CELL

The Fundamental Unit Of Life

What is Cell?

Cell is the basic Structural and functional unit of living organisms.

In other words, cells make up living things and carry out activities that keep a living thing alive.

Cell Theory

Cell theory is a collection of ideas and conclusions from many different scientists over time that describes cells and how cells operate.

1. All known living things are made up of one or more cells.
2. All living cells arise from pre-existing cells by division.
3. The cell is the basic unit of structure and function in all living organisms.

Cell Theory Timeline

1665

Robert Hooke

Discovered cell

1674

Anton Van Leeuwenhoek

Observed living cell

1883

Robert Brown

Discovered nucleus

Cell Theory Timeline

1835

Felix Dujardin

Discovered fluid content of cell

1838

Matthias Schleiden

Proposed all plants are made up of cells

1839

J. E. Purkinje

Named fluid content of cell as protoplasm

Cell Theory Timeline

1845

Carl Heinrich Braun

Proposed cell is the basic unit of life

1839

Theodor Schwann

Proposed all animals are made up of cells

1855

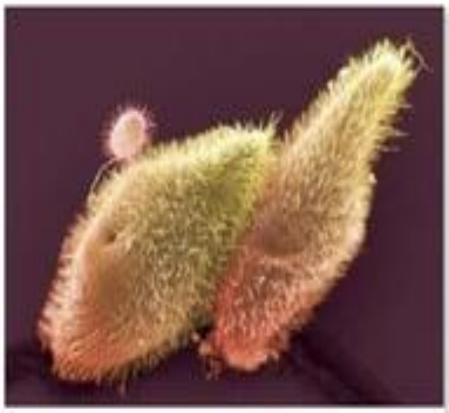
Rudolf Virchow

Proposed all cells arise from pre-existing cells

Unicellular Organisms

An organism that is made up of only one cell is called as unicellular organism.

Euglena



Paramecium

Yeast

Multicellular Organisms

An organism that is made up of more than one cell is called as multicellular organism.

Plants

Animals

Fungus

Multicellular Organisms Under Microscope

Leaf cells

Muscle cells

Size of Cells

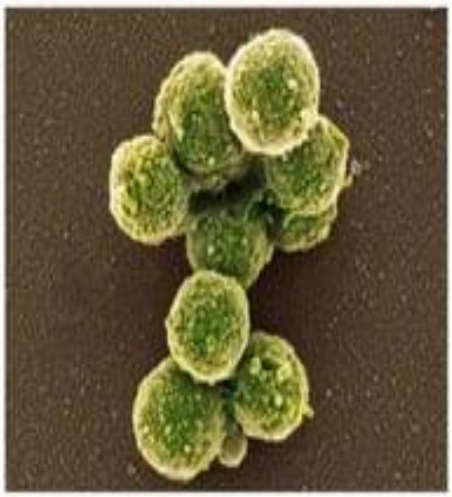
Cells vary in size.

Most cells are very small (microscopic), some may be very large (macroscopic).

The unit used to measure size of a cell is micrometer.

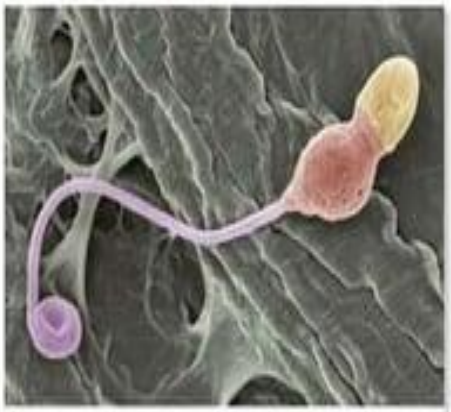
1 µm = 1/1000 millimeter

- Smallest cell
- Mycoplasma
- Size: 0.1 µm



- Largest cell
- Ostrich egg
- Size: 18 cm

Size of Cells in Humans



Smallest cell

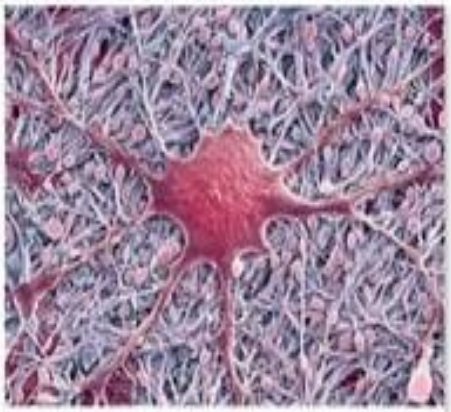
Sperm cell

Size: 5 µm

Largest cell

Ovum cell

Size: 120 µm



Longest cell

Nerve cell

Size: 1 m

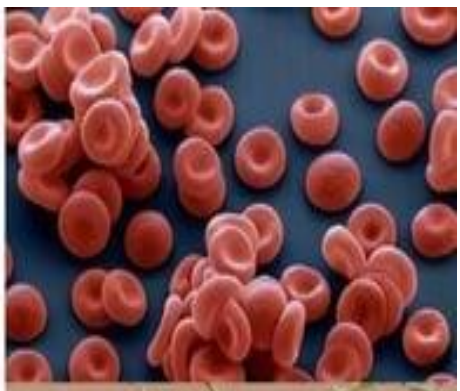
Shape of Cells

Cells vary in shape.

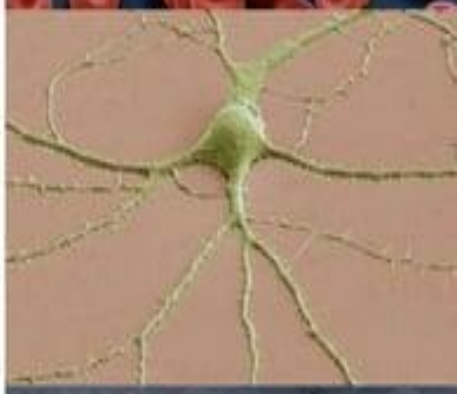
Variation depends mainly upon the function of cells.

Some cells like Euglena and Amoeba can change their shape, but most cells have a fixed shape.

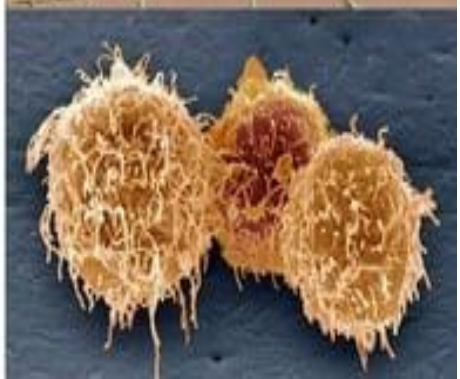
Human RBCs are circular biconcave for easy passage through human capillaries.



Nerve cells are branched to conduct impulses from one point to another.



Human WBCs can change their shape to engulf the microorganisms that enter the body.



Structure Of Cell

The detailed structure of a cell has been studied under compound microscope and electron microscope.

Certain structures can be seen only under an electron microscope.

The structure of a cell as seen under an electron microscope is called ultrastructure.

Compound microscope

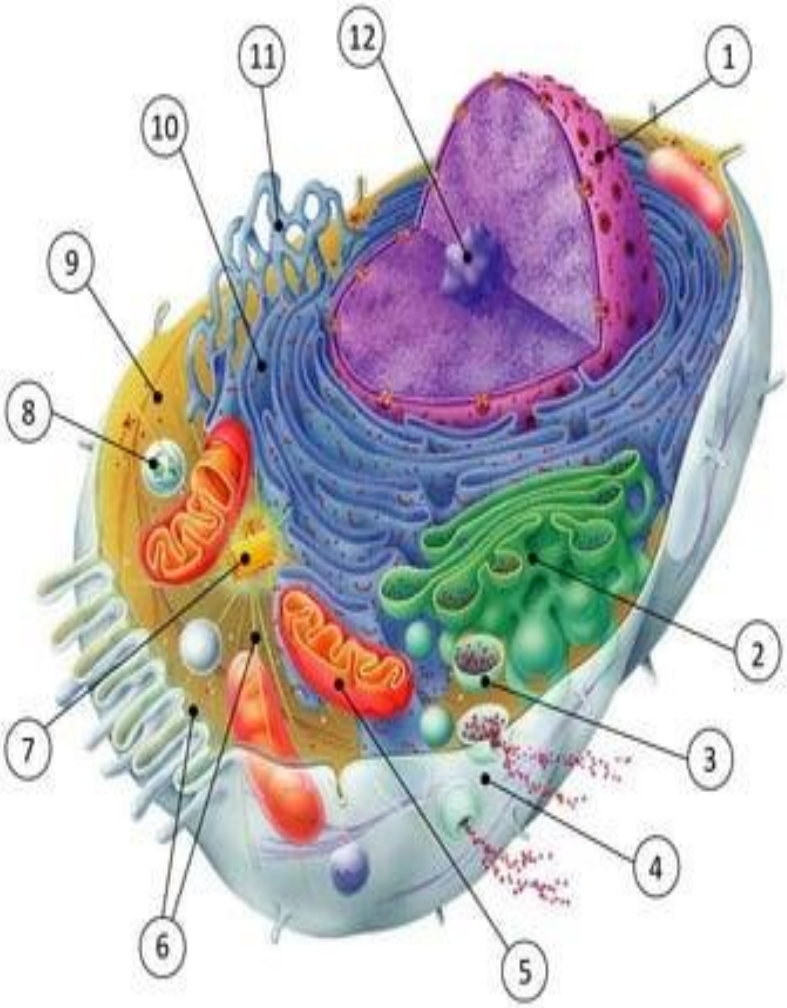
Magnification 2000X

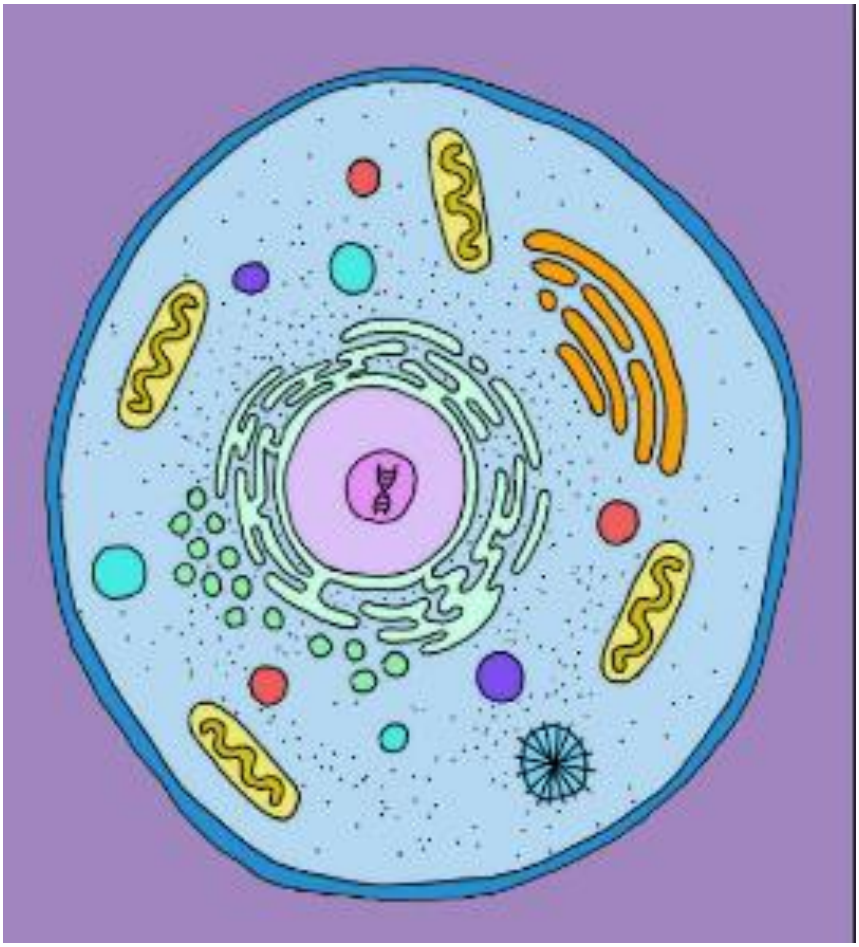
Electron microscope

Magnification 500000X

Animal Cell

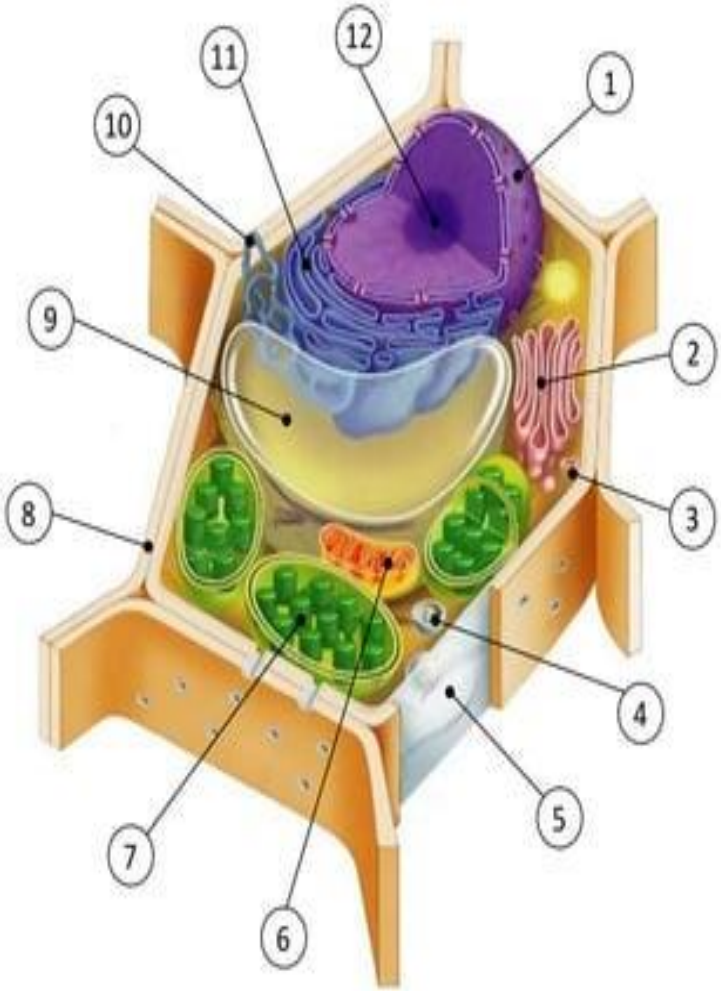
1. Nucleus
2. Golgi body
3. Vesicle
4. Plasma membrane
5. Mitochondria
6. Cytoskeleton
7. Centriole
8. Lysosome
9. Cytoplasm
10. Rough endoplasmic reticulum
11. Smooth endoplasmic reticulum
12. Nucleolus





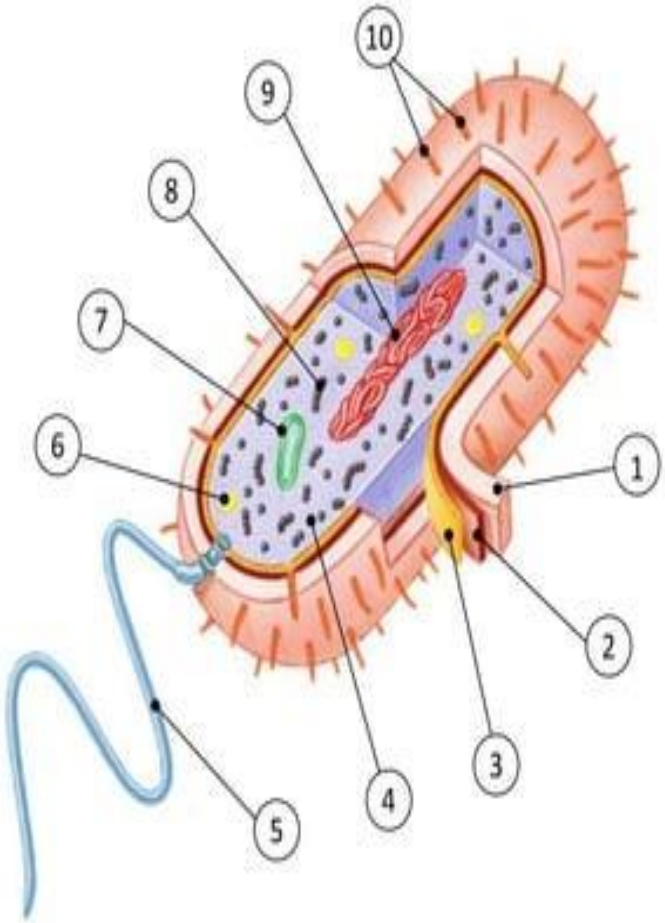
Plant Cell

1. Nucleus
2. Golgi body
3. Vesicle
4. Lysosome
5. Plasma membrane
6. Mitochondria
7. Chloroplast
8. Cell wall
9. Vacuole
10. Smooth endoplasmic reticulum
11. Rough endoplasmic reticulum
12. Nucleolus



Bacterial Cell

1. Capsule
2. Cell wall
3. Plasma membrane
4. Cytoplasm
5. Flagellum
6. Food granule
7. Plasmid (DNA)
8. Ribosomes
9. Nucleoid
10. Pili



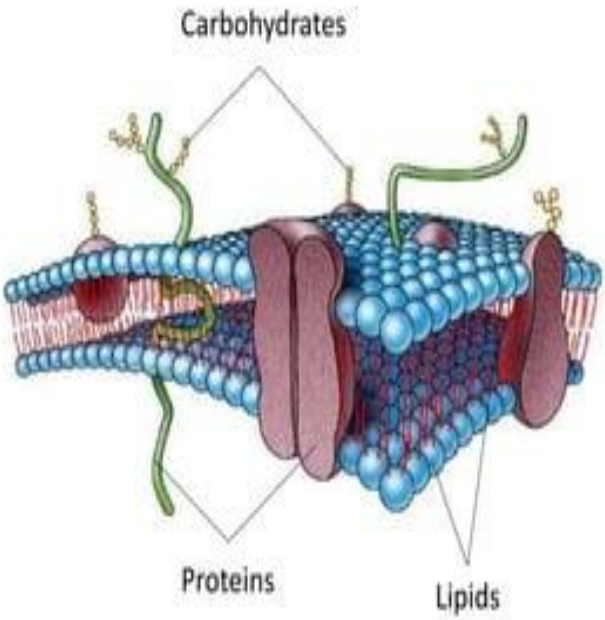
Structure Of Cell

If we study a cell under a microscope, we would come across three features in almost every cell: plasma membrane, nucleus and cytoplasm.

All activities inside the cell and interactions of the cell with its environment are possible due to these features.

1. Plasma Membrane
2. Nucleus
3. Cytoplasm
   A. Cytosol
   B. Cell Organelles
      a) Endoplasmic reticulum
      b) Golgi body
      c) Lysosomes
      d) Vacuoles
      e) Mitochondria
      f) Plastids
      g) Centrosome
      h) Cytoskeleton

Plasma Membrane

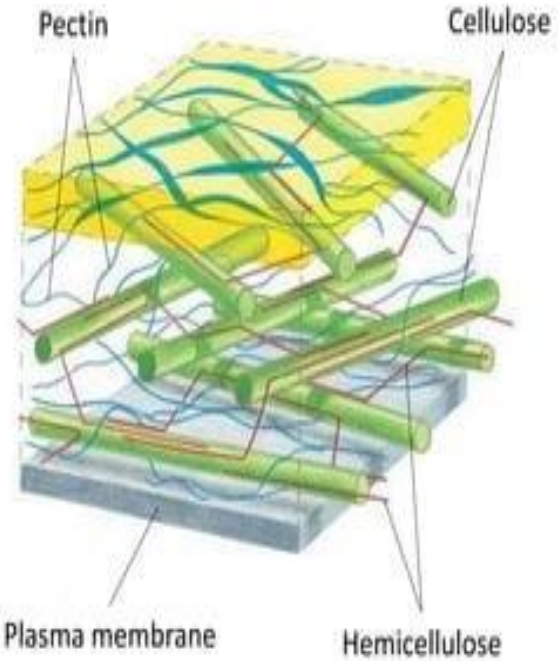


- Extremely delicate, thin , elastic, living and semi-permeable membrane
- Made up of two layers of lipid molecules in which protein molecules are floating
- Thickness varies from 75-110 A°
- Can be observed under an electron microscope only

Functions:

- Maintains shape & size of the cell
- Protects internal contents of the cell
- Regulates entry and exit of substances in and out of the cell
- Maintains homeostasis

Cell wall



- Non-living and outermost covering of a cell (plants & bacteria)
- Can be tough, rigid and sometimes flexible
- Made up of cellulose, hemicellulose and pectin
- May be thin or thick, multilayered structure
- Thickness varies from 50-1000 A°

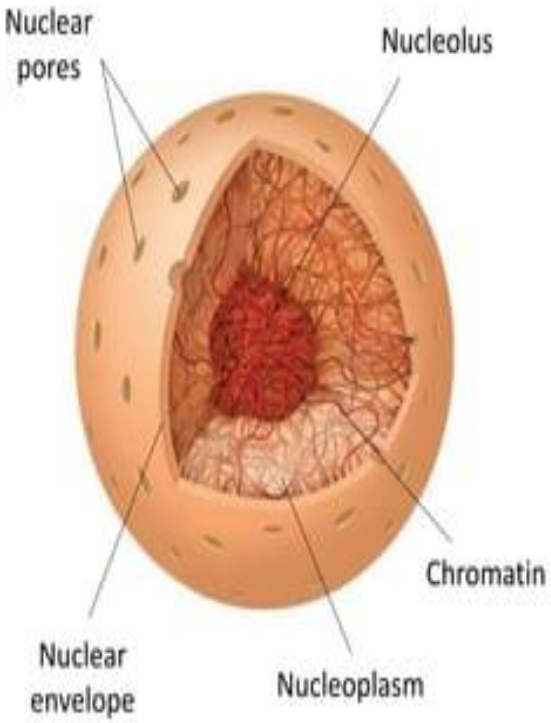
Functions:

- Provides definite shape, strength & rigidity
- Prevents drying up(desiccation) of cells
- Helps in controlling cell expansion
- Protects cell from external pathogens

Nucleus

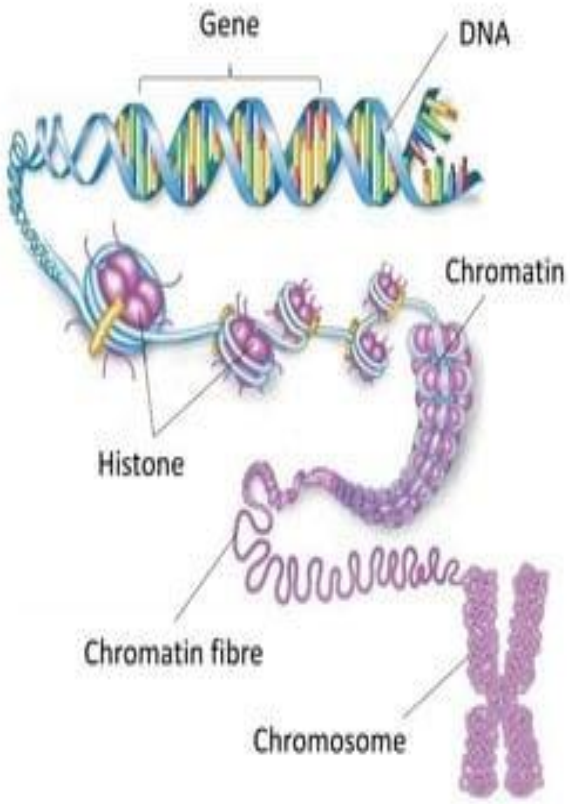
- Dense spherical body located near the centre of the cell
- Diameter varies from 10-25 µm
- Present in all the cells except red blood cells and sieve tube cells
- Well developed in plant and animal cells
- Undeveloped in bacteria and blue-green algae (cyanobacteria)
- Most of the cells are uninucleated (having only one nucleus)
- Few types of cells have more than one nucleus (skeletal muscle cells)

Nucleus



- Nucleus has a double layered covering called nuclear membrane
- Nuclear membrane has pores of diameter about 80-100 nm
- Colourless dense sap present inside the nucleus known as nucleoplasm
- Nucleoplasm contains round shaped nucleolus and network of chromatin fibres
- Fibres are composed of deoxyribonucleic acid (DNA) and protein histone
- These fibres condense to form chromosomes during cell division

Nucleus



- Chromosomes contain stretches of DNA called genes
- Genes transfer the hereditary information from one generation to the next

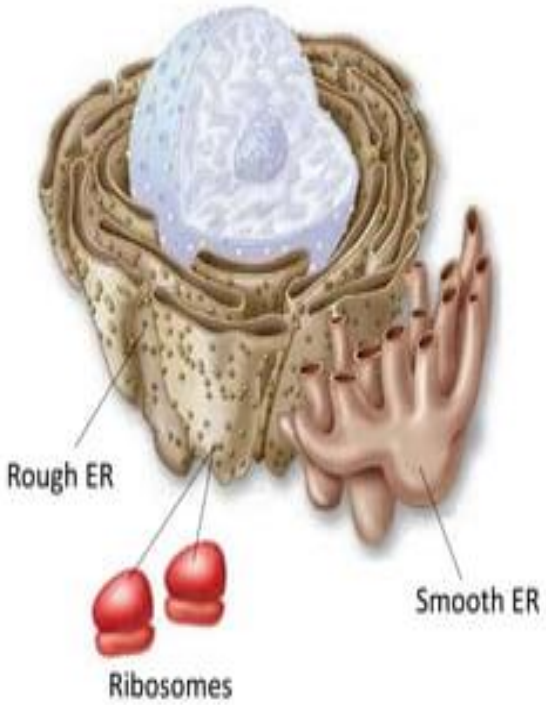
Functions:

- Control all the cell activities like metabolism, protein synthesis, growth and cell division
- Nucleolus synthesizes ribonucleic acid (RNA) to constitute ribosomes
- Store hereditary information in genes

Cytoplasm

- Jelly-like material formed by 80 % of water
- Present between the plasma membrane and the nucleus
- Contains a clear liquid portion called cytosol and various particles
- Particles are proteins, carbohydrates, nucleic acids, lipids and inorganic ions
- Also contains many organelles with distinct structure and function
- Some of these organelles are visible only under an electron microscope
- Granular and dense in animal cells and thin in plant cells

Endoplasmic Reticulum

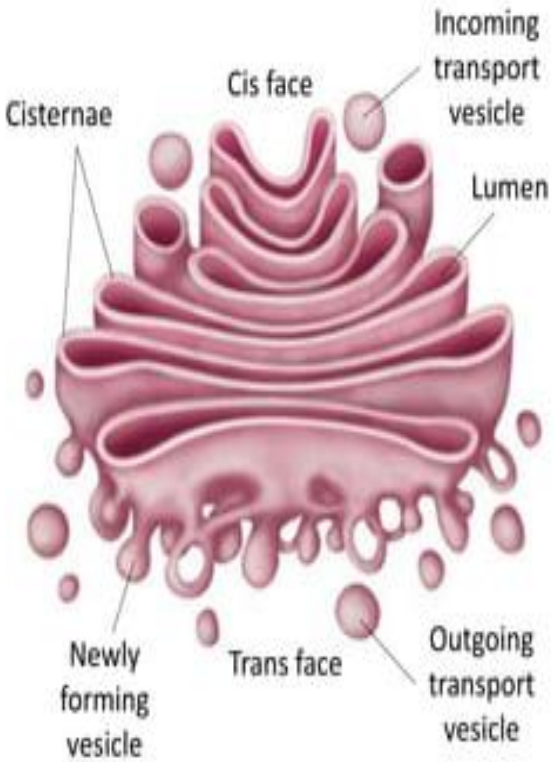


- Network of tubular and vesicular structures which are interconnected with one another
- Some parts are connected to the nuclear membrane, while others are connected to the cell membrane
- Two types: smooth(lacks ribosomes) and rough(studded with ribosomes)

Functions:

- Gives internal support to the cytoplasm
- RER synthesize secretory proteins and membrane proteins
- SER synthesize lipids for cell membrane
- In liver cells SER detoxify drugs & poisons
- In muscle cells SER store calcium ions

Golgi body

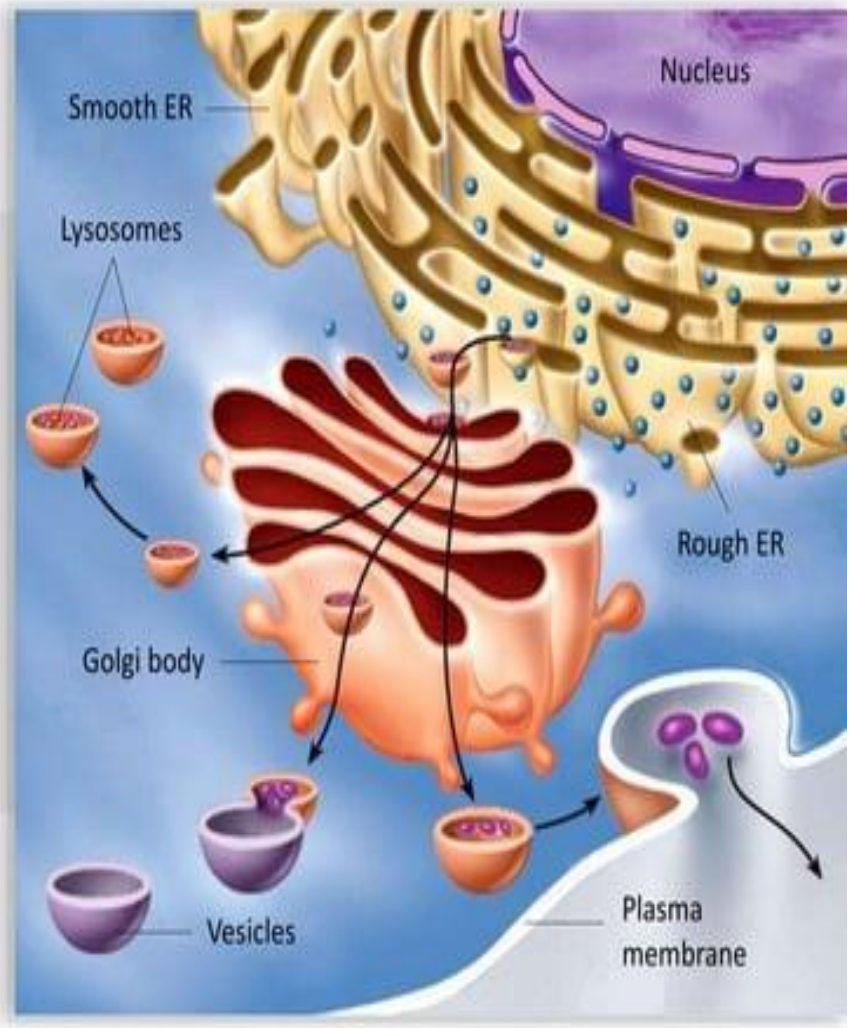


- Discovered by Camillo Golgi
- Formed by stacks of 5-8 membranous sacs
- Sacs are usually flattened and are called the cisternae
- Has two ends: cis face situated near the endoplasmic reticulum and trans face situated near the cell membrane

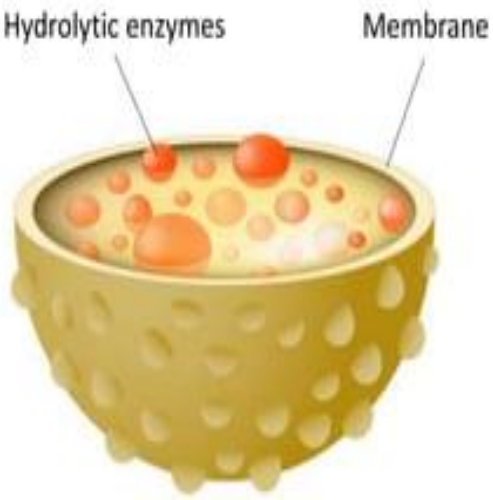
Functions:

- Modifies, sorts and packs materials synthesized in the cell
- Delivers synthesized materials to various targets inside the cell and outside the cell
- Produces vacuoles and secretory vesicles
- Forms plasma membrane and lysosomes

Golgi Body At Work



Lysosomes

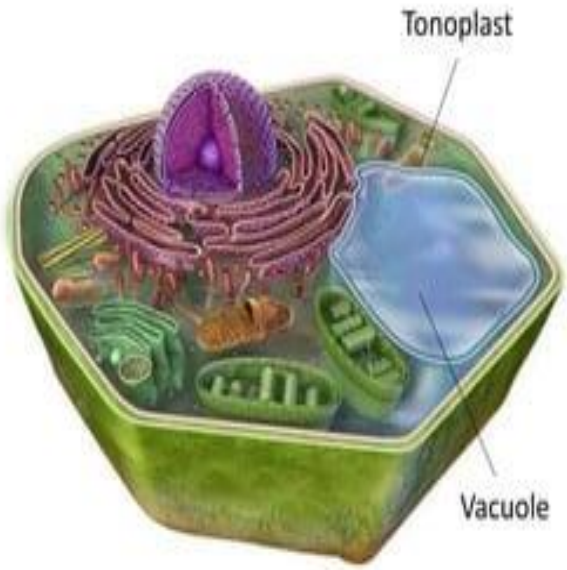


- Small, spherical, single membrane sac
- Found throughout the cytoplasm
- Filled with hydrolytic enzymes
- Occur in most animal cells and in few type of plant cells

Functions:

- Help in digesting of large molecules
- Protect cell by destroying foreign invaders like bacteria and viruses
- Degradation of worn out organelles
- In dead cells perform autolysis

Vacuoles

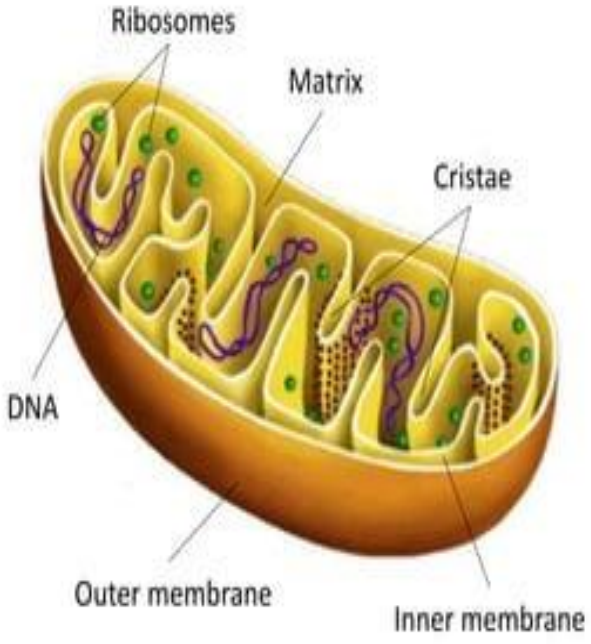


- Single membrane sac filled with liquid or sap (water, sugar and ions)
- In animal cells, vacuoles are temporary, small in size and few in number
- In plant cells, vacuoles are large and more in number
- May be contractile or non-contractile

Functions:

- Store various substances including waste products
- Maintain osmotic pressure of the cell
- Store food particles in amoeba cells
- Provide turgidity and rigidity to plant cells

Mitochondria



- Small, rod shaped organelles bounded by two membranes - inner and outer
- Outer membrane is smooth and encloses the contents of mitochondria
- Inner membrane is folded in the form of shelf like inward projections called cristae
- Inner cavity is filled with matrix which contains many enzymes
- Contain their own DNA which are responsible for many enzymatic actions

Functions:

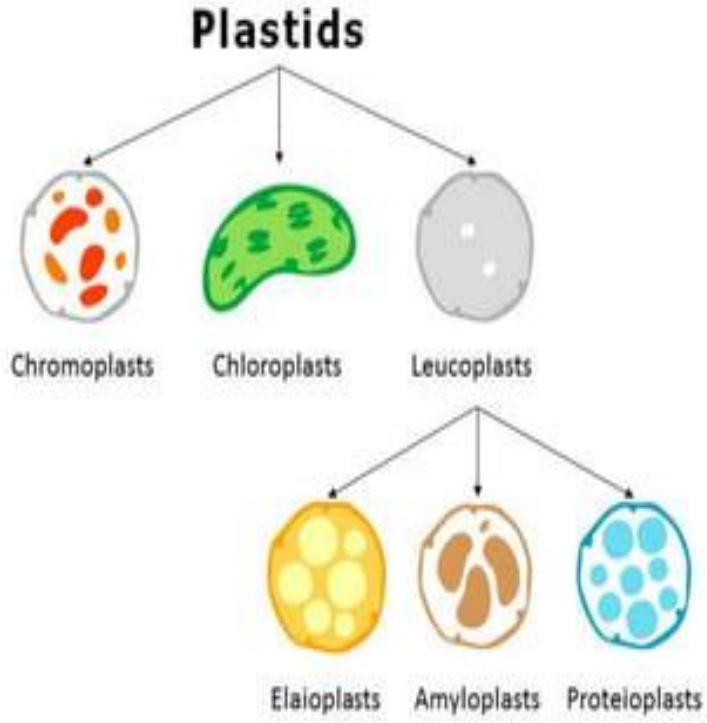
- Synthesize energy rich compound ATP
- ATP molecules provide energy for the vital activities of living cells

Plastids

Plastids are double membrane-bound organelles found inside plants and some algae.

They are responsible for activities related to making and storing food.

They often contain different types of pigments that can change the colour of the cell.



Chromoplasts

Chromoplasts are plastids that produce and store pigments

They are responsible for different colours found in leaves, fruits, flowers and vegetables.

Carrot

Pigment: Carotene

Mango

Pigment: Xanthophyll

Tomato

Pigment: Lycopene

Leucoplasts

Leucoplasts are colourless plastids that store foods.

They are found in storage organs such as fruits, tubers and seeds.

Potato tubers

Food: Starch

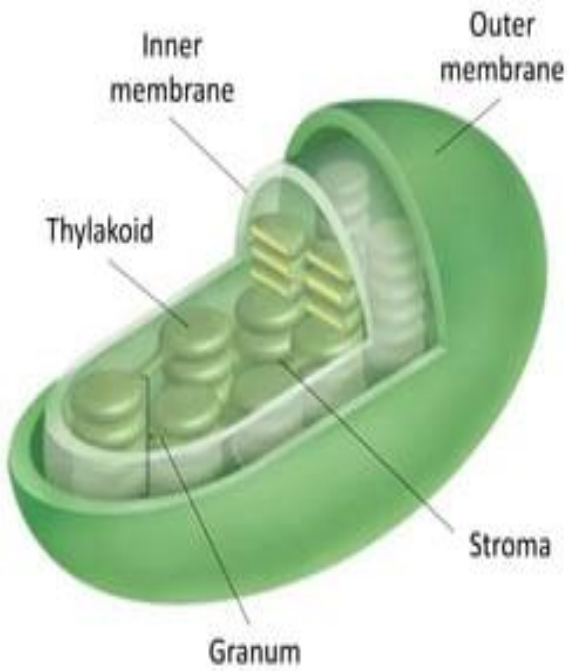
Maize grains

Food: Protein

Castor seeds

Food: Oil

Chloroplasts

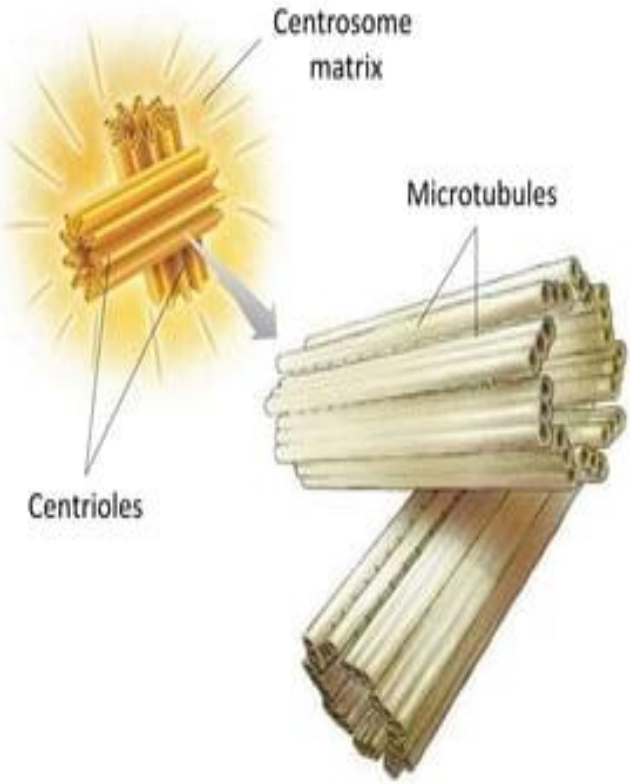


- Double membrane-bound organelles found mainly in plant cells
- Usually spherical or discoidal in shape
- Shows two distinct regions-grana and stroma
- Grana are stacks of thylakoids (membrane-bound, flattened discs)
- Thylakoids contain chlorophyll molecules which are responsible for photosynthesis
- Stroma is a colourless dense fluid

Functions:

- Convert light energy into chemical energy in the form of food
- Provide green colour to leaves, stems and vegetables

Centrosome

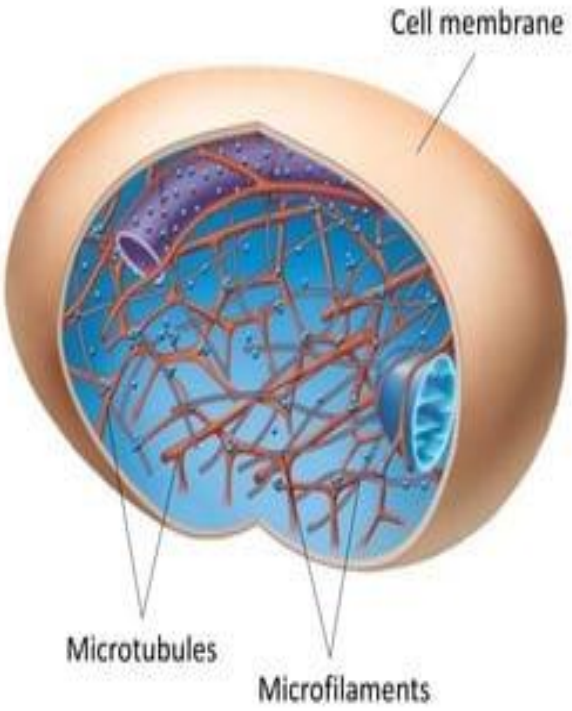


- Centrosome is the membrane bound organelle present near the nucleus
- Consists of two structures called centrioles
- Centrioles are hollow, cylindrical structures made of microtubules
- Centrioles are arranged at right angles to each other

Functions:

- Form spindle fibres which help in the movement of chromosomes during cell division
- Help in the formation of cilia and flagella

Cytoskeleton



- Formed by microtubules and microfilaments
- Microtubules are hollow tubules made up of protein called tubulin
- Microfilaments are rod shaped thin filaments made up of protein called actin

Functions:

- Determine the shape of the cell
- Give structural strength to the cell
- Responsible for cellular movements

Prokaryotic cell

1. Nucleus is undeveloped
2. Only one chromosome is present
3. Membrane bound organelles are absent
4. Size ranges from 0.5-5 µm
5. Examples: Bacteria and blue green algae

Eukaryotic cell

1. Nucleus is well developed
2. More than one chromosomes are present
3. Membrane bound organelles are present
4. Size ranges from 5-100 µm
5. Examples: All other organisms

Animal cell

1. Generally small in size
2. Cell wall is absent
3. Plastids are absent
4. Vacuoles are smaller in size and less in number
5. Centrioles are present

Plant cell

1. Generally large in size
2. Cell wall is present
3. Plastids are present
4. Vacuoles are larger in size and more in number
5. Centrioles are absent


THANK YOU...