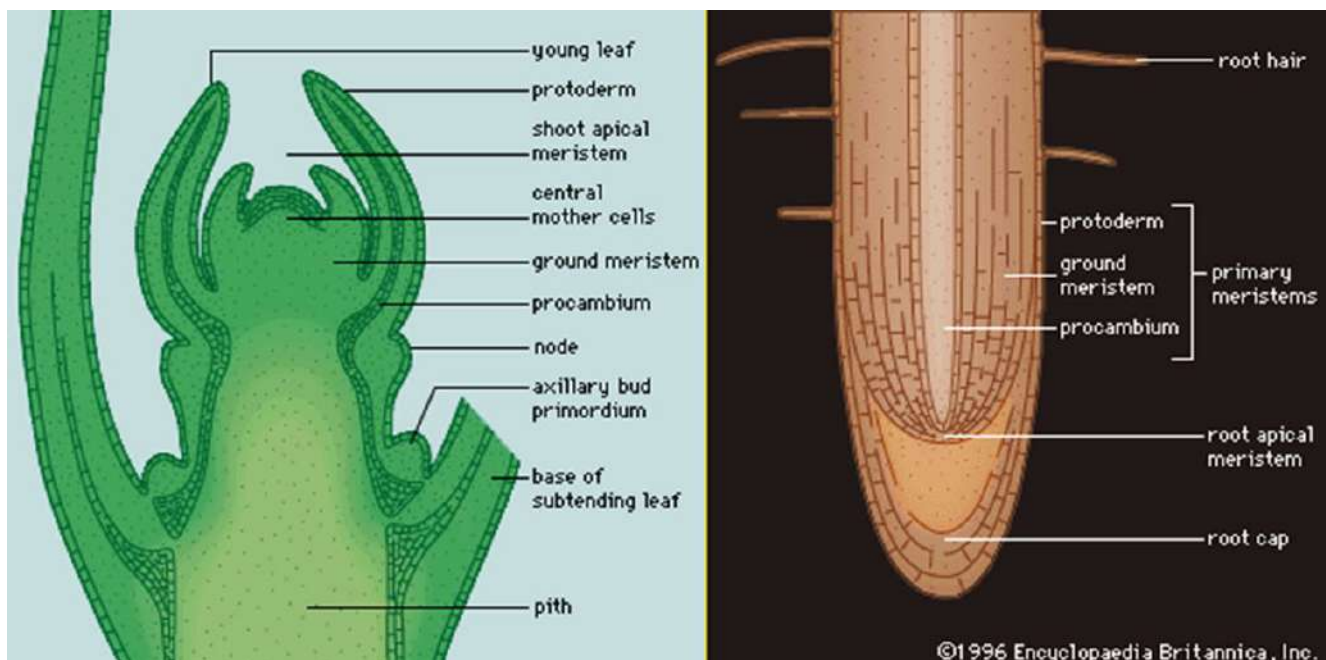
## FUNCTION

- Retain the ability to divide by mitosis to produce new cells.



# Apical Meristems

- ❖ **Location** : Shoot apical meristem  
: Root apical meristem
- ❖ **Functions**: Responsible for **primary growth**  
:Responsible for **producing new buds and leaves**
- **Shoot apical meristems** also produces epidermis, cortex, primary xylem and phloem and the central pith .
- **Root apical meristems** located at the various terminal of the root are the **growing points for the root system.**

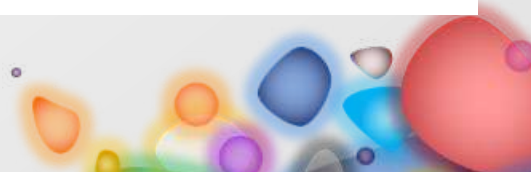
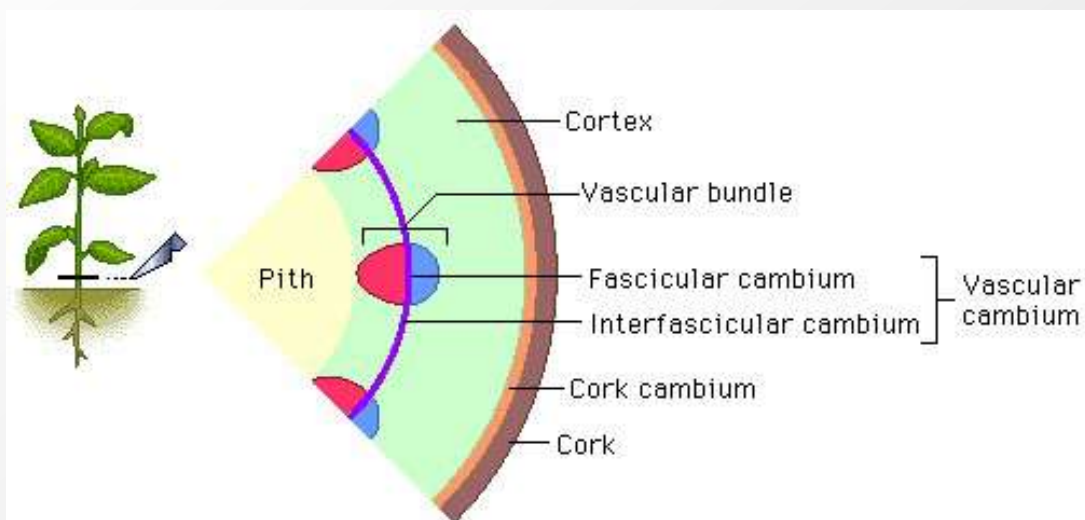


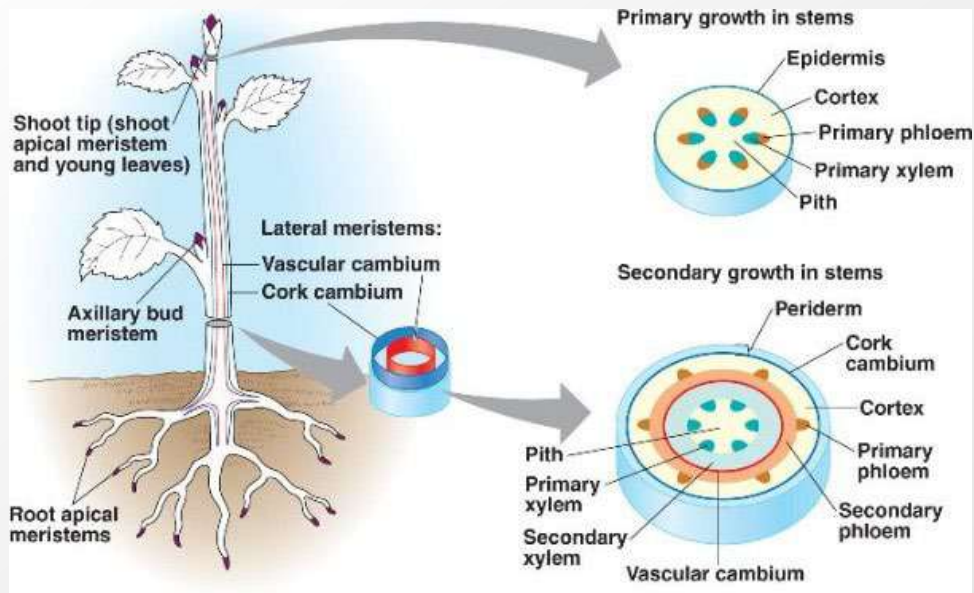
# Lateral Meristems

- ❖ **Location** : surrounding stem parts of the plant
- ❖ **Functions** : Responsible for the **secondary growth** of dicotyledon plants.
  - : Add **birth of the root and stem** .
- **Two types of lateral meristem** :
  - ❑ **vascular cambium** ( produce new xylem and phloem ).
  - ❑ **cork cambium** (produce bark @ epidermis ).



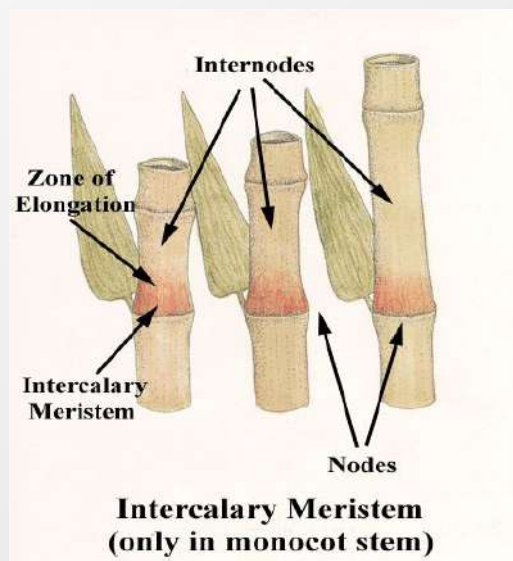
# Lateral Meristem



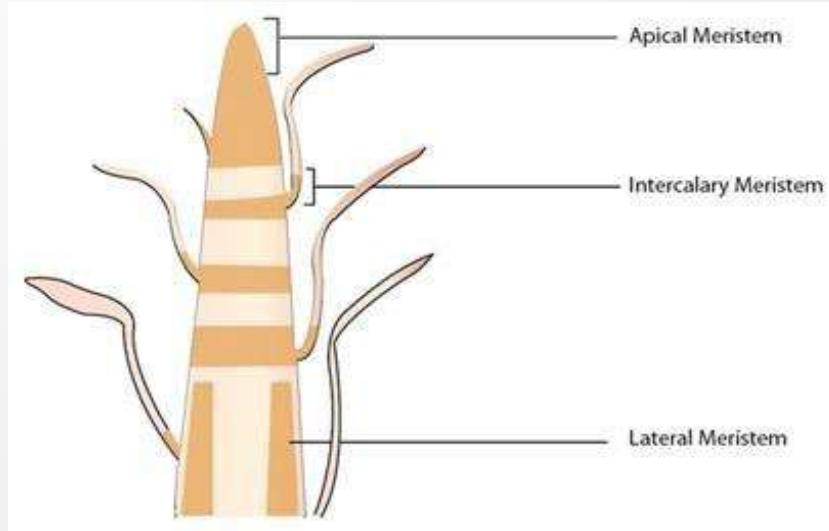


## Intercalary Meristems

- ❖ Location : **nodes** of the plant
- ❖ Function : Allow rapid **stem elongation**
- Occur only in **monocot**.

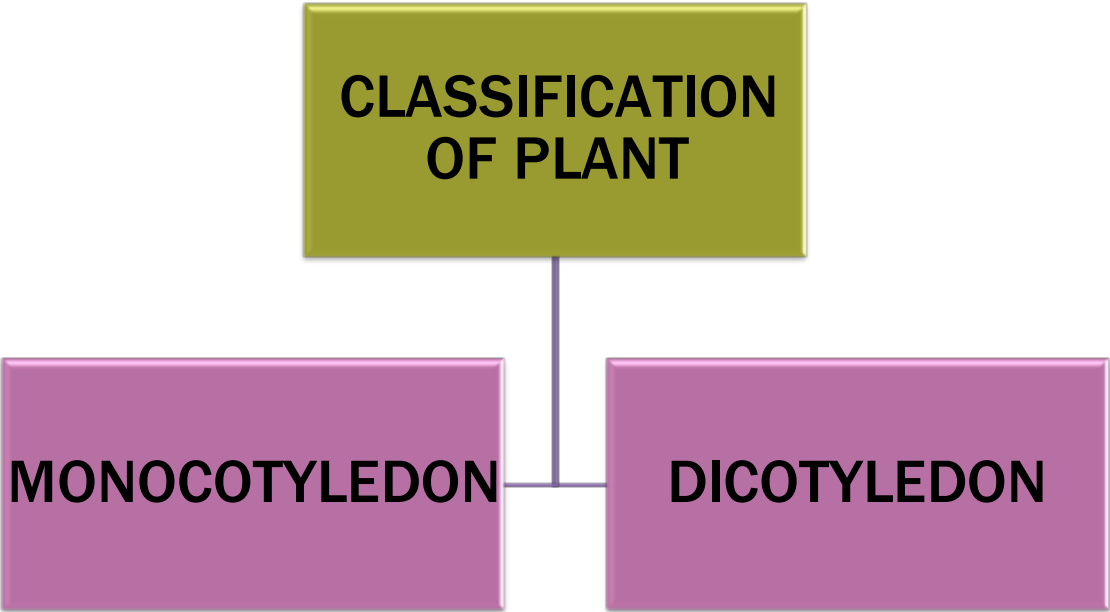
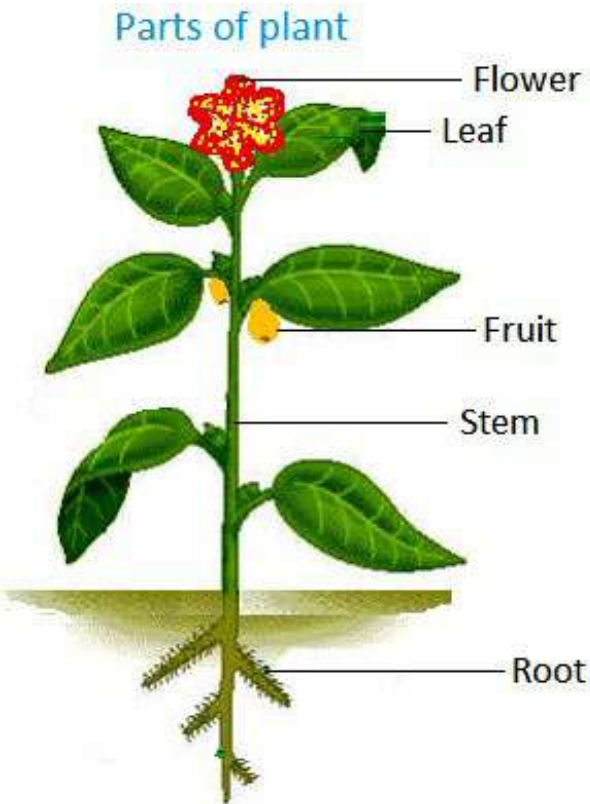


# Classification of meristematic tissue according to position





# PLANT ORGAN

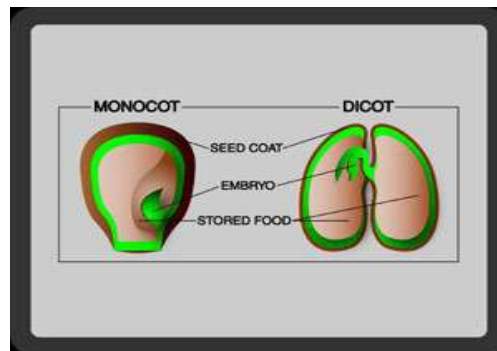


## MONOCOTYLEDON

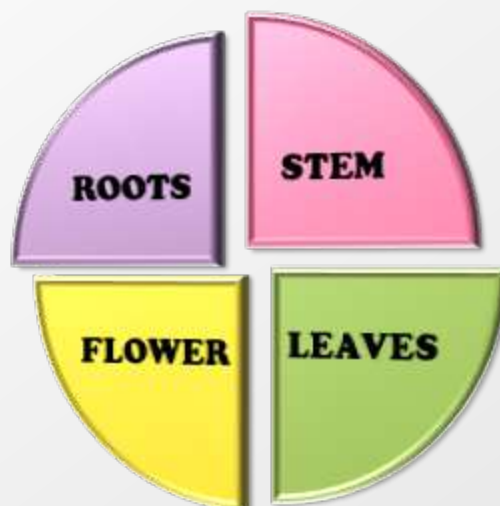
## DICOTYLEDON

- Embryo with **single cotyledon**

- Embryo with **two cotyledon**



## ANATOMY OF PLANT PARTS



# ROOT

- consist of
  - epidermis
    - a protective tissue
  - cortex
    - unspecialized cells
  - endodermis
    - at innermost layer of the cortex
  - vascular cylinder
    - Xylem and phloem
- **Functions:**
  - **Absorbing and conducting water and mineral nutrients.**
  - **To anchoring and supporting the plant.**
  - **Storage of nutrients and mineral.**

## CROSS SECTION OF ROOTS (Monocot vs Dicot)

Roots:

**Monocots**  
**Fibrous Roots**



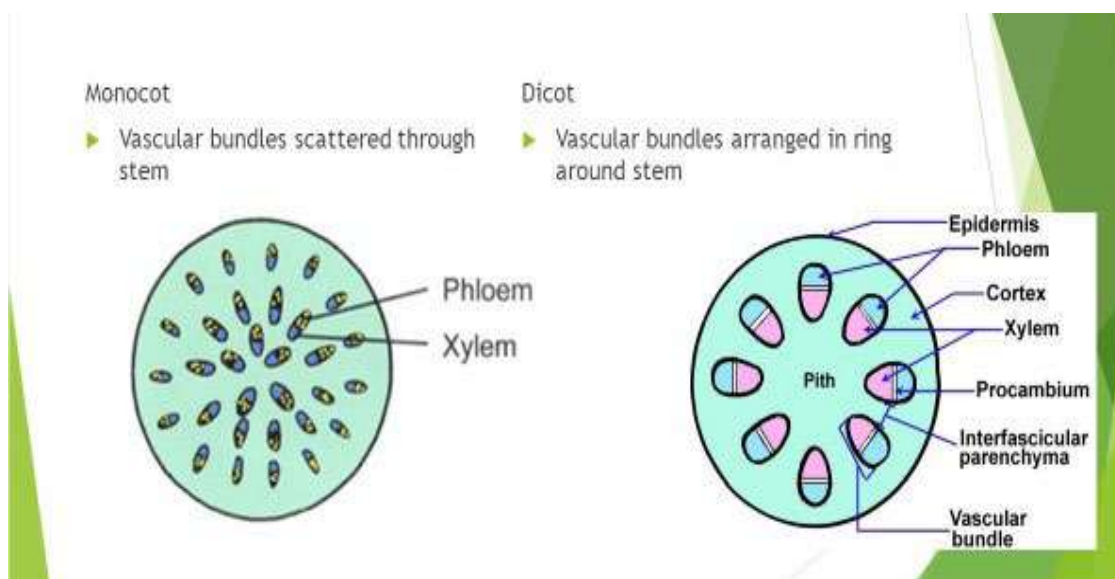
**Dicots**  
**Tap Roots**

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# STEM

- **Parts of stem:**
  - Vascular bundle (xylem and phloem)
  - Pith
    - Internal tissue
  - Cortex
    - located between vascular tissue and dermal tissue
  - Epidermis
- **Functions:**
  - To transport and storage a nutrients and water
  - Support the leaves

## CROSS SECTION OF STEMS (Monocot vs Dicot)



# LEAVES

- Most leaves are thin and flat.
- The epidermis is one cell layer thick, as protective layer covering the upper and lower surface of the leaf.
- It was covered by waxy layer called cuticle to reduce the loss of water.
- Cell of the epidermis may be thicker on the side exposed directly to the sun
- **Function :**
- **Trap light in the presence of light for photosynthesis.**

## DIAGRAM OF LEAVES (Monocot vs Dicot)

Monocot leaves



Parallel-veined leaves

Dicot leaves



Net-veined leaves

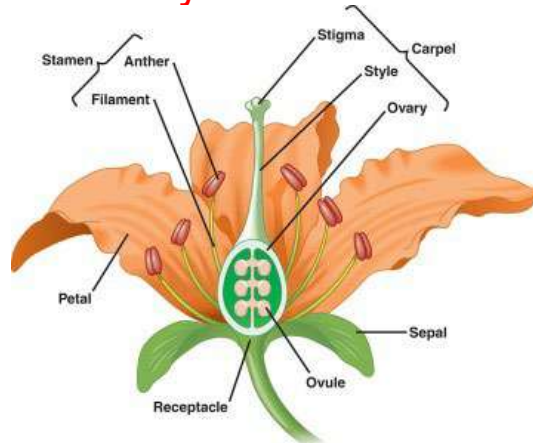
# FLOWERS

- **Floral organs:**

- Sepals
- Petals
- Stamens
- Carpels

- **Function:**

- **Reproduction system**



## DIAGRAM OF FLOWERS (Monocot vs Dicot)

Monocot flower



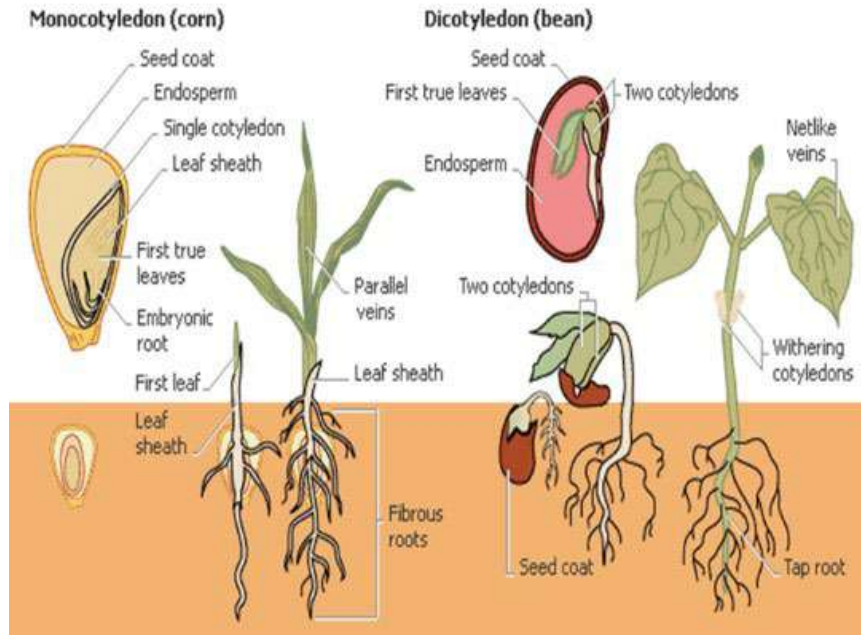
Petals: multiples of 3

Dicot flower



multiples of 4 or 5

# SUMMARY OF DICOTS VS MONOCOTS



## 2.4 TAXONOMY


# TAXONOMY

- **Taxonomy** is the science of describing, classifying and naming organism.
- **Taxa/taxon** is the name for one category or group of organism at one level or rank in the taxonomic hierarchy scheme.






# TAXONOMY

- Taxonomy has two branches, **nomenclature & systematic** :-
    - **Nomenclature (naming)** refers to the naming of organisms and the taxa to which they belong. It also refers to the correct usage of scientific names used in taxonomy. It based on binomial system.
    - **Systematic (grouping)** is the discovery and scientific study of biological diversity. Systematics place organisms in the systematic groups/classification method. (Eg : Phylogeny and Cladistics).
    - **Classification** means arranging organisms into groups on their similarities.
- 

## Importance of Taxonomy:

1. To give universal name (**scientific name**) to organism.
  2. To manage the **information and data** that can be kept and catalogued in a good system
  3. To study the **diversify of biology** and the **natural connection** among the organism in the web of life.
  4. To **support** the organic **evolution theory**.
- 

5. Allow the **study of other field** (morphology, anatomy, physiology).
6. Allow to find the **connection** between individuals and other individuals with the environment efficiently and systematic
7. Able to distinguish between **beneficial and harmful** varieties.
8. To develop strategies for **protection and conservation** of endangered species.

## Classification Systems

- An activity of grouping and categorizing the organism base on the **similarity** characteristics that showed by the organism.

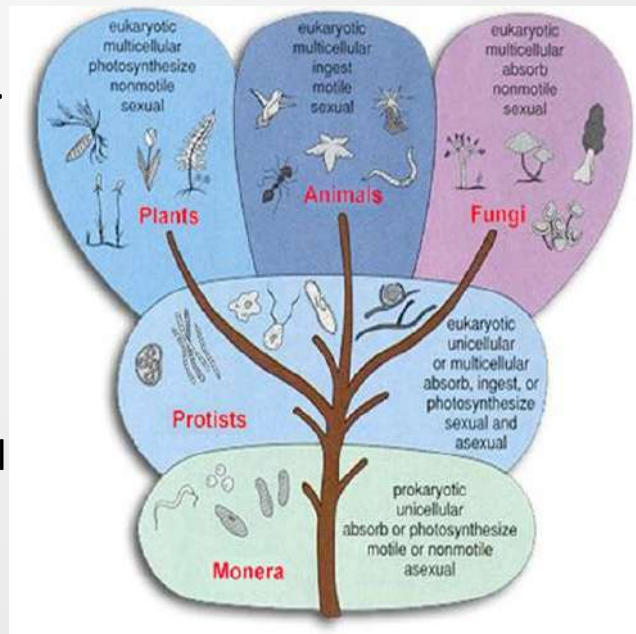


# TAXONOMY

## Natural Classification

- ✓ Showed natural relation.
- ✓ According to relationships based on descent from a common ancestor.

**Example :** Embryological, morphological, anatomical and physiological



There are basically three types of natural classification schemes :

Phenetic System

Phylogenetics System

Cladistic System

# HISTORY

## Nomenclature

Based on Binomial System/Binomial System Nomenclature/Linnaeus System/Biological Nomenclature, devised by the Carolus Linnaeus which also known as the 'father of modern taxonomy'.



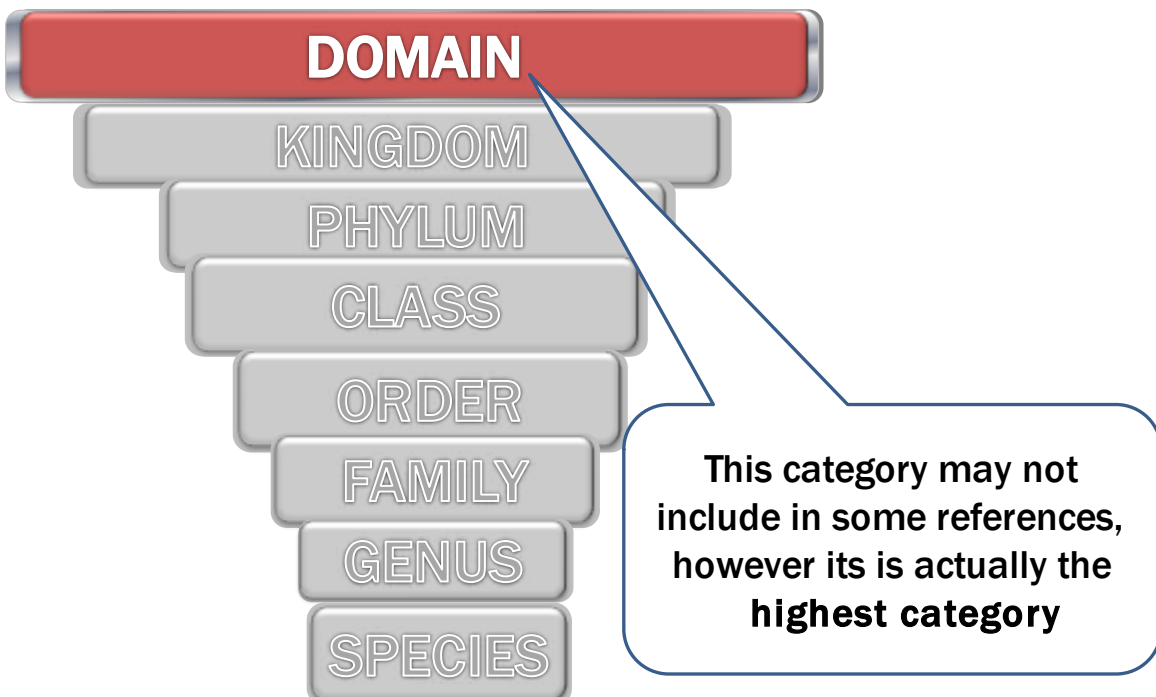
Each type of organism is given a **two-part** of Latin name:

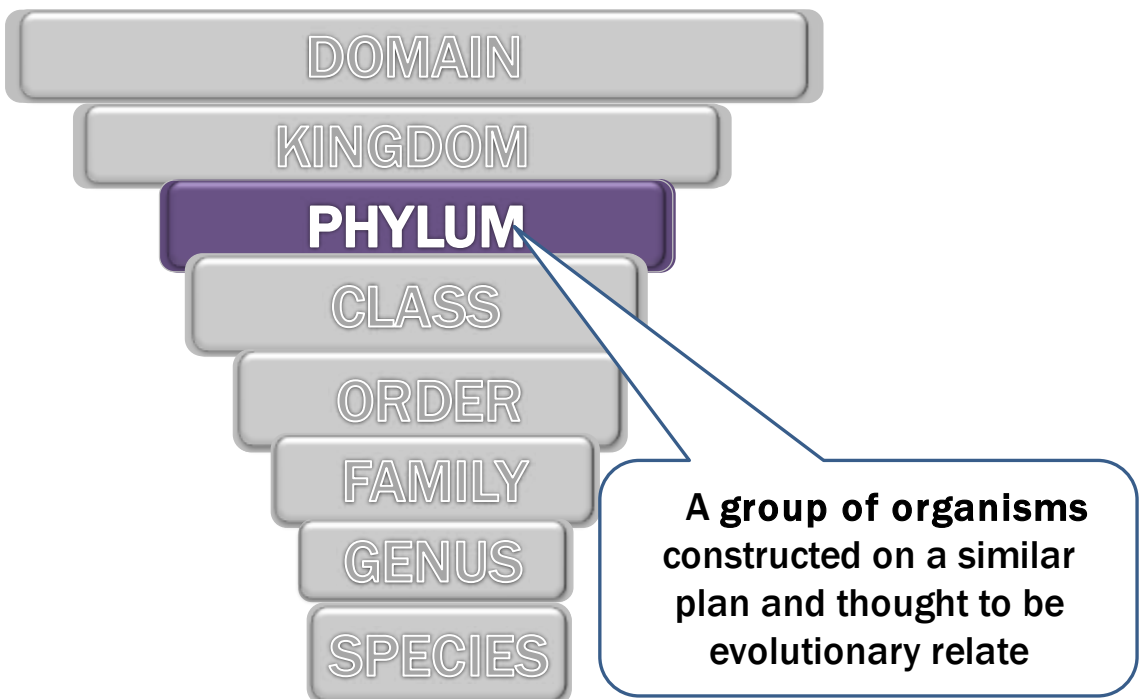
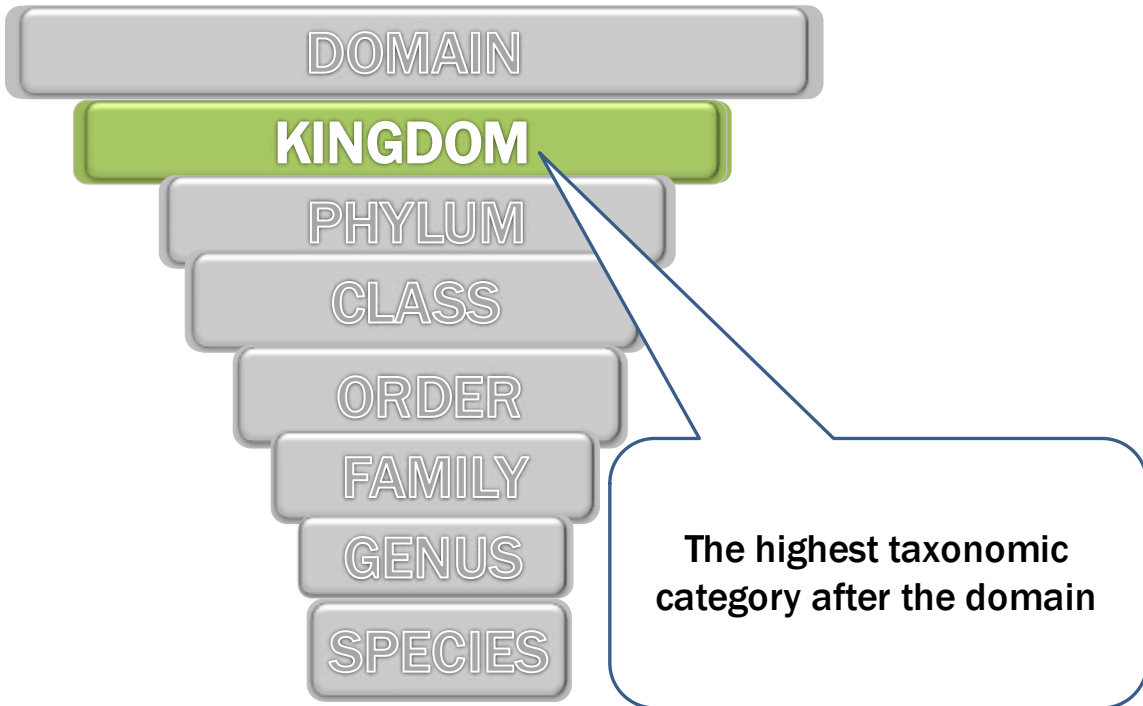
- ✓ The **first** word is the **generic/genus** name and begins with **capital letter**
- ✓ The **second** word is the **species** name and begins with **small letter**.

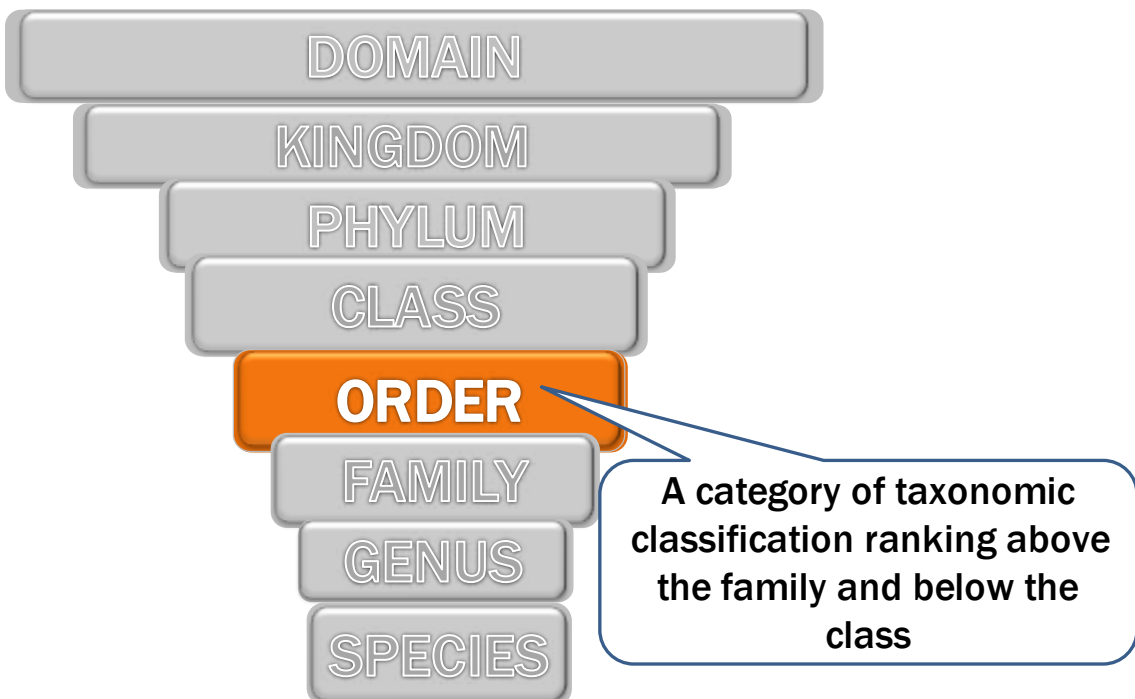
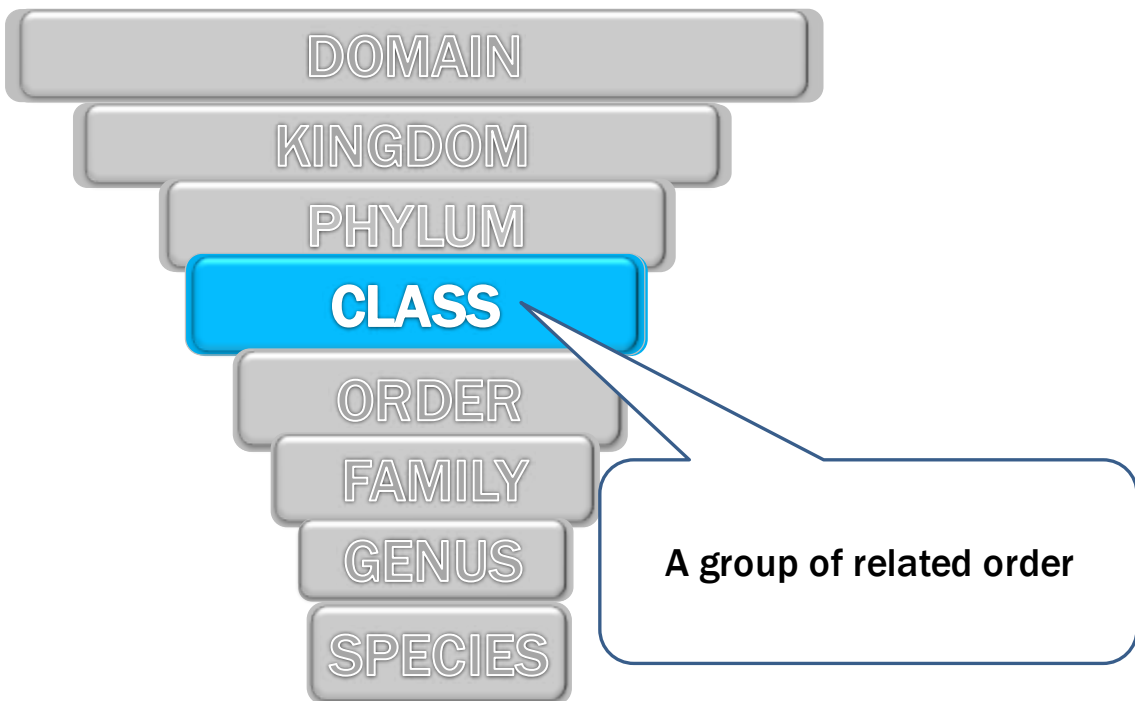
The biological or scientific name is printed in italicized or underlined when it is handwritten.

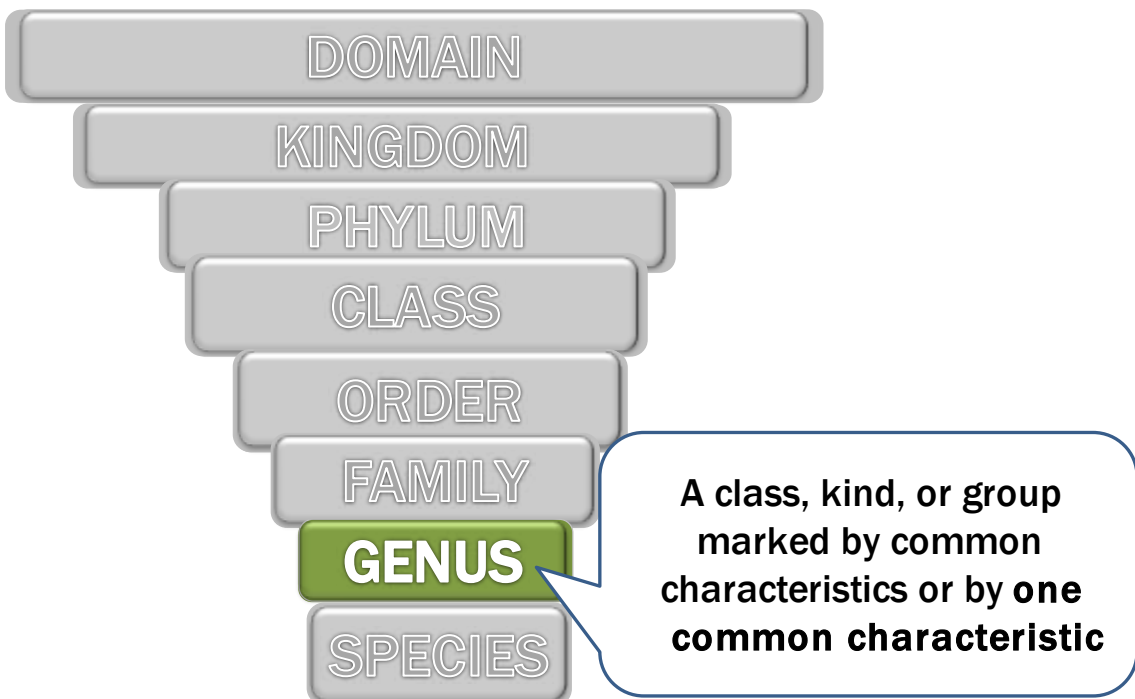
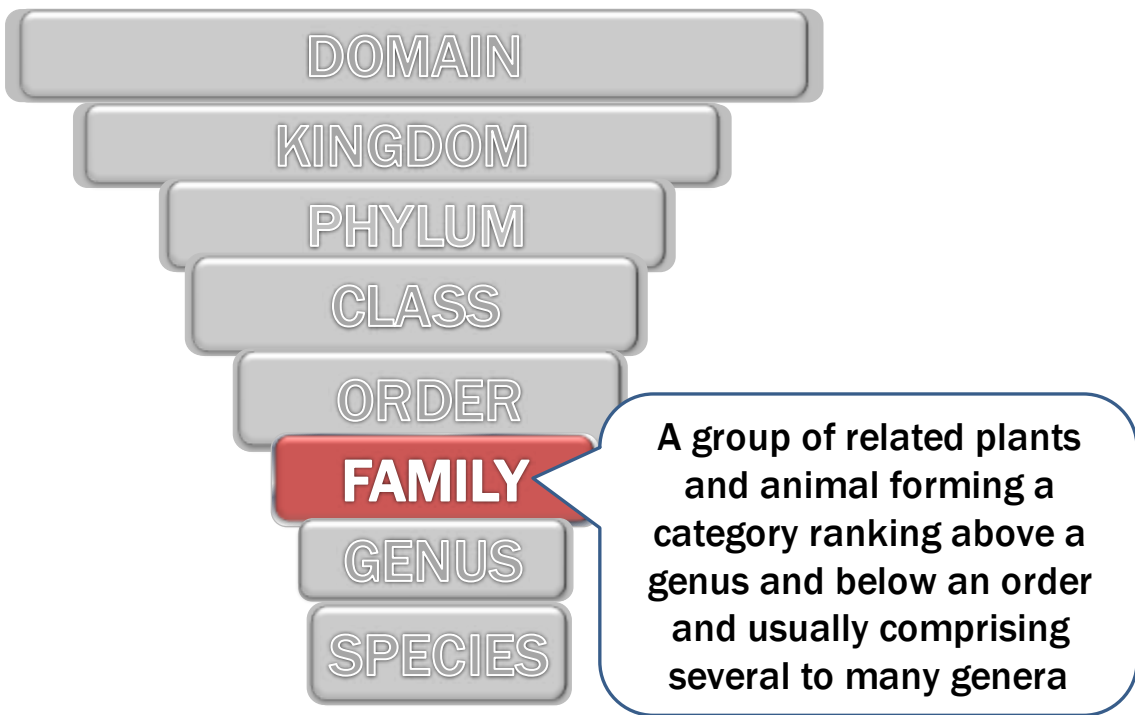
Eg: *Zea mays* or Zea mays

# TAXONOMY HIERARCHY

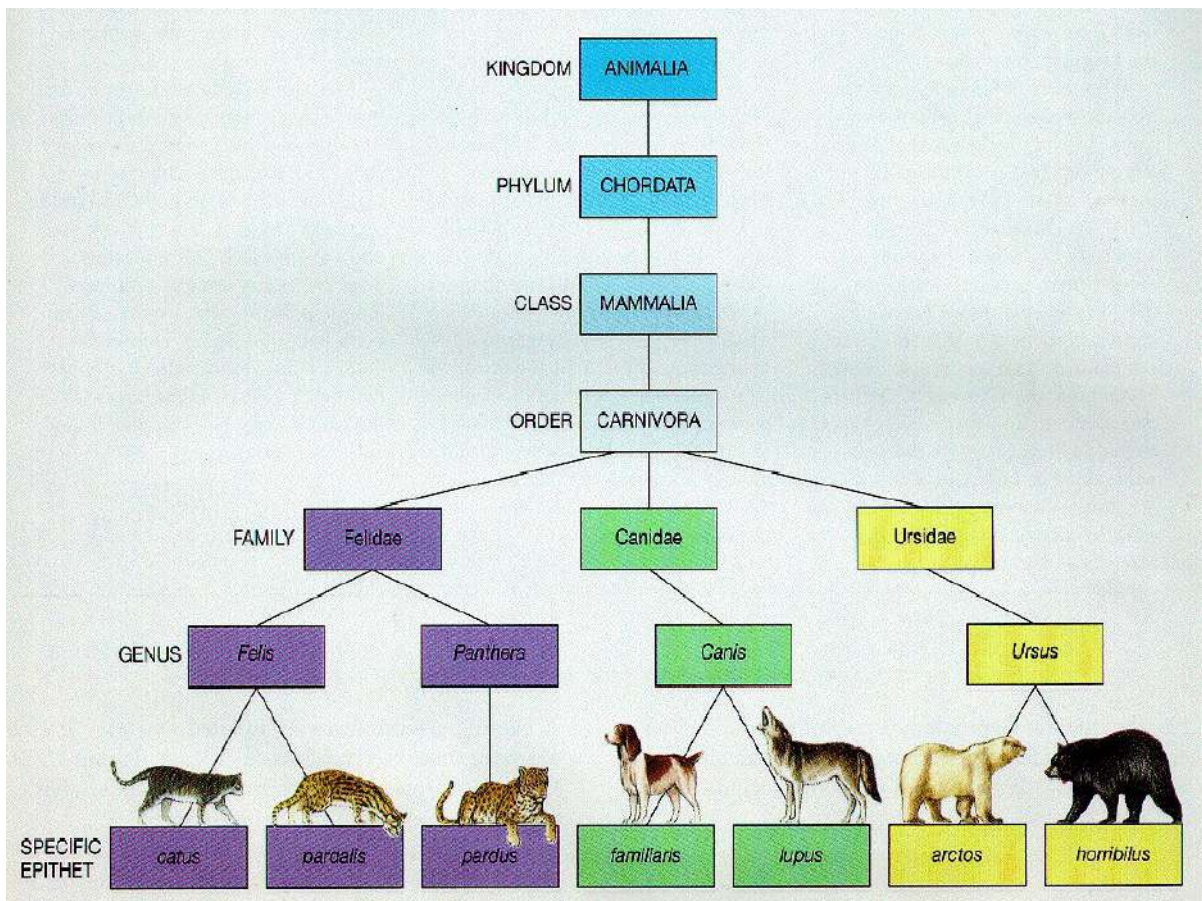
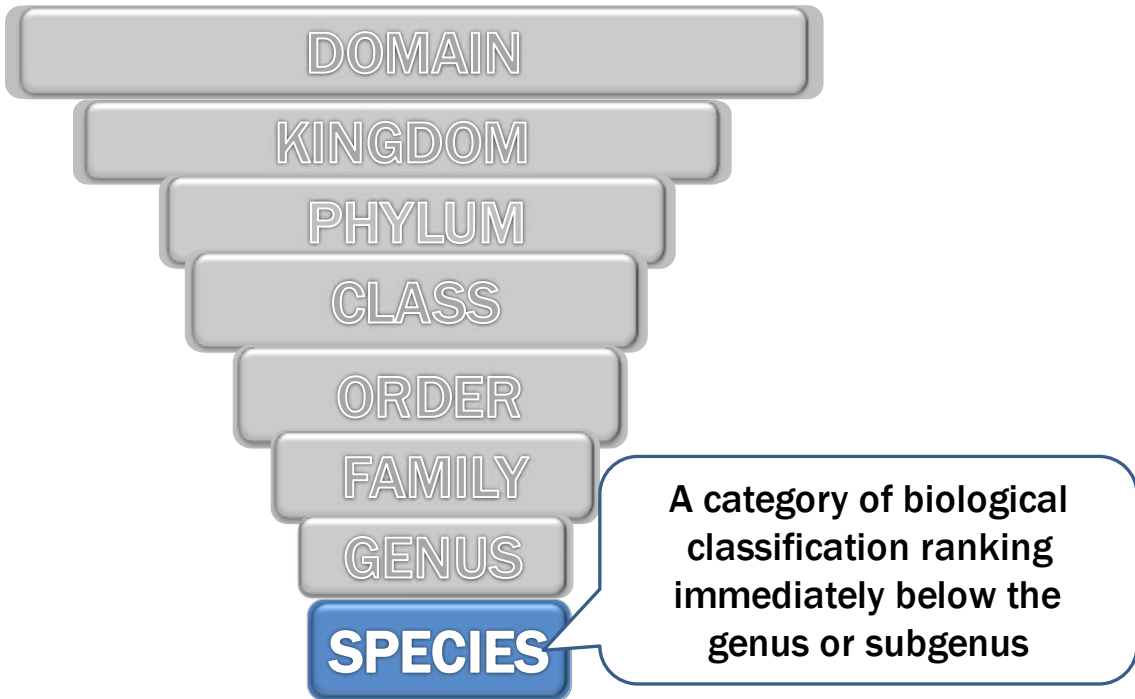












- ✓ Even though there are no fixed rules for naming taxa other than genera and species, certain conventions are followed. These rules are not fixed and have many exceptions.
- The **phylum**/division name for **PLANTS** usually ends with '**phyta**'.
- The **order** name for **PLANTS** usually ends with '**ales**'.
- The **family** name for **PLANTS** ends with '**ceae**'.
- The **order** name for **INSECTS** usually ends with '**tera**'.
- The **family** name for **ANIMALS** ends with '**dae**'.

## TAXONOMY - example

DOMAIN : EUKARYA  
 KINGDOM : Plantae  
 PHYLUM : Magnoliophyta  
 CLASS : Liliopsida  
 ORDER : Arecales  
 FAMILY : Arecaceae  
 GENUS : *Elaeis*  
 SPECIES : *guineensis*



DOMAIN : EUKARYA  
 KINGDOM : Plantae  
 PHYLUM : Magnoliophyta  
 CLASS : Liliopsida  
 ORDER : Poales  
 FAMILY : Poaceae  
 GENUS : *Oryza*  
 SPECIES : *sativa*



## TAXONOMY - example

**DOMAIN : EUKARYA**  
**KINGDOM : Plantae**  
**PHYLUM : Magnoliophyta**  
**CLASS : Magnoliopsida**  
**ORDER : Malpighiales**  
**FAMILY : Euphorbiaceae**  
**GENUS : Hevea**  
**SPECIES : *brasiliensis***



**DOMAINM : EUKARYA**  
**KINGDOM : Plantae**  
**PHYLUM : Magnoliophyta**  
**CLASS : Liliopsida**  
**ORDER : Arecales**  
**FAMILY : Arecaceae**  
**GENUS : Cocos**  
**SPECIES : *nucifera***



**DOMAIN : EUKARYA**  
**KINGDOM : Animalia**  
**PHYLUM : Chordata**  
**CLASS : Actinopterygii**  
**ORDER : Perciformes**  
**FAMILY : Latidae**  
**GENUS : Lates**  
**SPECIES : *calcarifer***



**DOMAIN : EUKARYA**  
**KINGDOM : Animalia**  
**PHYLUM : Chordata**  
**CLASS : Actinopterygii**  
**ORDER : Siluriformes**  
**FAMILY : Clariidae**  
**GENUS : Clarias**  
**SPECIES : *gariepinus***



DOMAIN : EUKARYA  
KINGDOM : Animalia  
PHYLUM : Chordata  
CLASS : Actinopterygii  
ORDER : Cypriniformes  
FAMILY : Cyprinidae  
GENUS : Carassius  
SPECIES : *auratus*



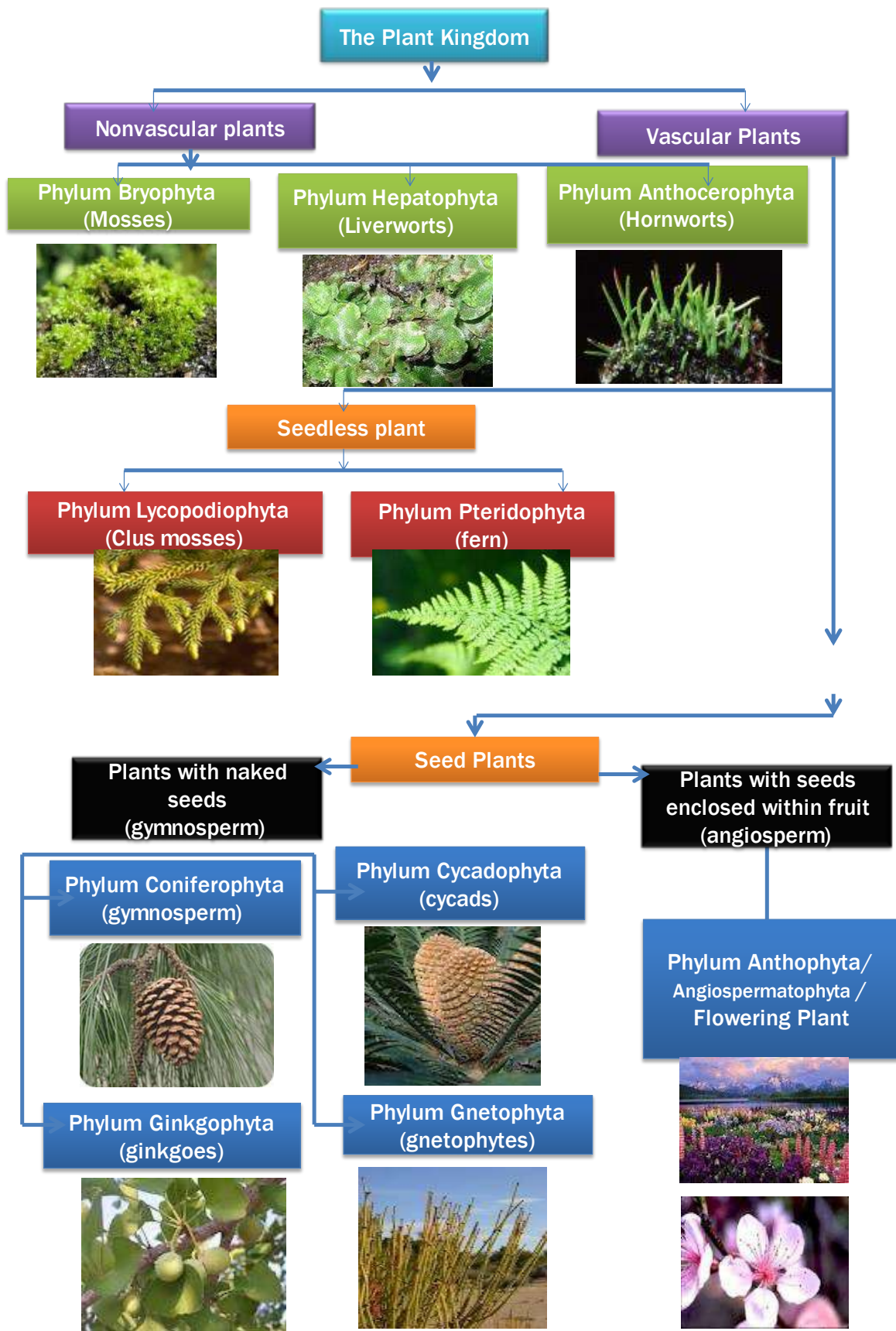
DOMAIN : EUKARYA  
KINGDOM : Animalia  
PHYLUM : Chordata  
CLASS : Actinopterygii  
ORDER : Cypriniformes  
FAMILY : Cyprinidae  
GENUS : Danio  
SPECIES : *rerio*



## TAXONOMY

### Classification of Plant Kingdom ~~P~~lantae

- is a group of organisms which multicellular, eukaryote, autotrophic and contain chlorophyll.
- Plants are highly organized, take in and use energy, respond to stimuli, grow and develop, reproduce, plant DNA transmits information from one generation to the next, and plants population undergo genetic changes over time.



We focus on the important Phylum that is Angiospermatophyta which divided into 2 main class : **Monocotyledones and Dicotyledons.**

The main characteristic of Angiosperm :

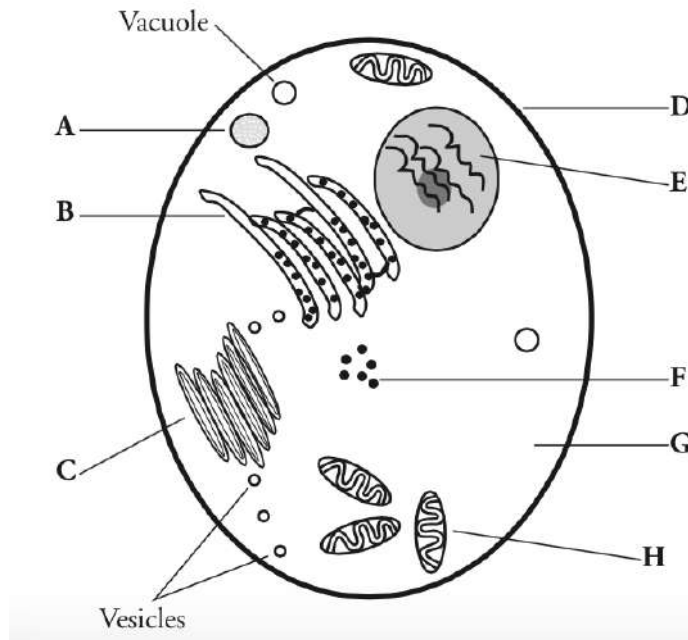
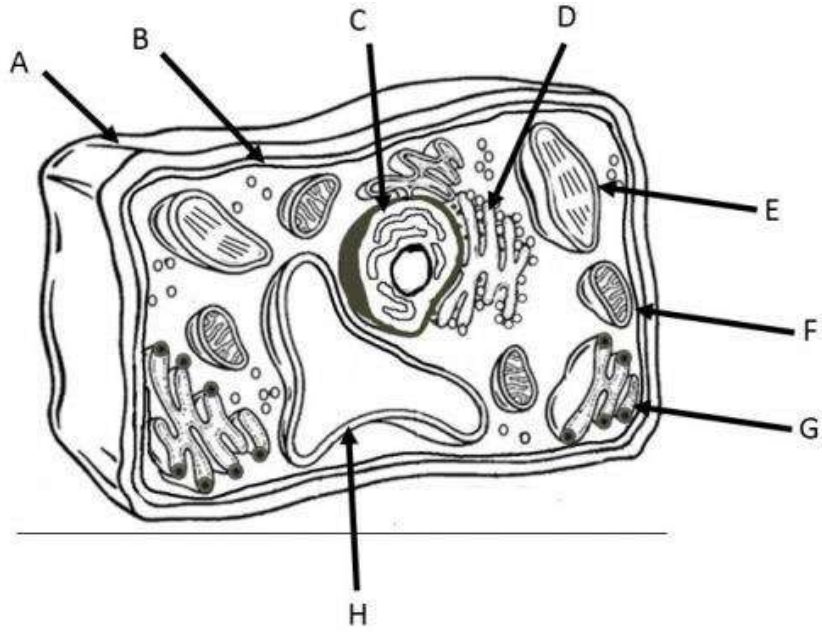
- ✓ Flowering and fruiting
- ✓ Seed produce in ovary that develop to fruit
- ✓ Complex vascular tissues (xylem and phloem)



# EXERCISE

# Exercises

1. Draw a plant cell and animal cell. Name eight important organelles found in it.

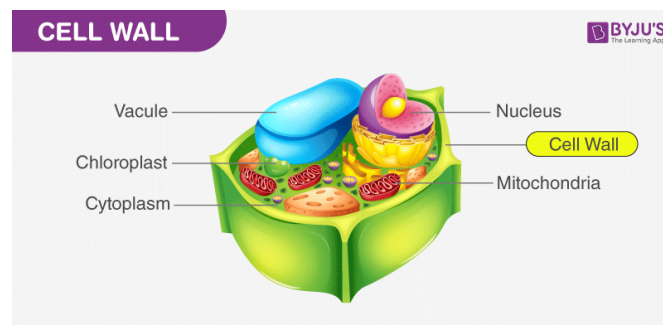




2. The cell wall is present only in plants, fungi and bacteria. The image above represents a plant cell wall. The cell wall is the outermost covering of plant cells. It is present outside the cell membrane and is tough, flexible and sometimes rigid in its texture. The main functions of the cell wall are:

- Protecting the cell against physical damage and invading pathogens.
- Regulates and controls the direction of cell growth.
- Providing the strength, structural support and maintaining the shape of the cell.
- Functions as a storage unit by storing carbohydrates for use in plant growth, especially in seeds.
- It allows entry of smaller molecules through it freely.

Explain the main functions of Nucleus, Mitochondria, Vacule, Chloroplast and Cytoplasm.



3. In the following quiz, we're going to be looking at monocotyledons and dicotyledons. Monocots are flowering plants whose seeds usually only contain one embryonic leaf, hence the name. In a similar vein, dicotyledons only possess seeds with two embryonic leaves or cotyledons. Don't worry; you don't need to answer any questions. All we need is for you to identify monocots and dicots based solely on their pictures! Good luck!



- A. Monocot
- B. Dicot



- A. Monocot
- B. Dicot



A. Monocot  
 B. Dicot



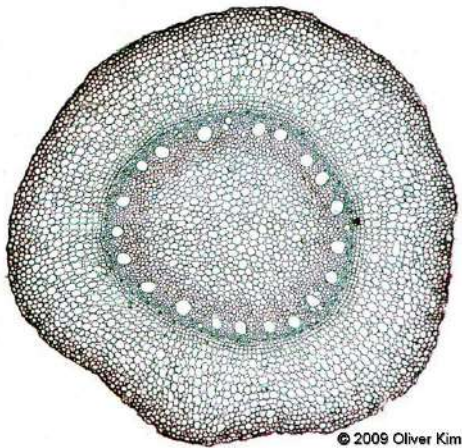
A. Monocot  
 B. Dicot



A. Monocot  
 B. Dicot

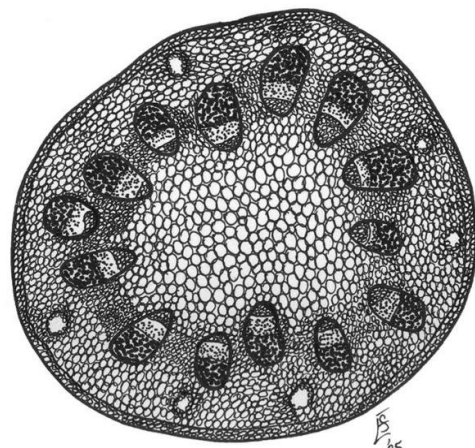


A. Monocot  
 B. Dicot



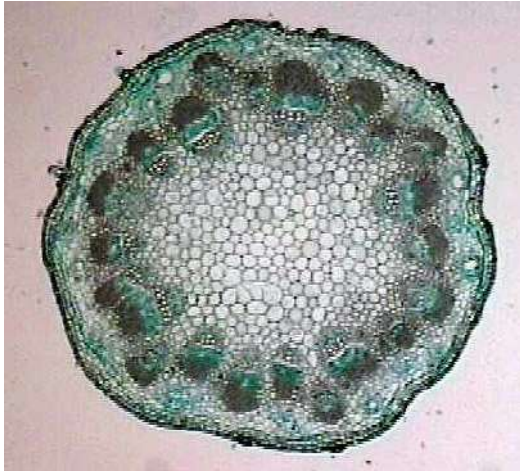
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A. Monocot  
 B. Dicot

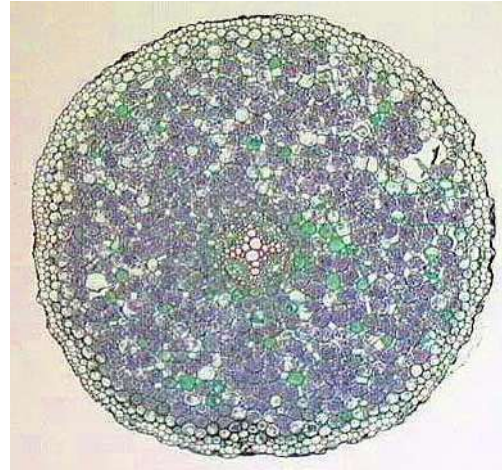


FB  
 bs

A. Monocot  
 B. Dicot



- A. Monocot
- B. Dicot



- A. Monocot
- B. Dicot

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