CELL : THE UNIT OF LIFE

CLASS XI
BIOLOGY

PREPARED BY

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PGT BIOLOGY
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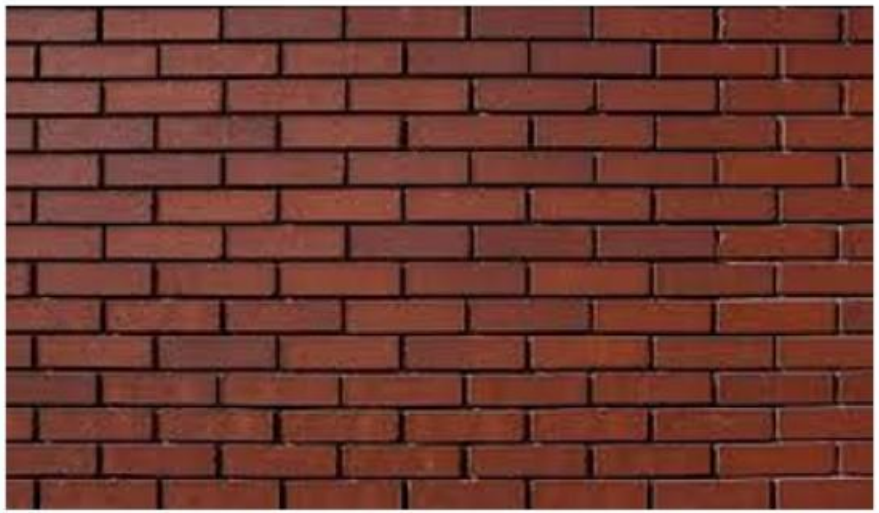
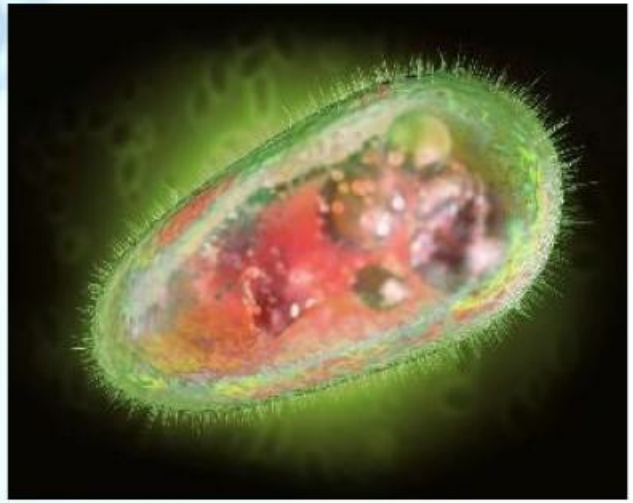
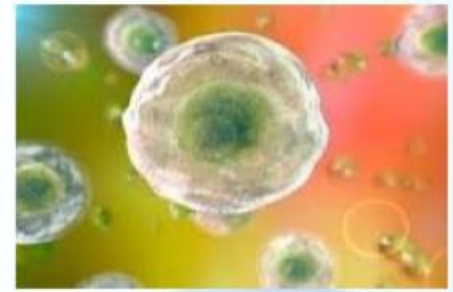
The wall is made up of



Bricks

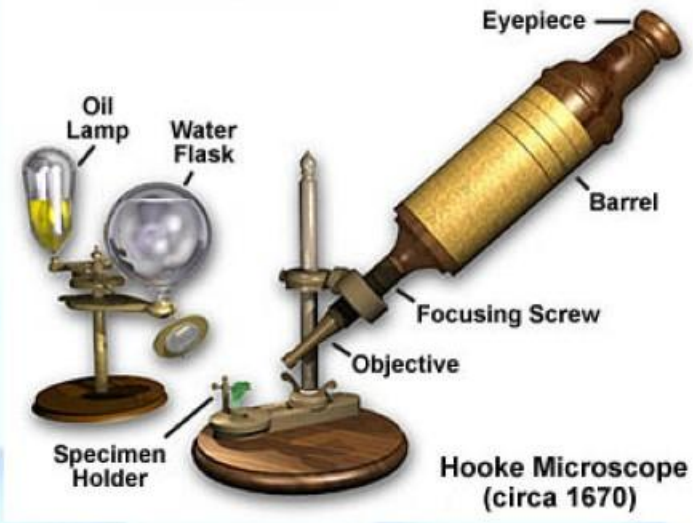
The brick is the unit of wall or a house





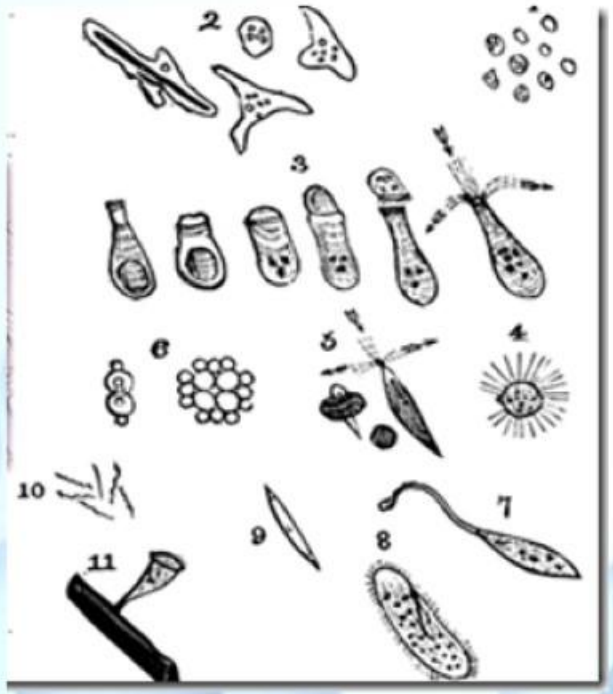
First seen with invention of microscope in 1665
Observed honeycomb of empty compartments in cork (**called them cells**)

Robert Hooke



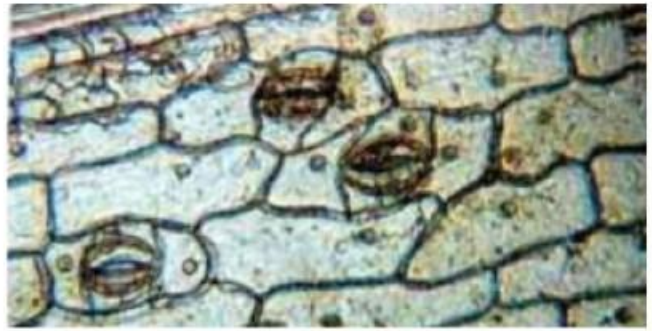
Hooke Microscope (circa 1670)

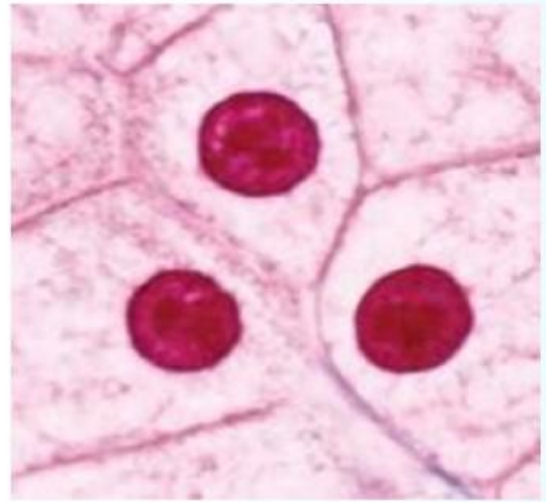
Anton Van Leeuwenhoek



Leeuwenhoek Microscope (circa late 1600s)

First observance of living microscopic single-celled organisms in water Called organisms "animalcules"



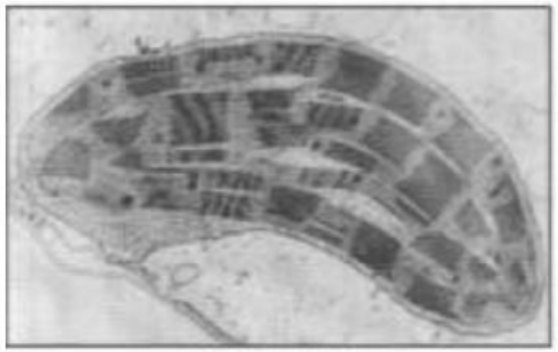


Robert Brown (1831)
discovered the nucleus.

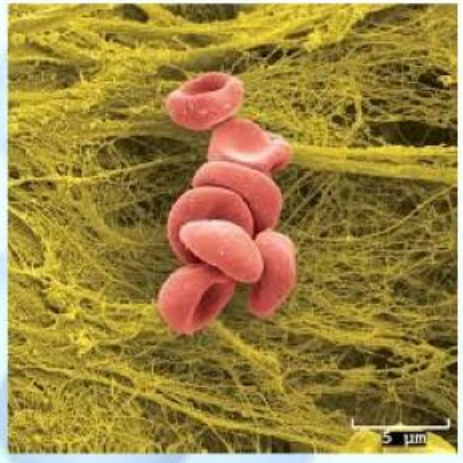
Electron microscope revealed detailed structure of cell

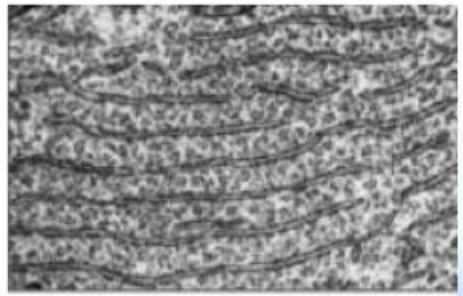
Golgi Apparatus

Mitochondrion



Chloroplast



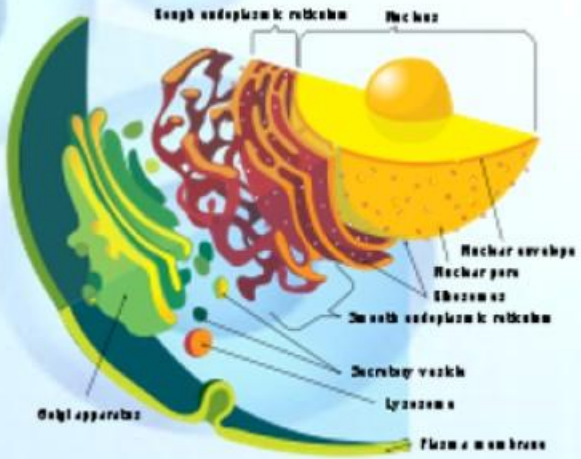


Endoplasmic Reticulum

Cell theory

Schleiden and Schwann

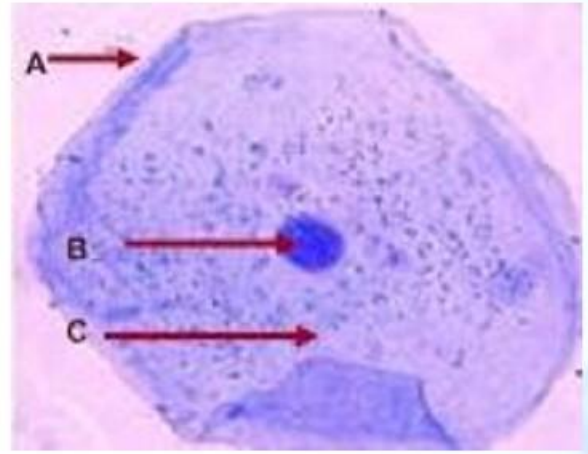
All living organism are made of cells and their products.



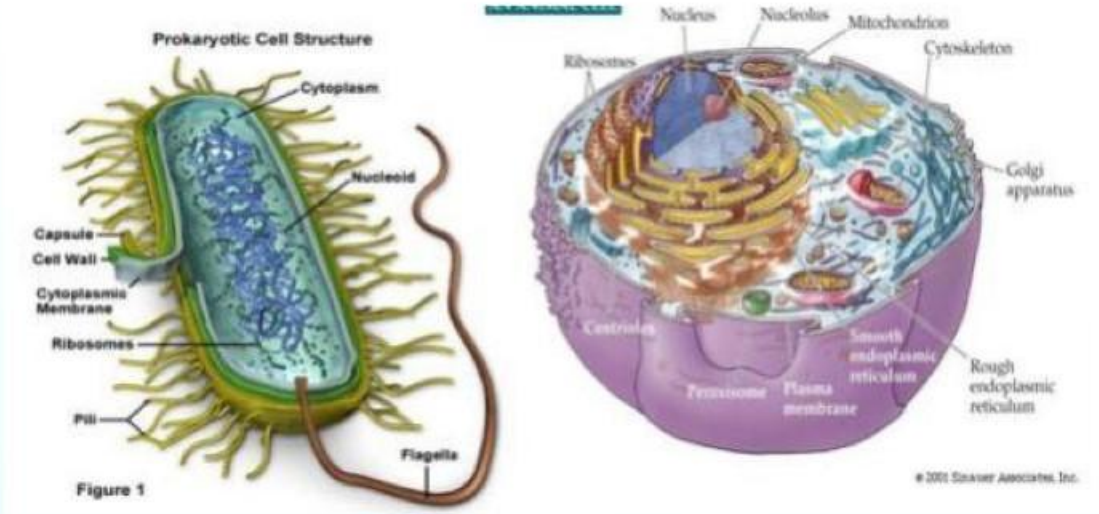
Rudolf Virchow

All cells arise from pre – existing cells.

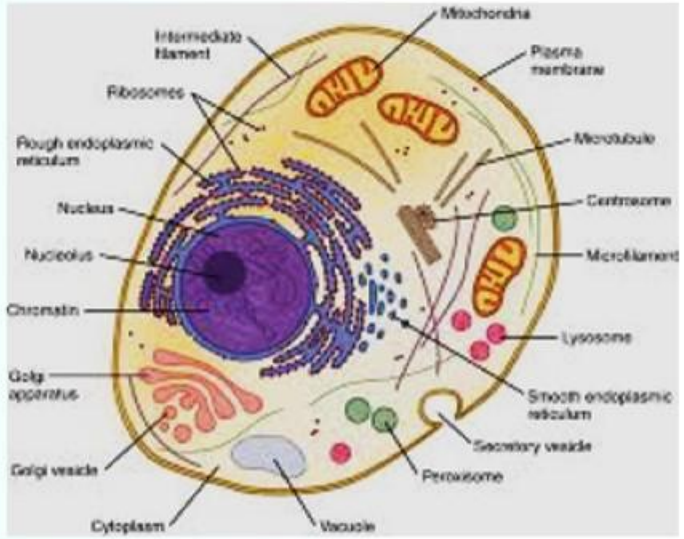
Onion peel cells

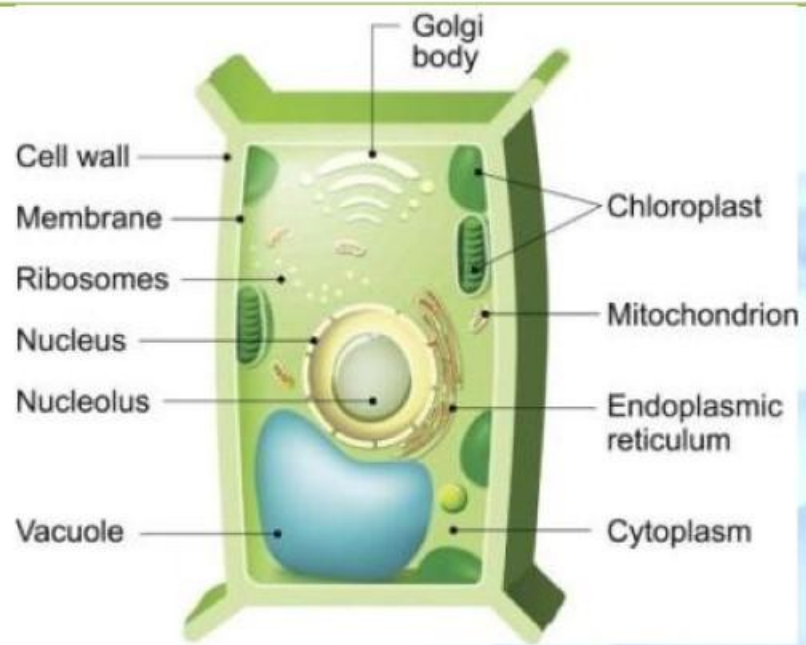


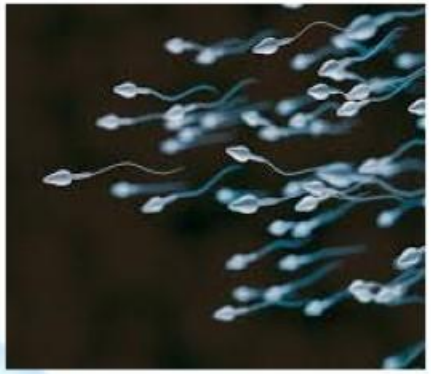
Human cheek cell



Plant , animal or prokaryotic cell, **cytoplasm** is the **main area of cellular activities**



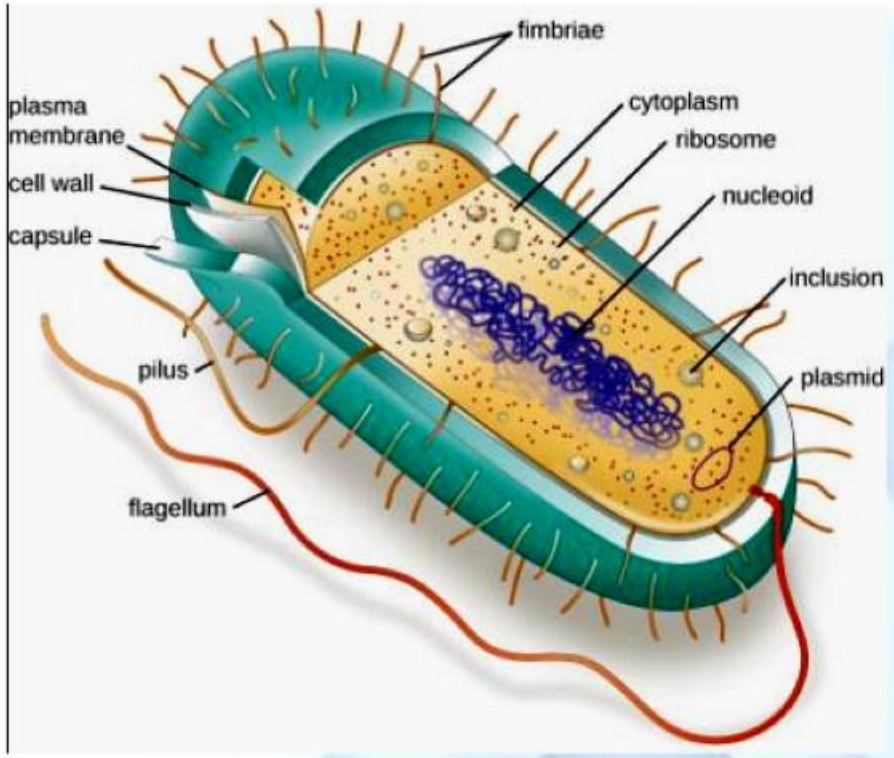




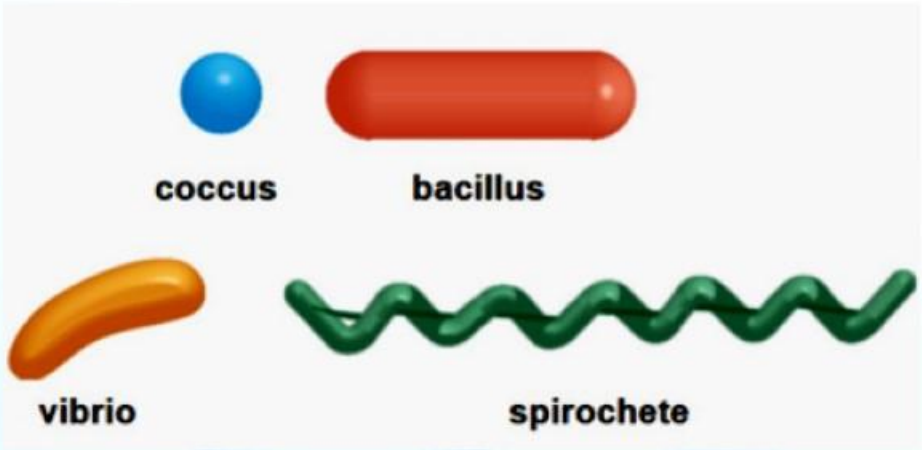
Largest to smallest cells – almost **same cellular machinery**

Prokaryotic cell

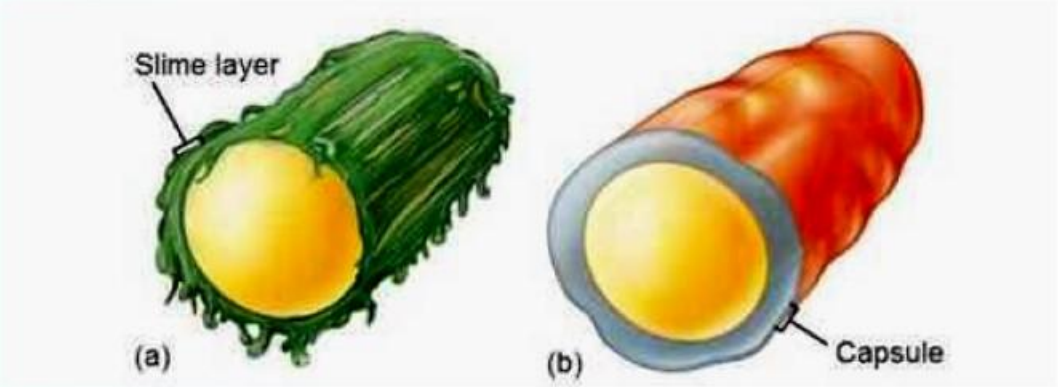
Bacteria, Blue-green algae, Mycoplasma, PPLO (Pleuro Pneumonia Like Organisms).

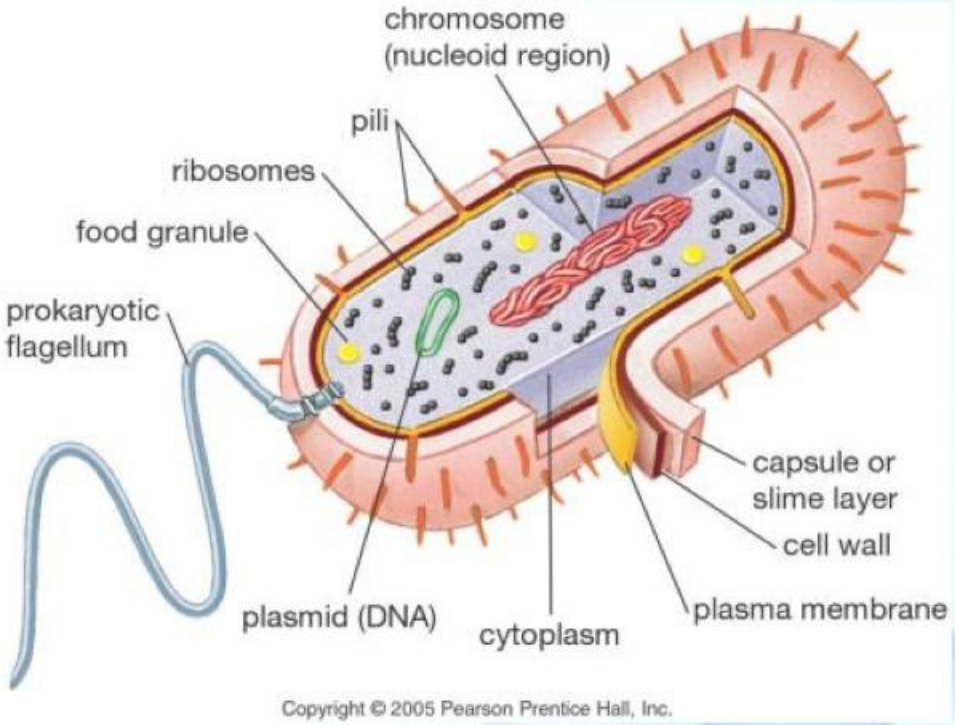


Bacterial cells may be **Bacillus (rod shaped)**, **Coccus (spherical)**, **Vibrio (comma-shaped)** and **Spirillum (spiral)**.

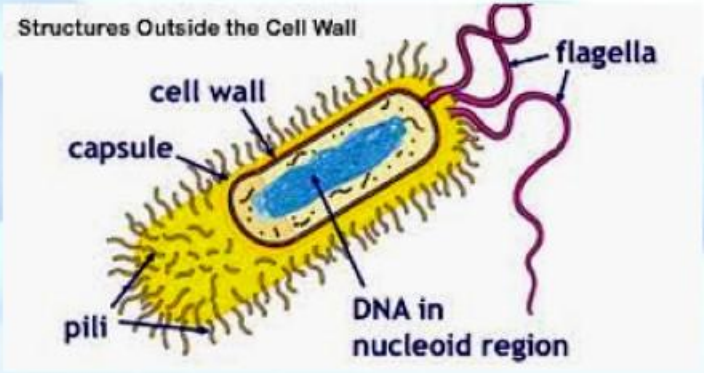


Bacteria has three layers Glycocalyx, cell wall, plasma membrane





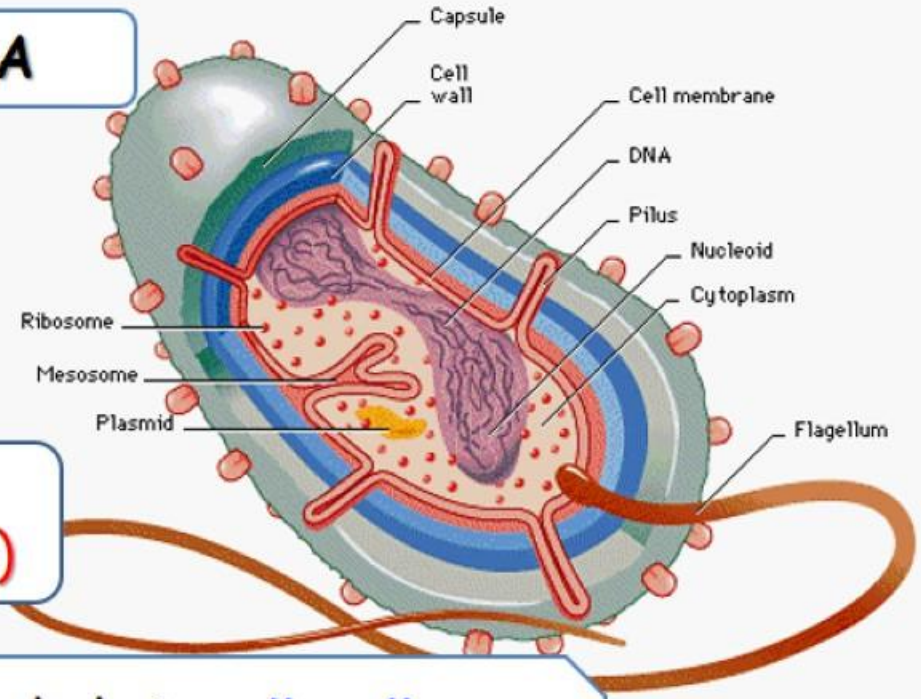
Glycocalyx as loose sheath in some bacteria called slime layer.
Glycocalyx may be thick and tough called capsule.



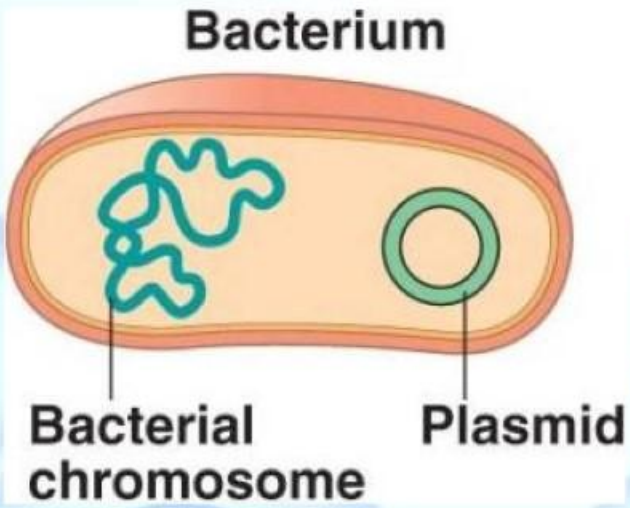
Plasmid

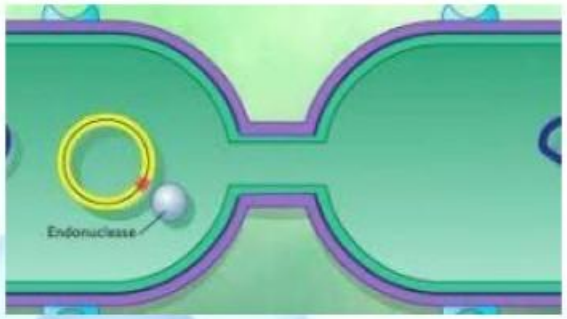
The **extrachromasomal circular DNA** in cytoplasm -**resistance to antibiotics**

Nucleoid – main DNA



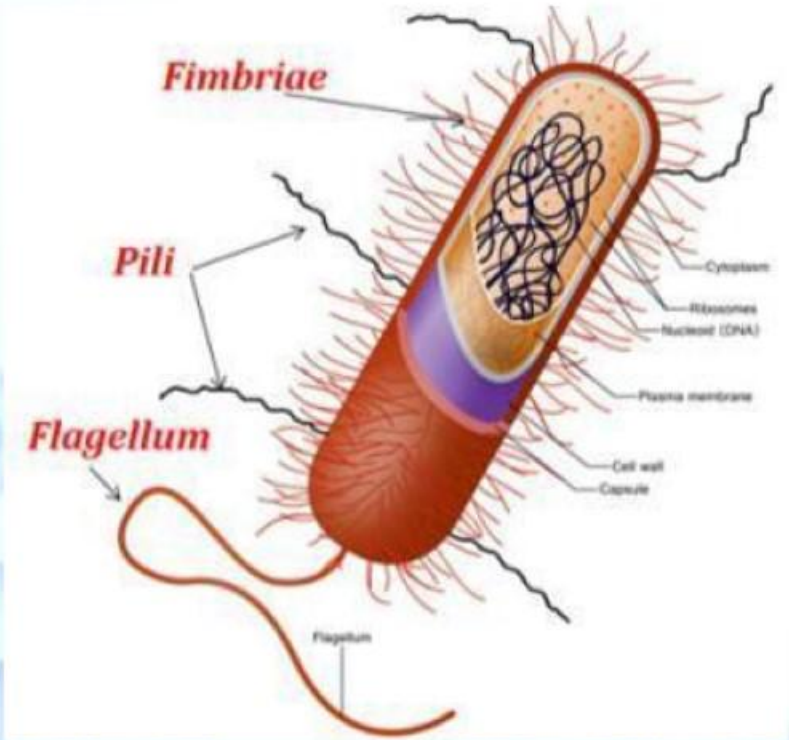
Mesosome, chromatophores (extension of plasma membrane)

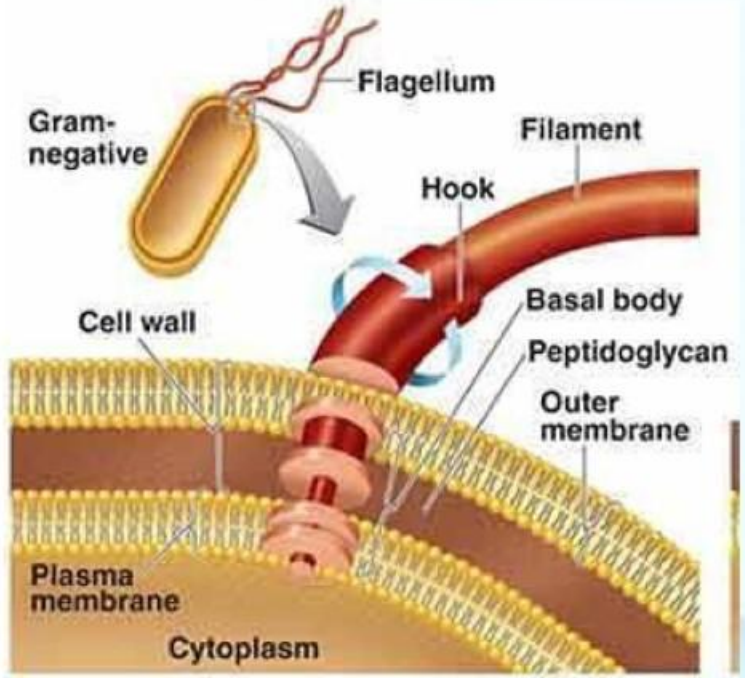




Mesosome help in **cell wall formation**, **DNA replication** and distribution to daughter cells.

Flagellum- three parts are – filament. Hook, and basal body

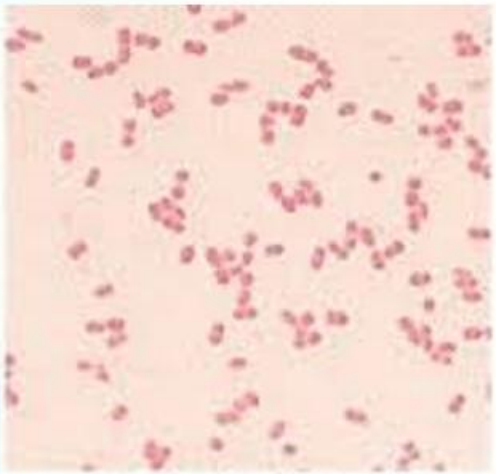




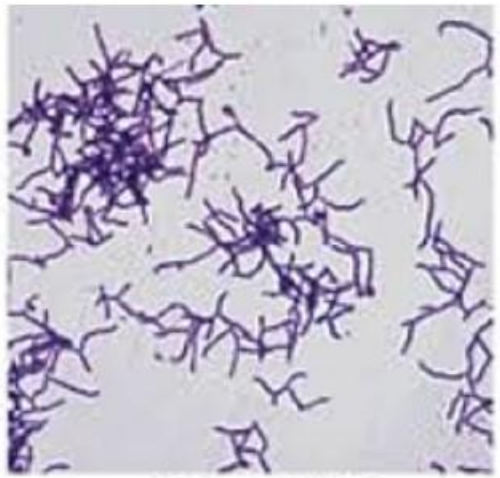
Pili, fimbriae – surface structure do not play a role in motility but helps in attachment

Based on staining property gram +ve and gram –ve bacteria.

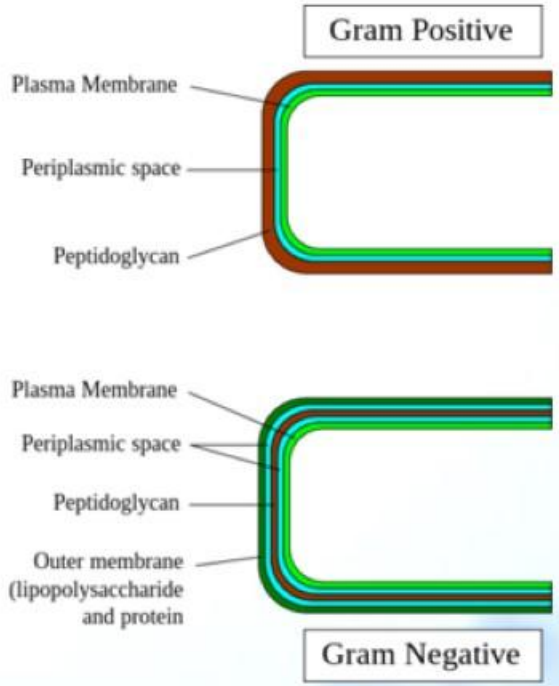
Staining with **Crystal violet**, **decolorization**, and **counter staining**, with **safranin**.



Gram Negative

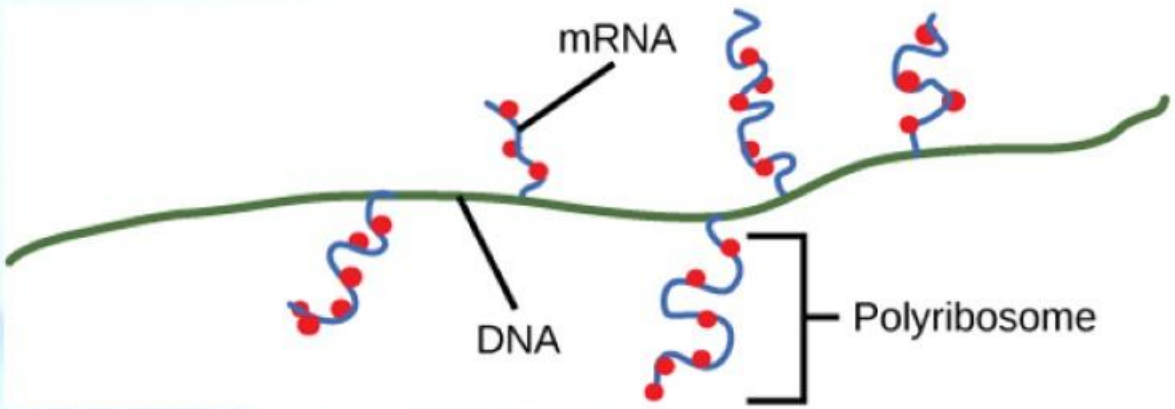


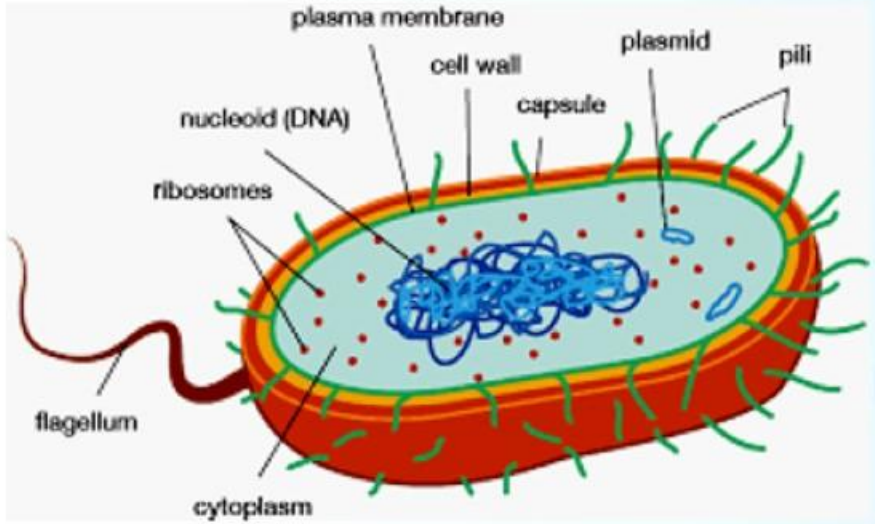
Gram Positive



Ribosomes

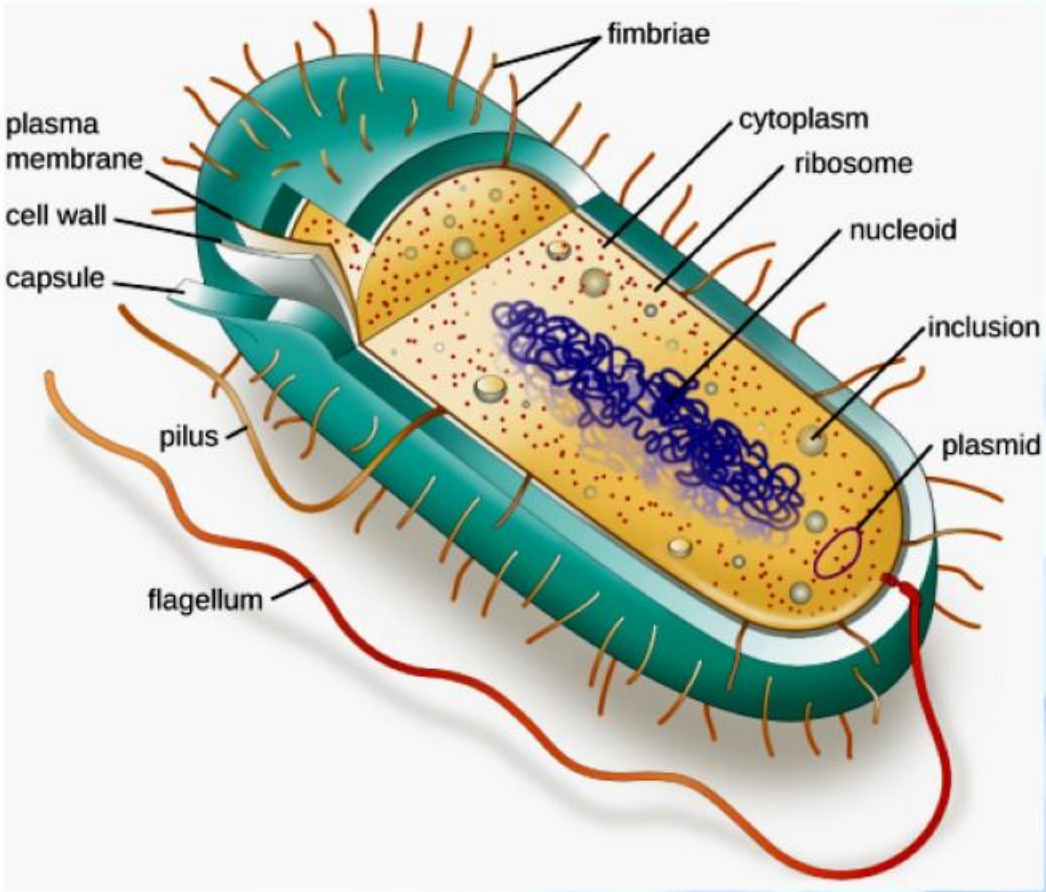
Ribosomes. 15-20 nm, 2 sub – units 50S and 30S- together form 70S. – help in Protein synthesis – polysomes / polyribosomes on m RNA





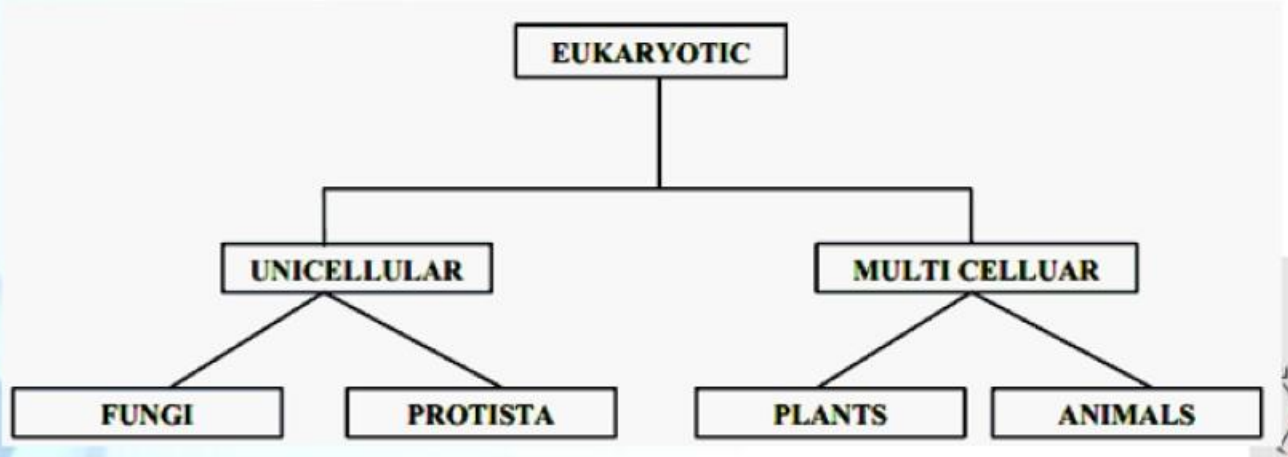
Inclusion bodies.

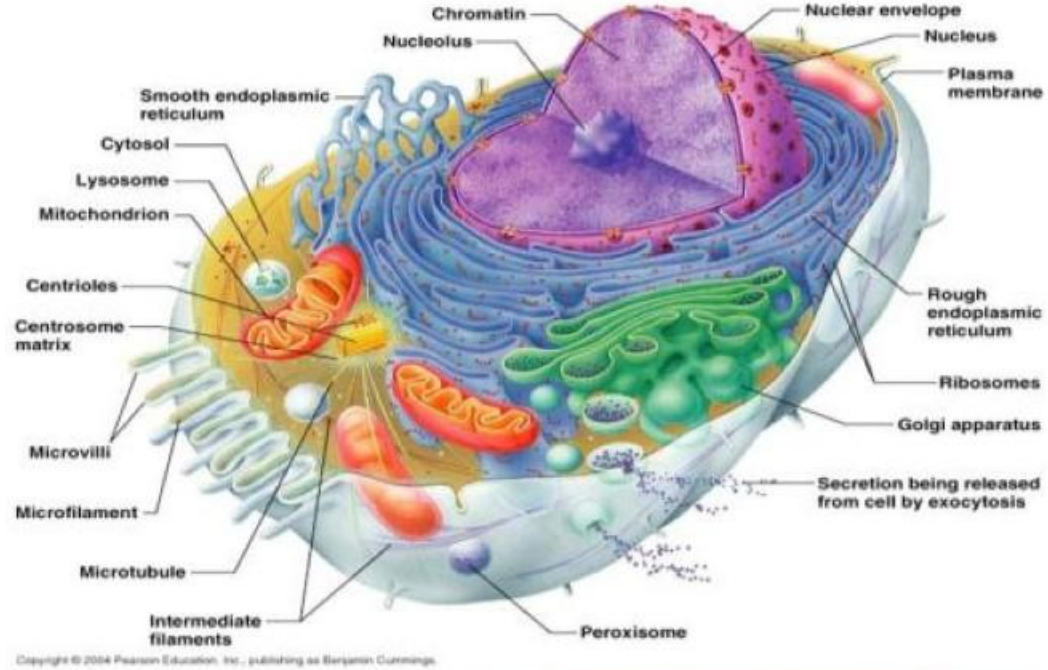
Reserve materials: Phosphate granules, Cyanophycean , Glycogen granules, Gas vacuoles.

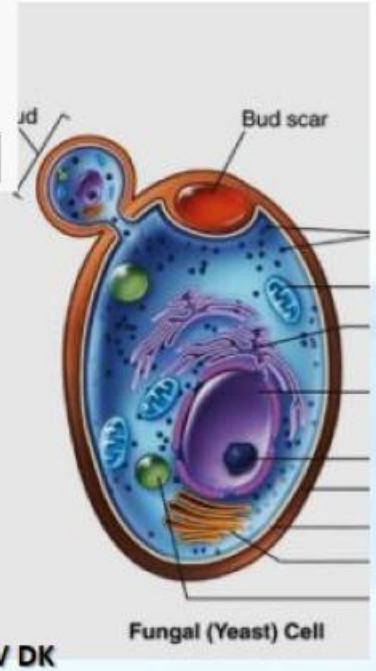


Eukaryotic cells

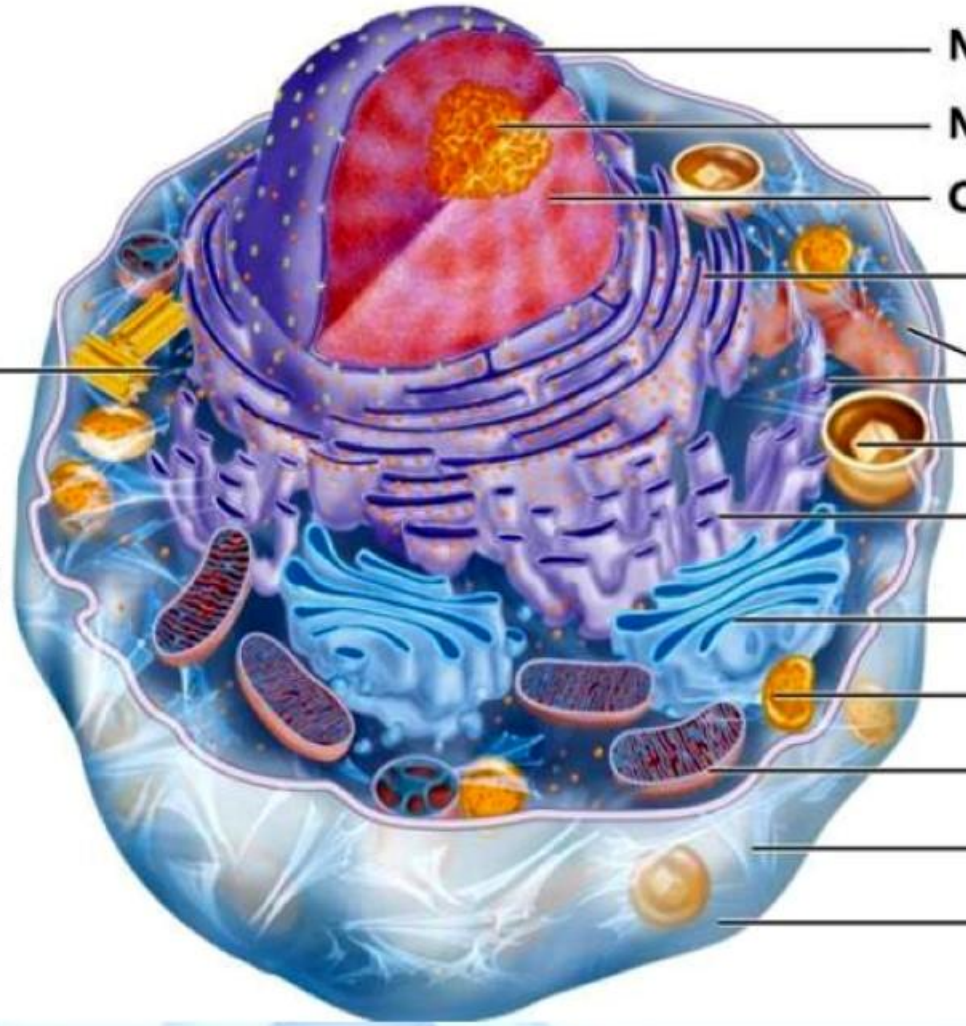
Possess an oragnized nucleus with nuclear envelope and have a variety of complex locomotory and cytoskeletal structures.







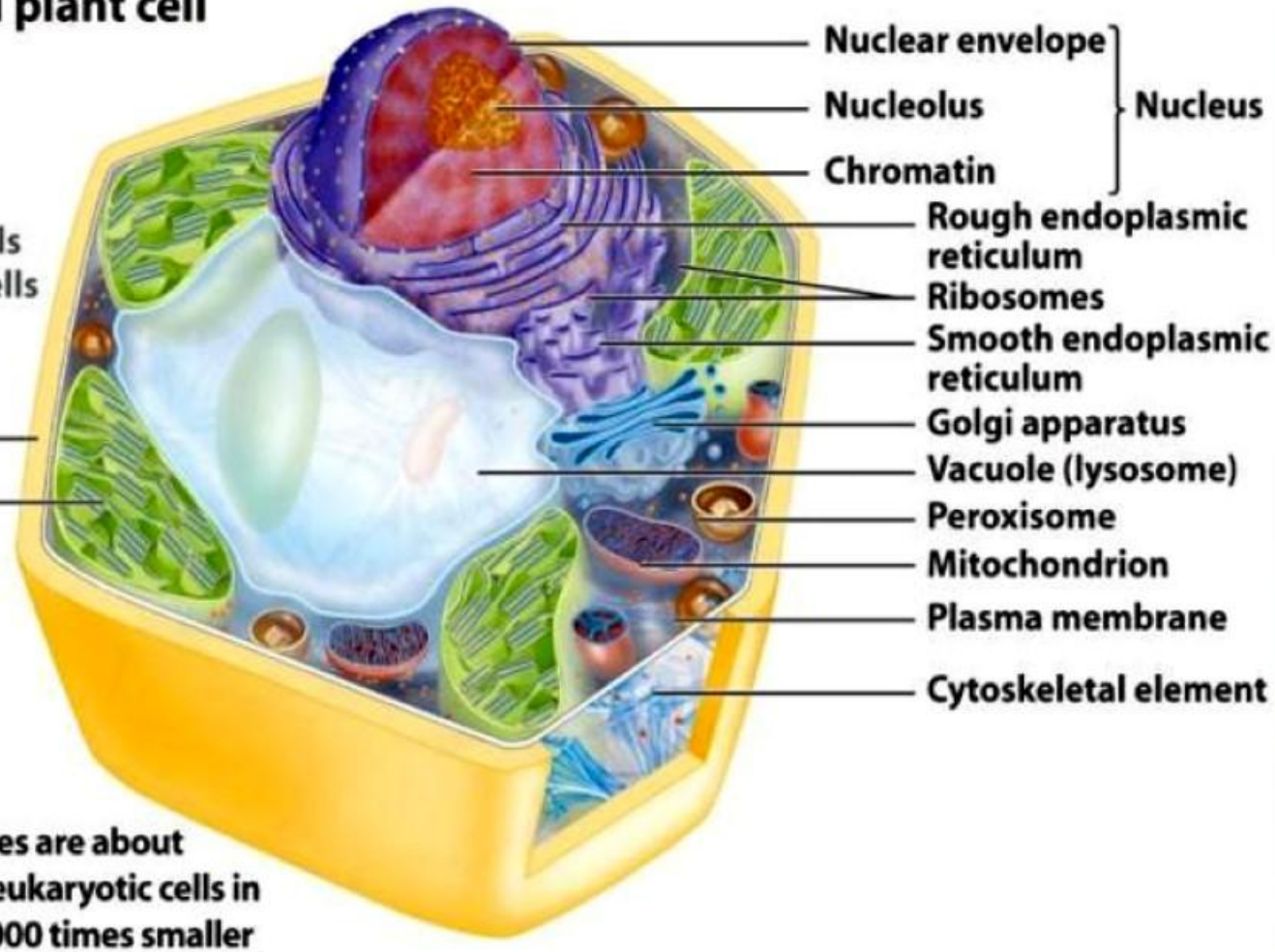
(a) Generalized animal cell



Nuclear envelope
Nucleolus
Chromatin
Nucleus
Rough endoplasmic reticulum
Ribosomes
Peroxisome
Smooth endoplasmic reticulum
Golgi apparatus
Lysosome
Mitochondrion
Cytoskeletal element
Plasma membrane
Centrioles

Structures that occur in animal cells but not plant cells

(b) Generalized plant cell

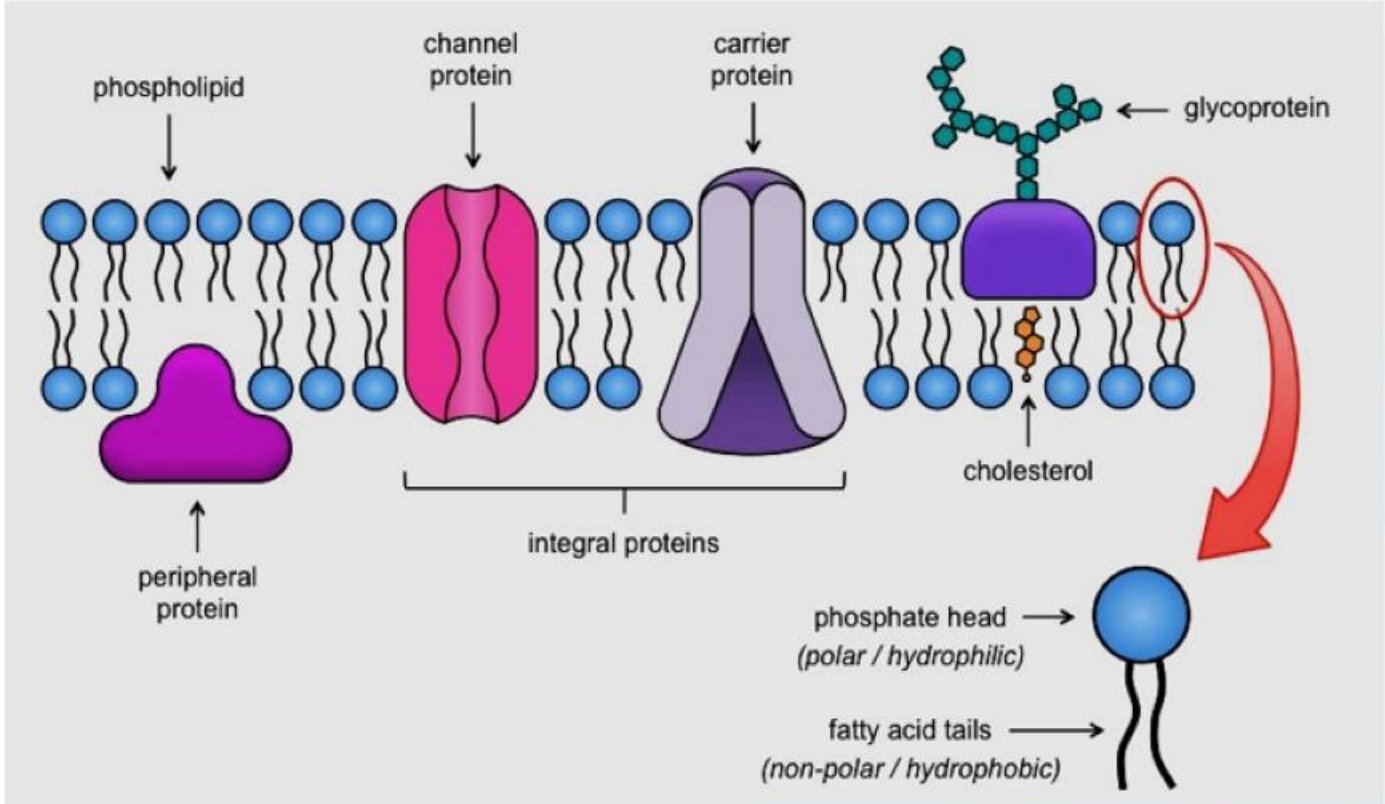


On average, prokaryotes are about 10 times smaller than eukaryotic cells in diameter and about 1000 times smaller than eukaryotic cells in volume.

Cell membrane

Cell membrane is composed of **lipids** and that are **arranged in bilayer**. It is mainly composed of **phosphoglycerides**

The **polar head towards outside** and **nonpolar tail towards inside**



Singer and Nicolson (1972) gave fluid mosaic model..

According to this the quasi fluid nature of lipid enables lateral movement of proteins within the overall bilayer.

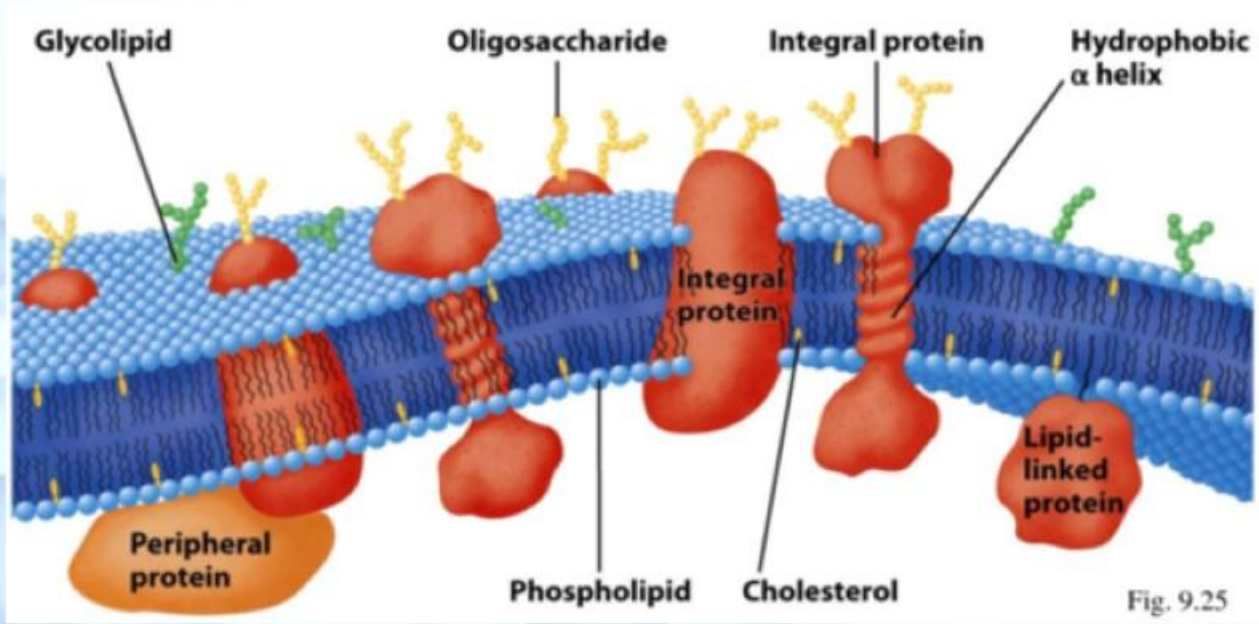
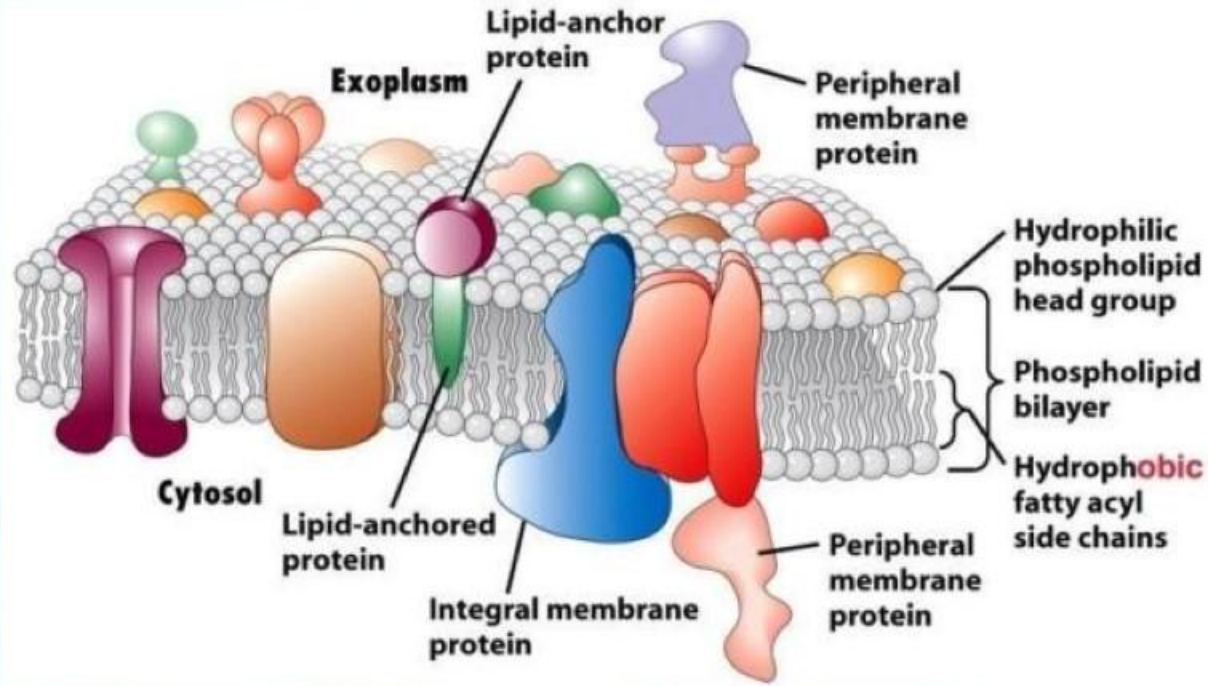
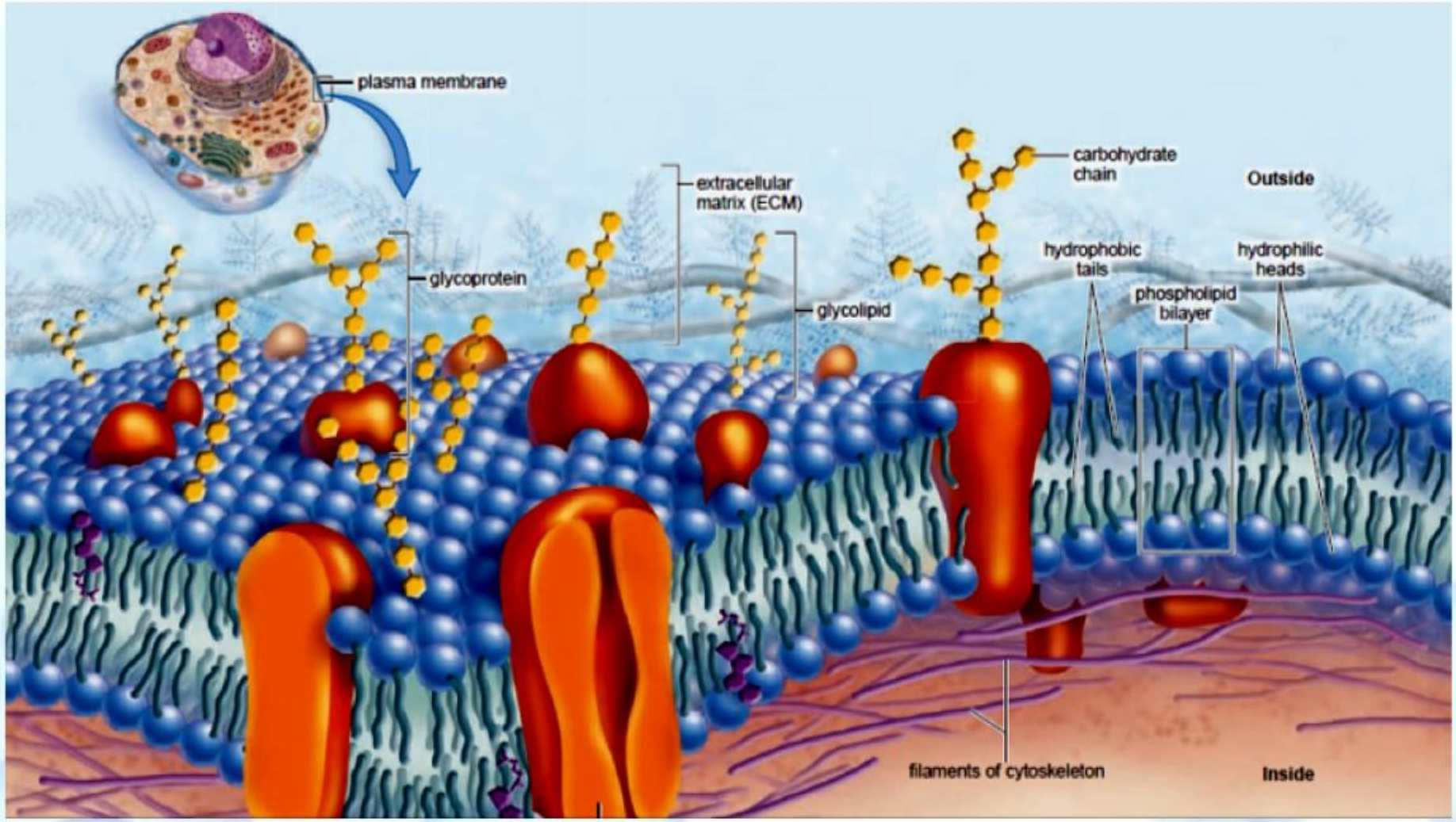


Fig. 9.25

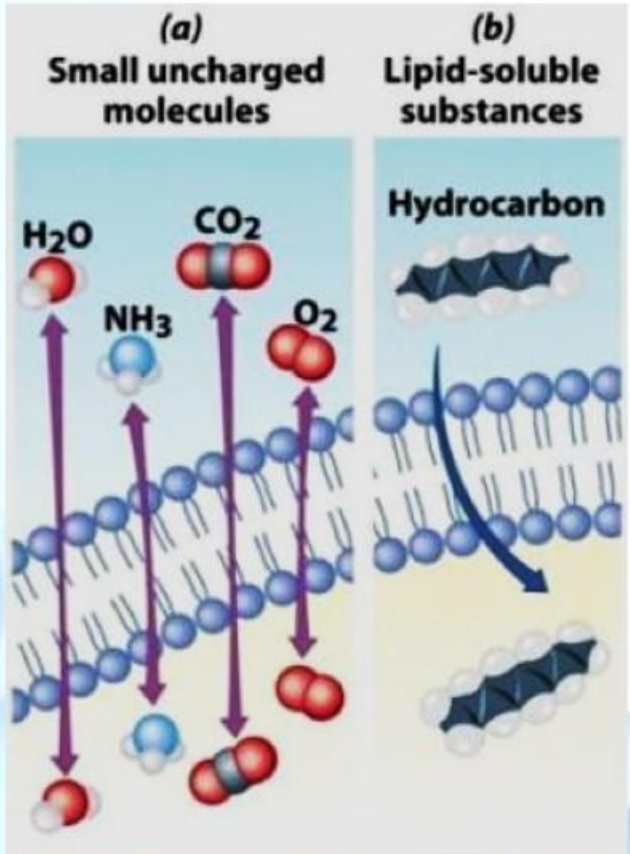
Two types of proteins (Peripheral and integral proteins) with cholesterol, glycolipids and glycoproteins.

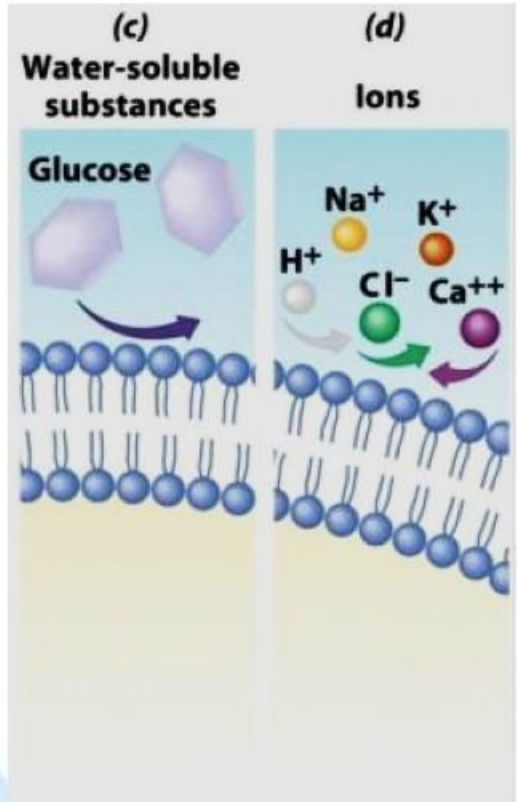


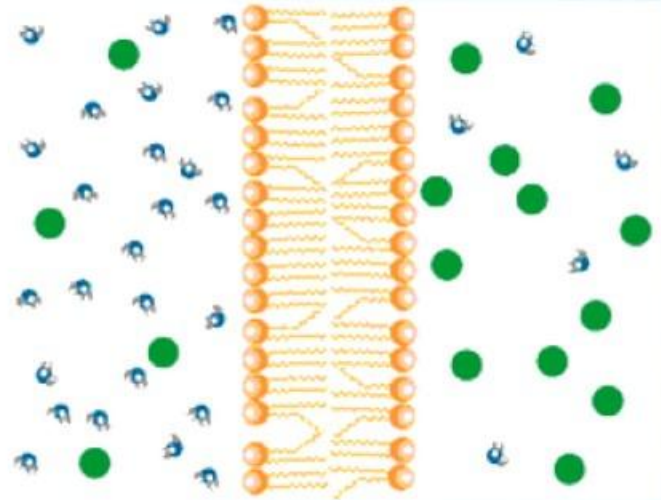
Erythrocyte membrane has 52% protein and 40% lipids.


plasma membrane
extracellular matrix (ECM)
carbohydrate chain
Outside
glycoprotein
glycolipid
hydrophobic tails
hydrophilic heads
phospholipid bilayer
filaments of cytoskeleton
Inside

Function: -It is semi permeable and helps in transport of molecule across it.



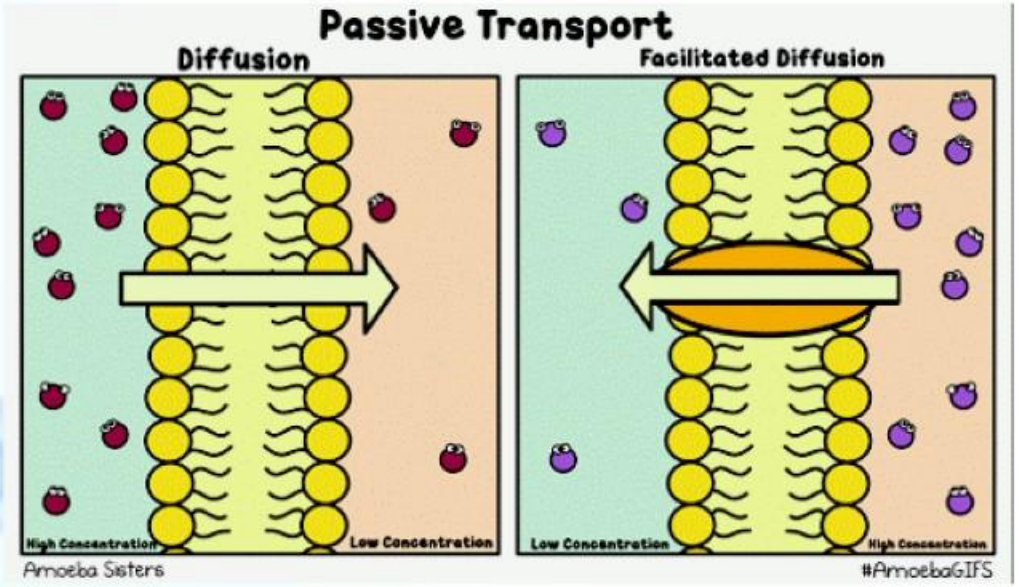




Water moves by osmosis

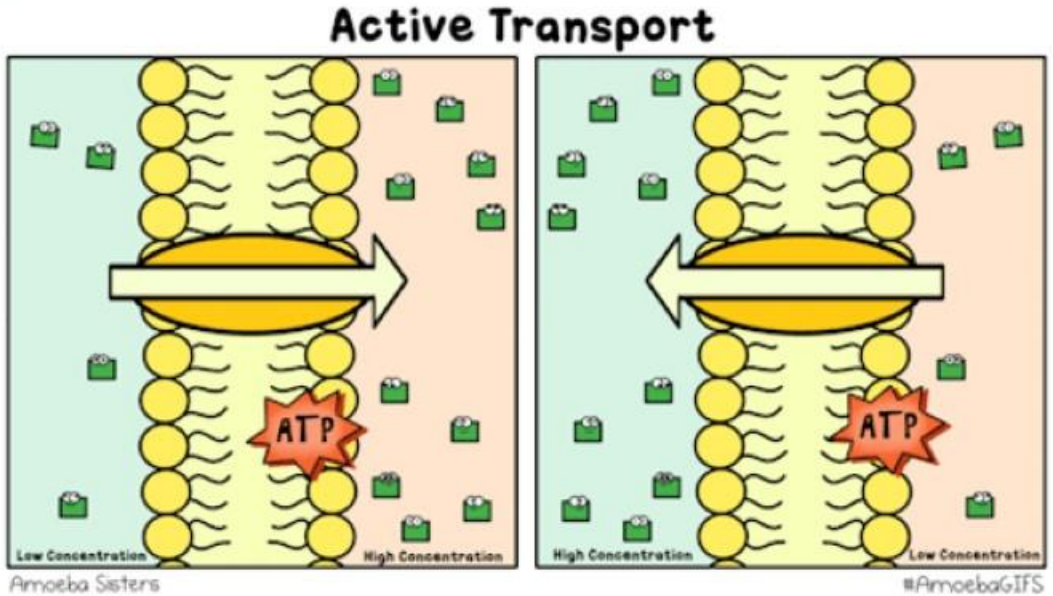
Transport of molecules from **higher to lower concentration**

e.g., Diffusion

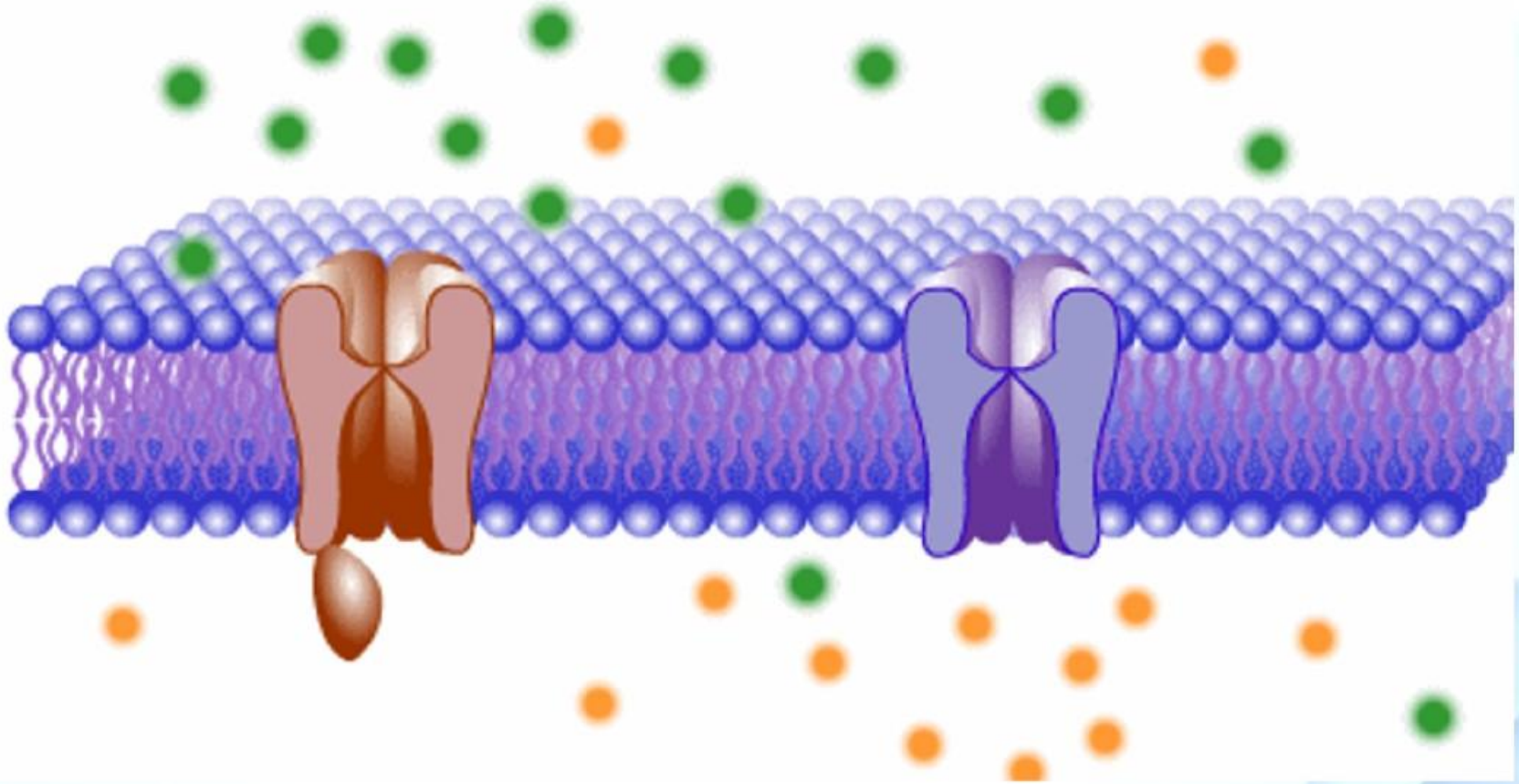


It do not utilise **energy (ATP)**.

Transport of molecules from lower to Higher concentration



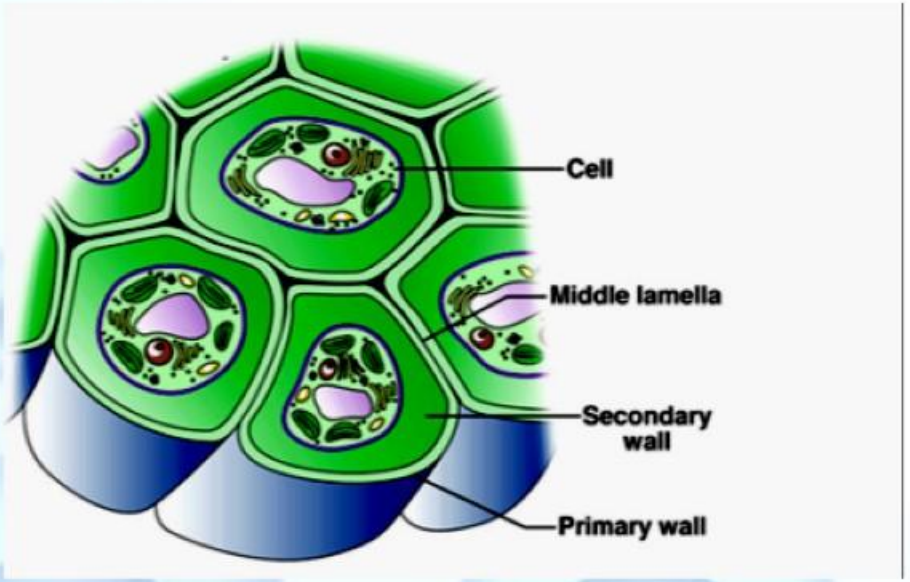
It utilises energy (ATP)
e.g. Na+/K+ ATPase Pump

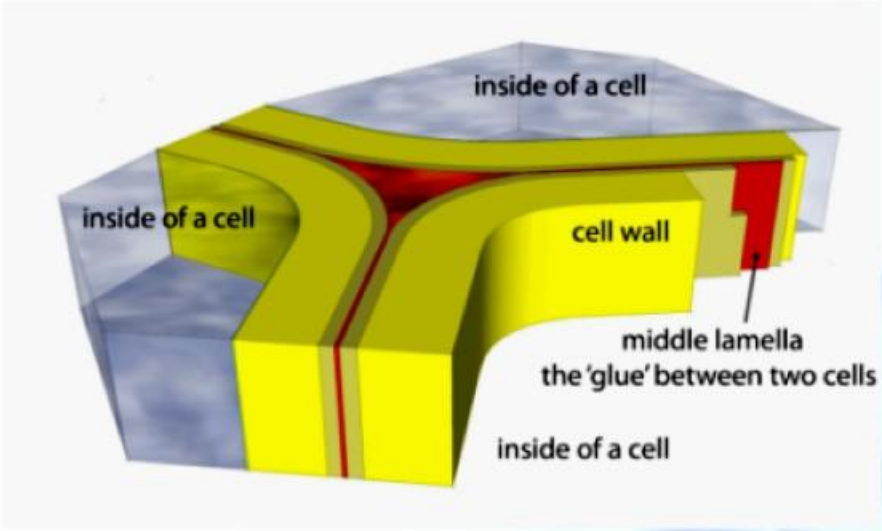


Cell Wall

It is non-living rigid structure. Gives shape to the cell and protects cell from mechanical damage and infection.

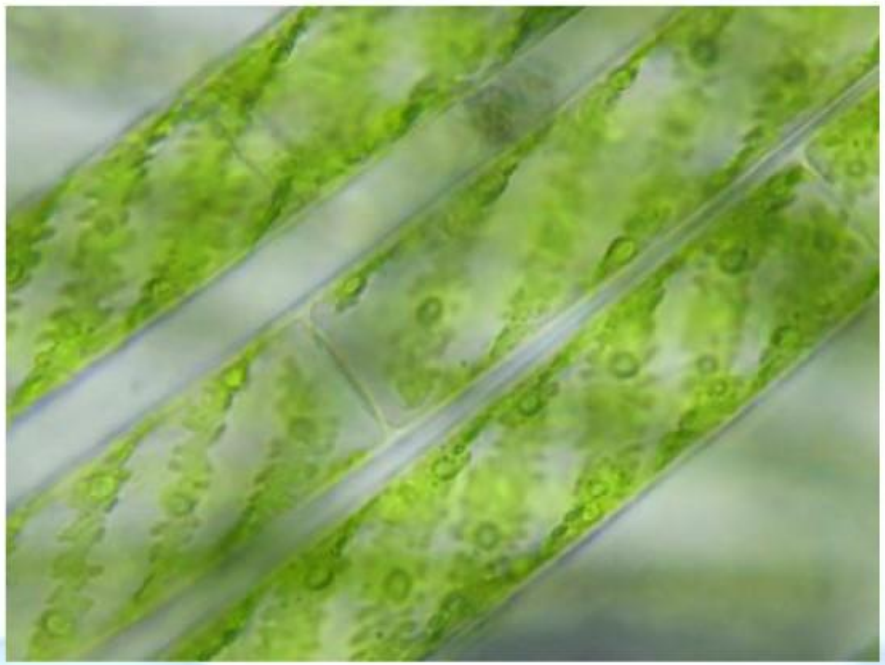
It helps in cell-to-cell interaction and provides barrier to undesirable macromolecules

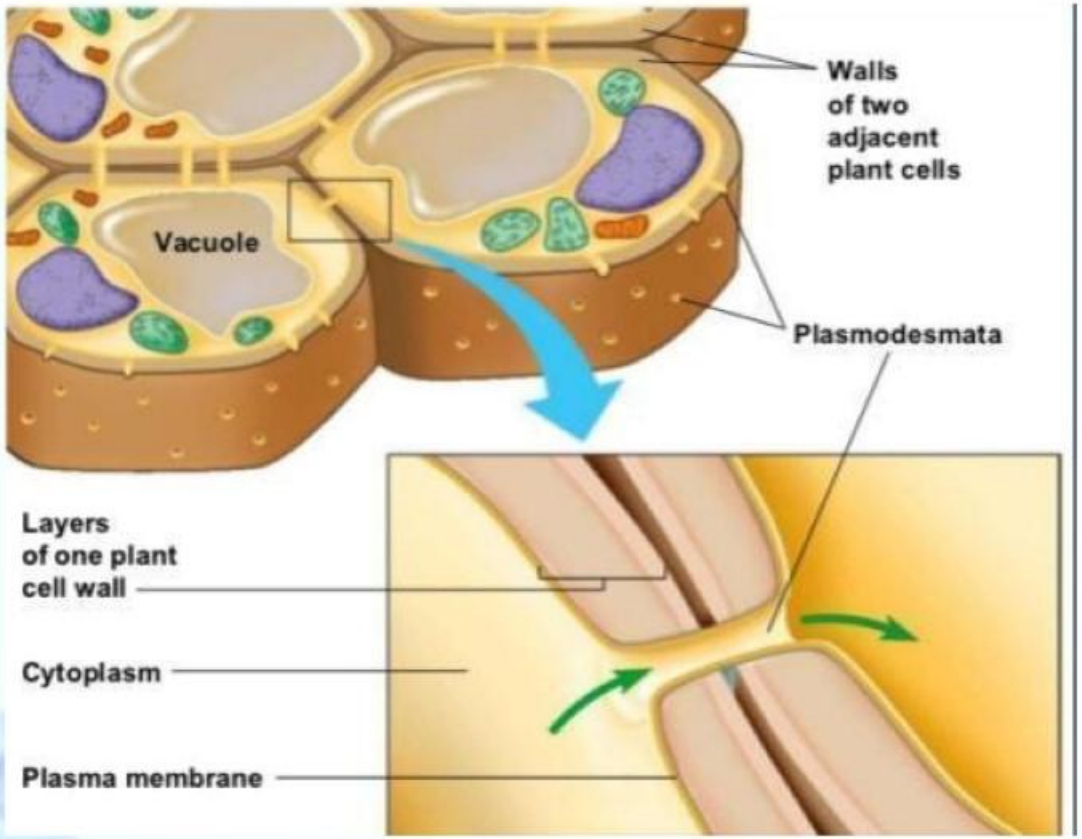




Cell Wall

Cell wall of algae is made of **cellulose, galactans, mannans** and minerals like calcium carbonate.





Plant cell wall consists of cellulose, hemicellulose, pectins and proteins.

Middle lamella is made of calcium pectate which holds neighboring cells together

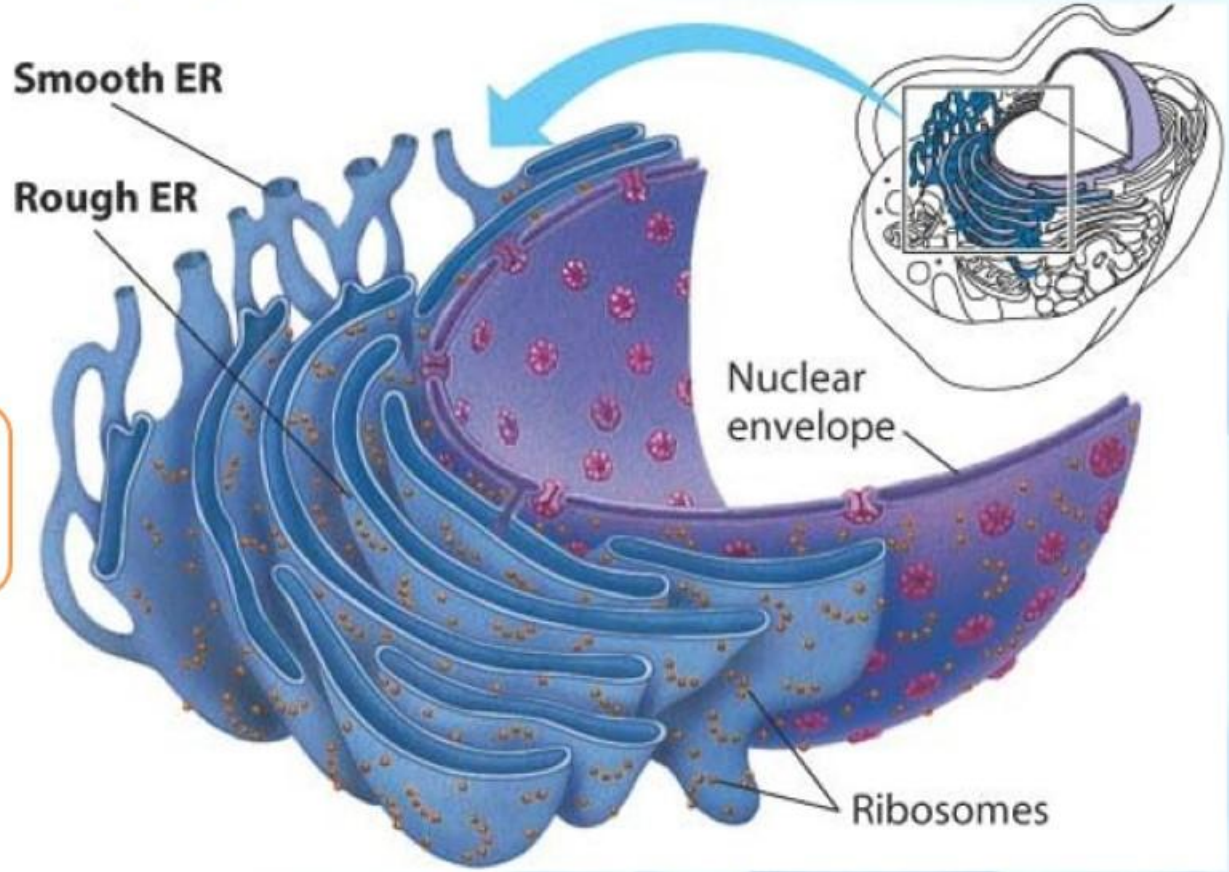
Plasmodesmata connect the cytoplasm of neighboring cells.

Endoplasmic Reticulum (ER)

Consists of network of tiny tubular structure scattered in cytoplasm.

ER divides the intracellular space into two distinct compartments

Luminal (inside ER) and extra luminal (cytoplasm).



Rough Endoplasmic Reticulum (RER)

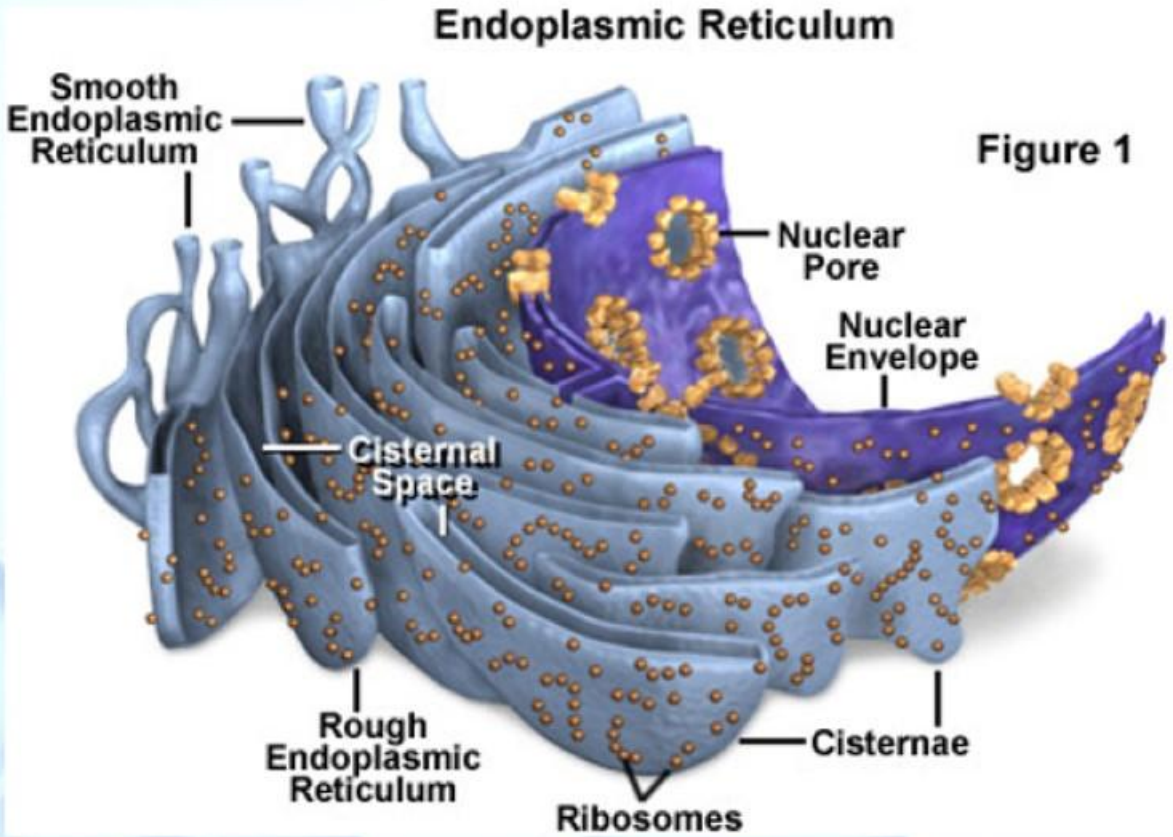


Figure 1

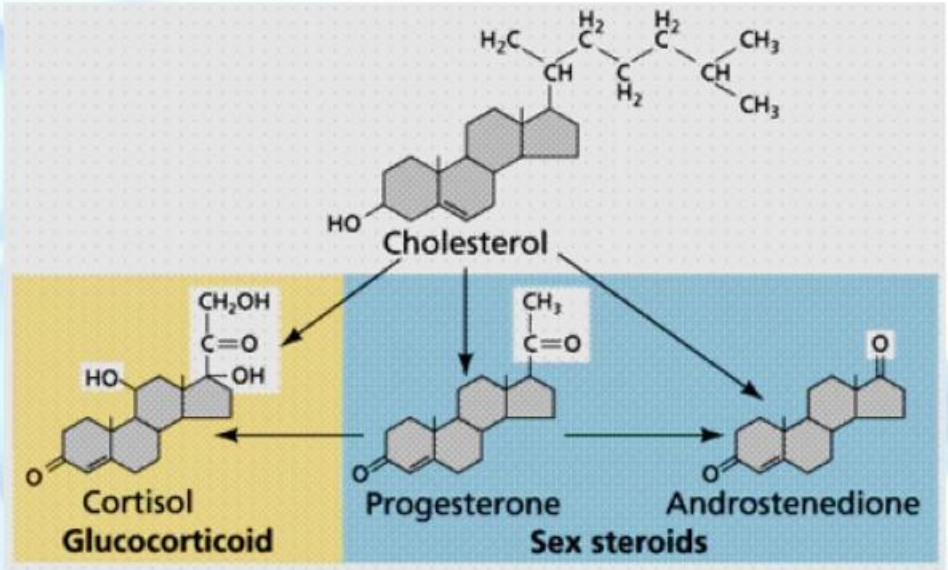
Ribosomes attached to outer surface. Continuous with outer membrane of nucleus

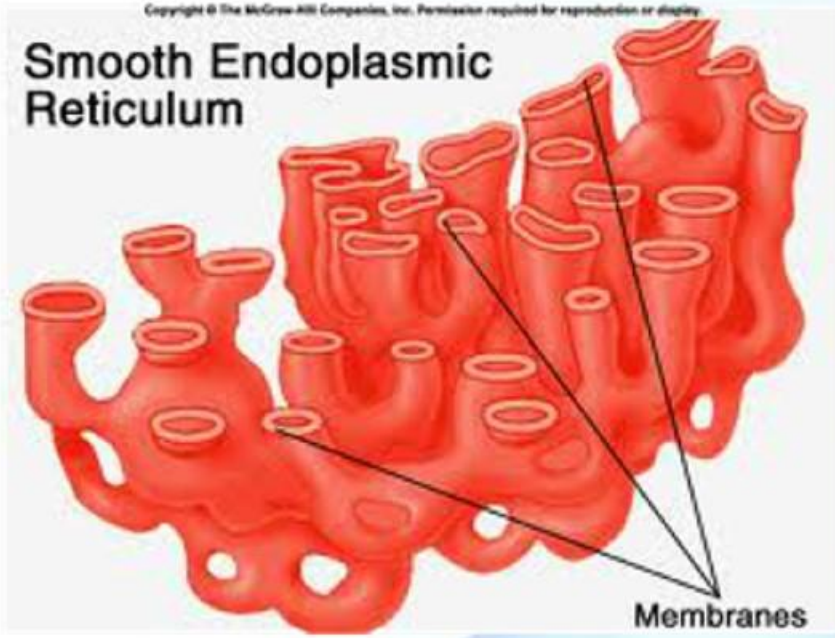
Function :Involved in **protein synthesis** and secretion.

Smooth Endoplasmic Reticulum (SER)

Lack ribosomes.
Function **Site for synthesis of lipid.**

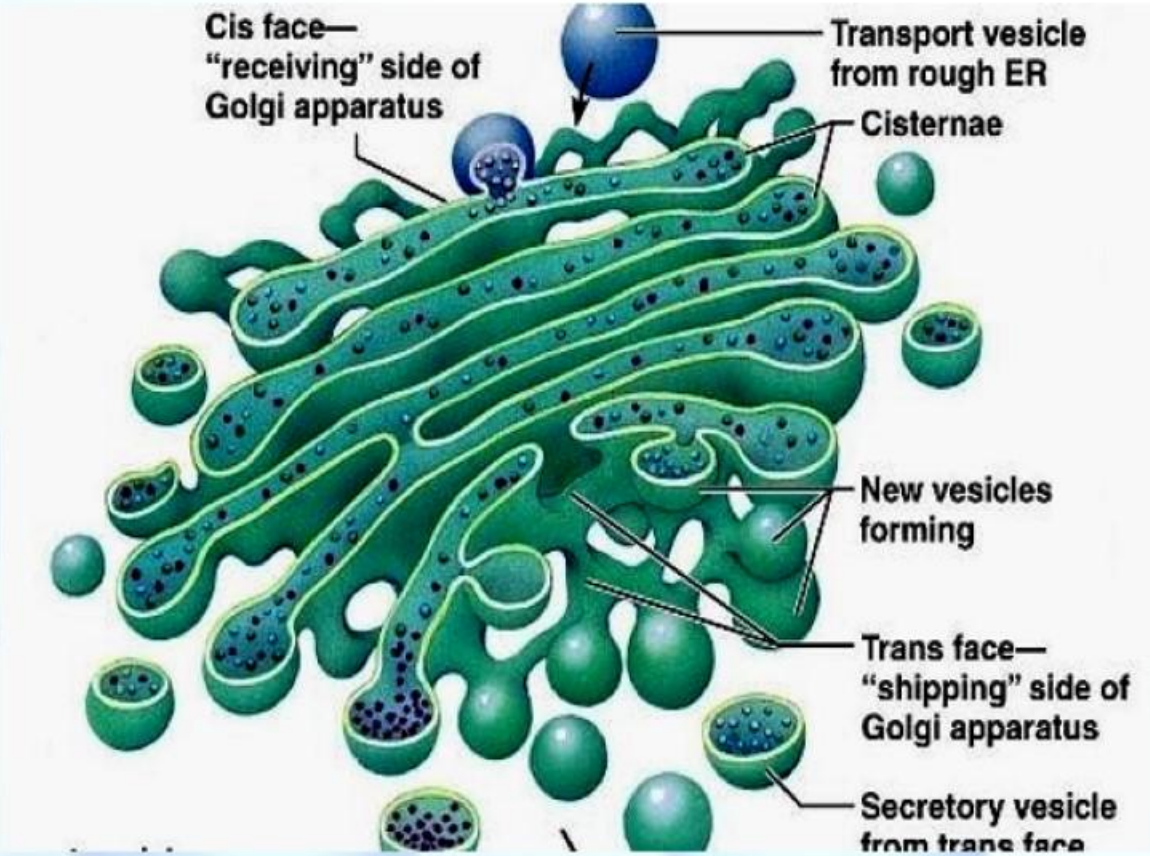
Steroidal hormones are synthesised in SER





Golgi apparatus

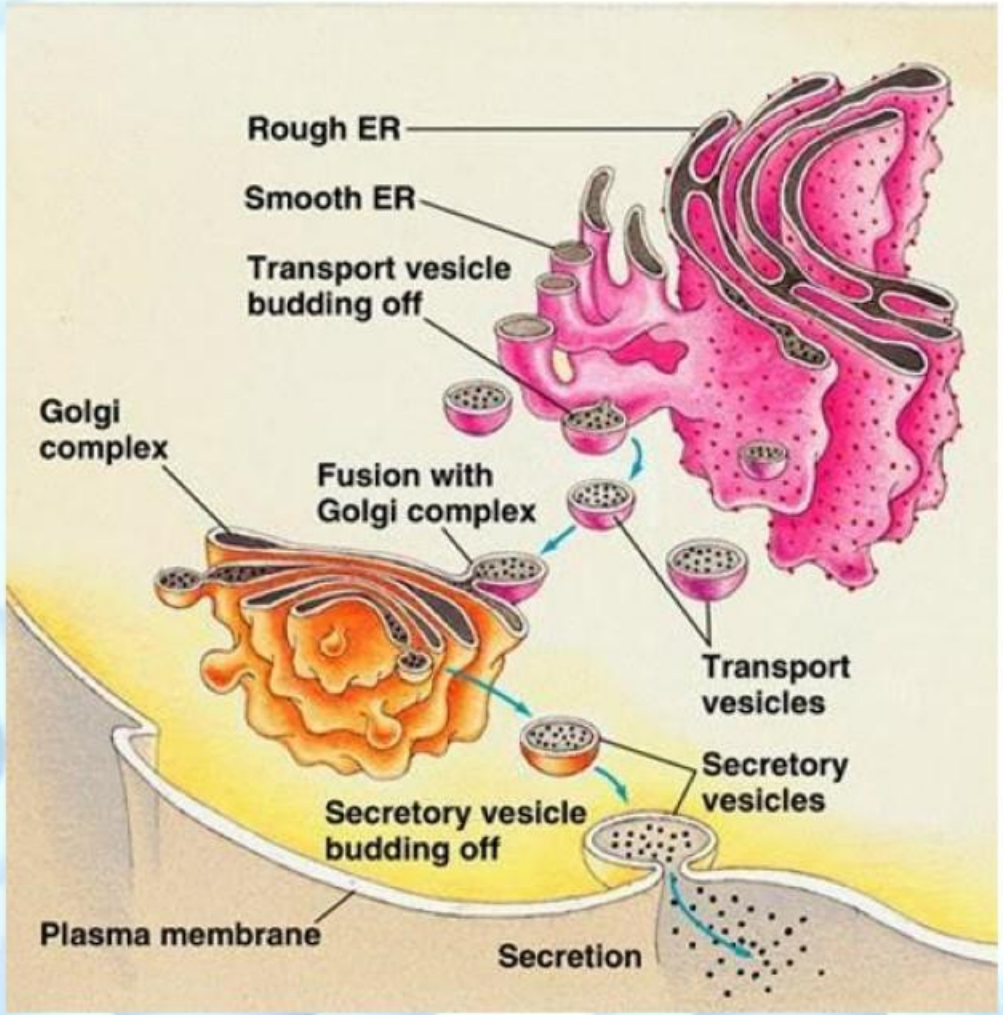
First observed by
Camillo Golgi (in 1898)



Consist of cisternae stacked parallel to each other.

Two faces of the organelle are convex/cis or forming face and concave/trans or maturing face.

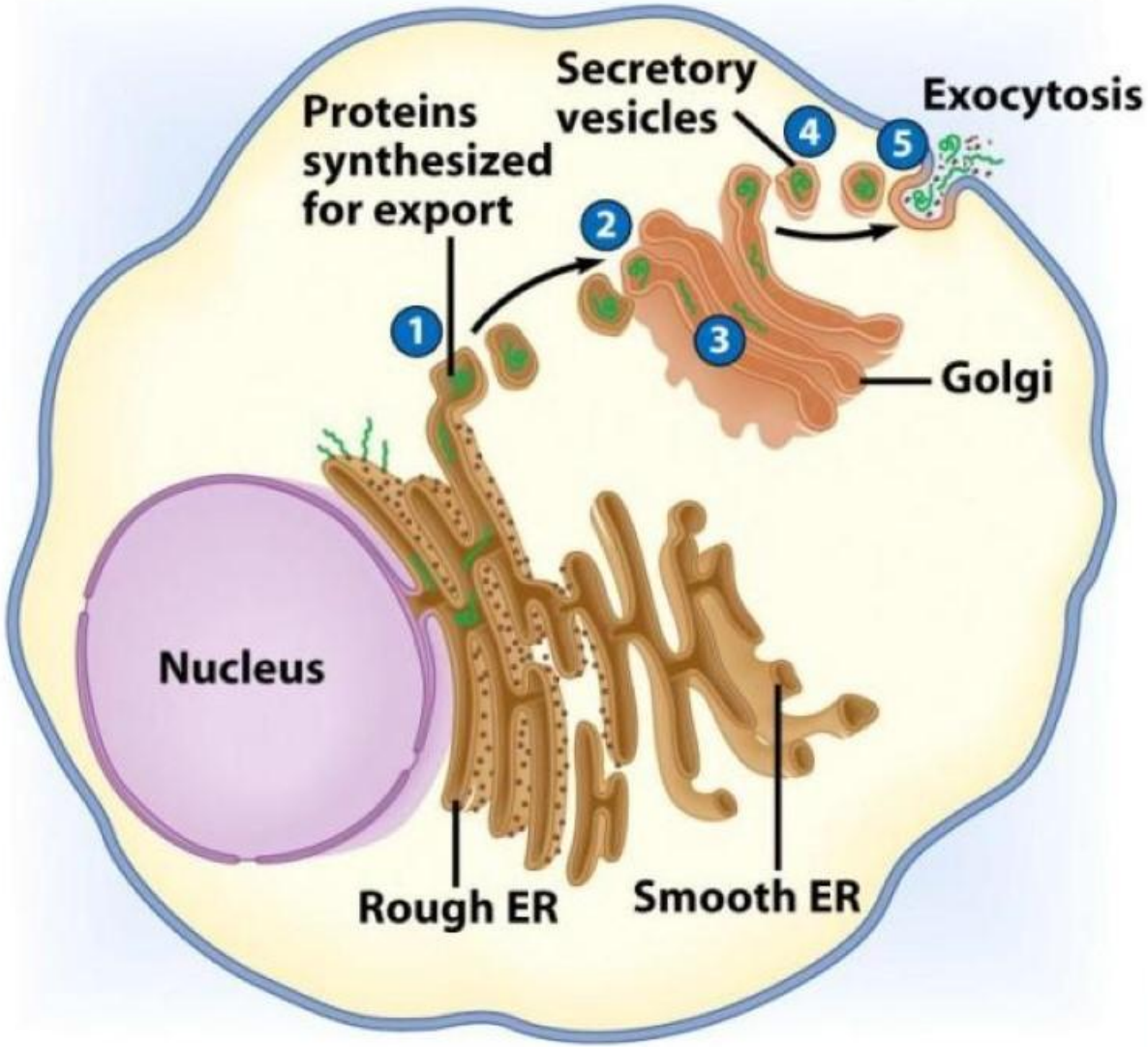
Functions



Performs **packaging of materials**, to be delivered either to the **intra-cellar targets** or secreted outside the cell.

Important site of formation of **glycoproteins and glycolipids**

Membrane biogenesis

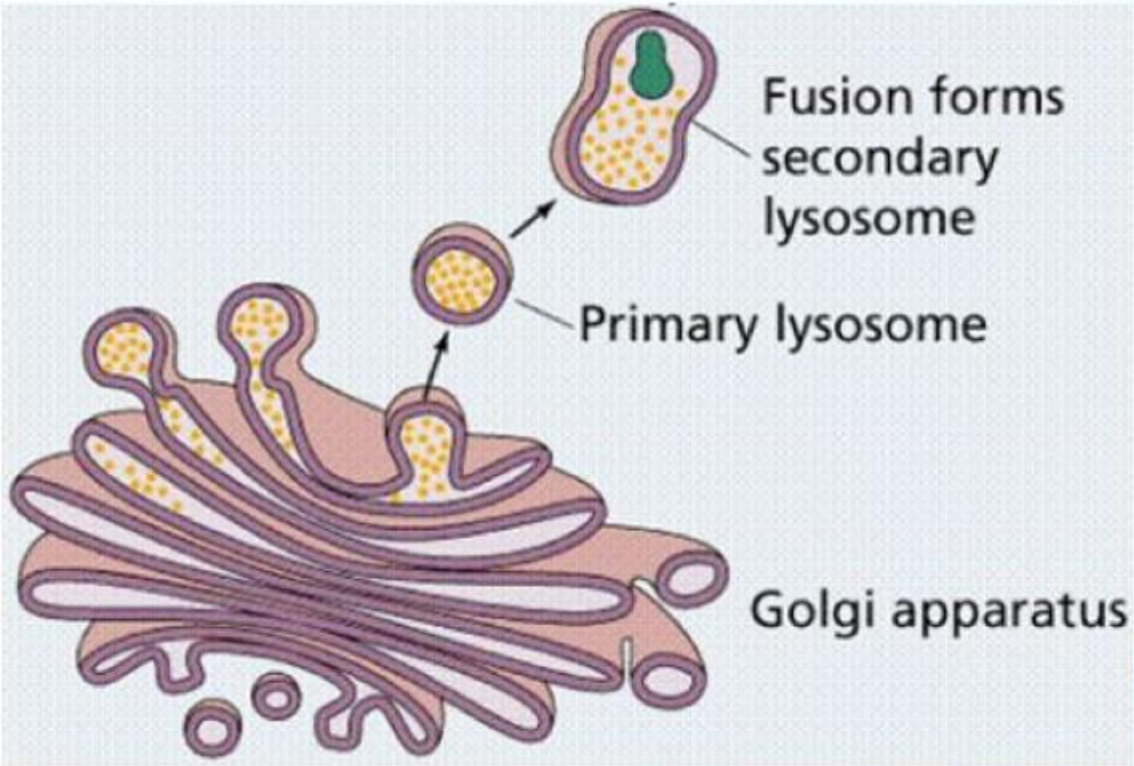


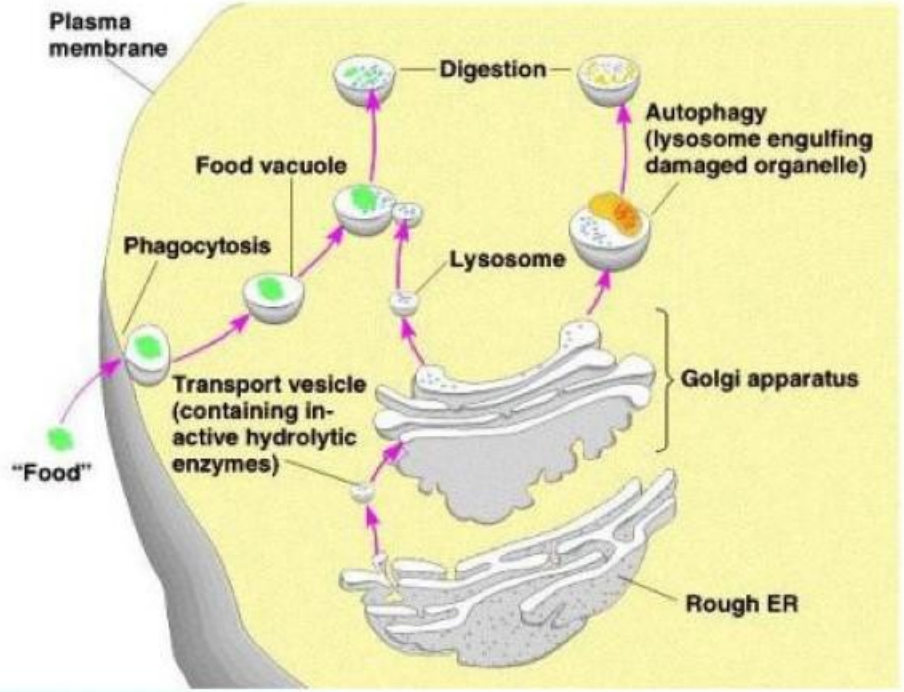
Proteins **synthesised by ribosomes** on RER **modified in the Golgi apparatus,** packed and released.

Lysosomes

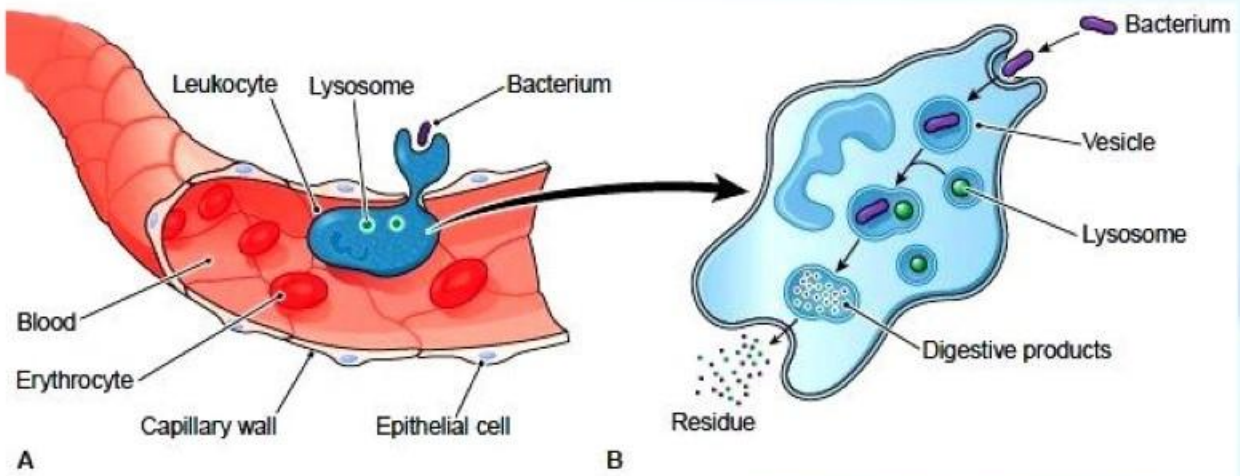
Membrane bound **vesicular structures** formed by the process **of packaging in the Golgi apparatus.**

Contain hydrolyzing **enzymes (lipases, proteases, carbohydrases)** which are active in **acidic pH.**

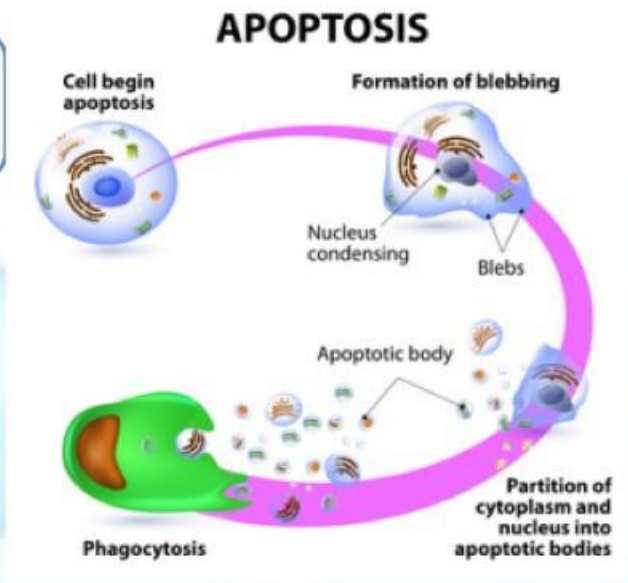


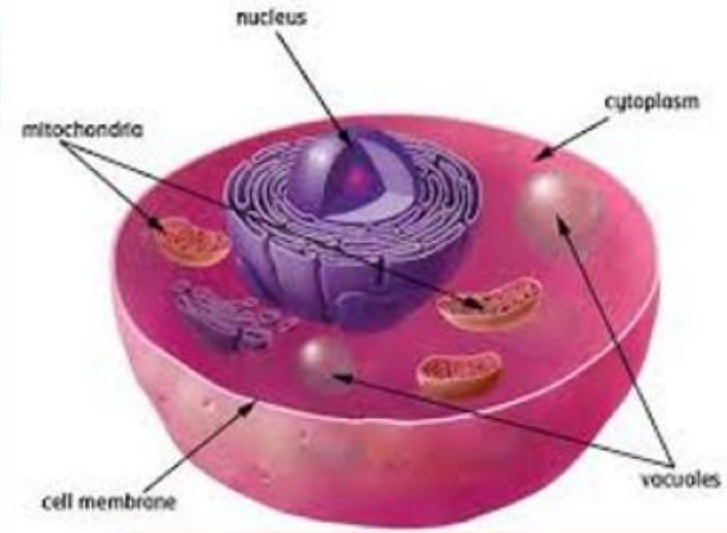


It called as Suicidal Bag.

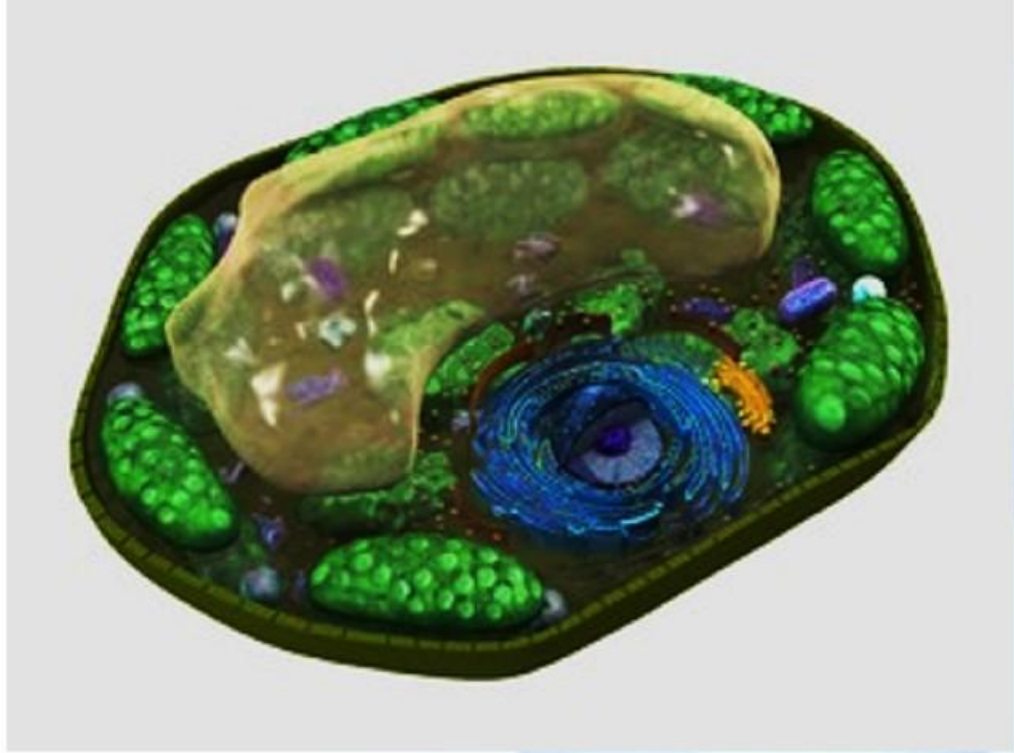


Function: Intracellular digestion.





Vacuoles

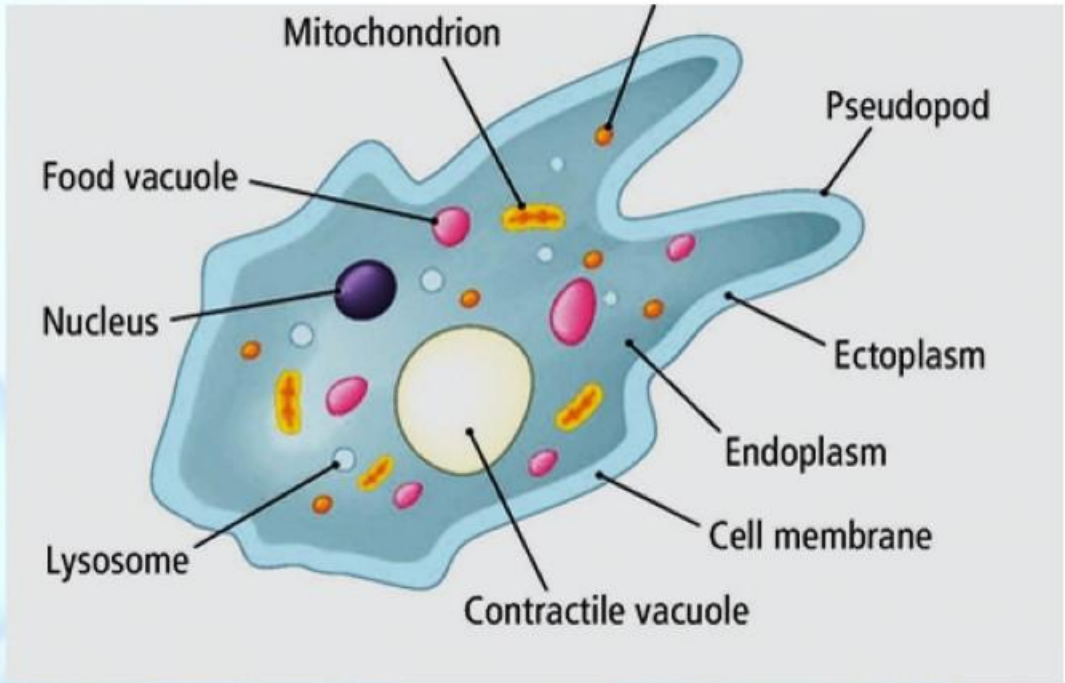


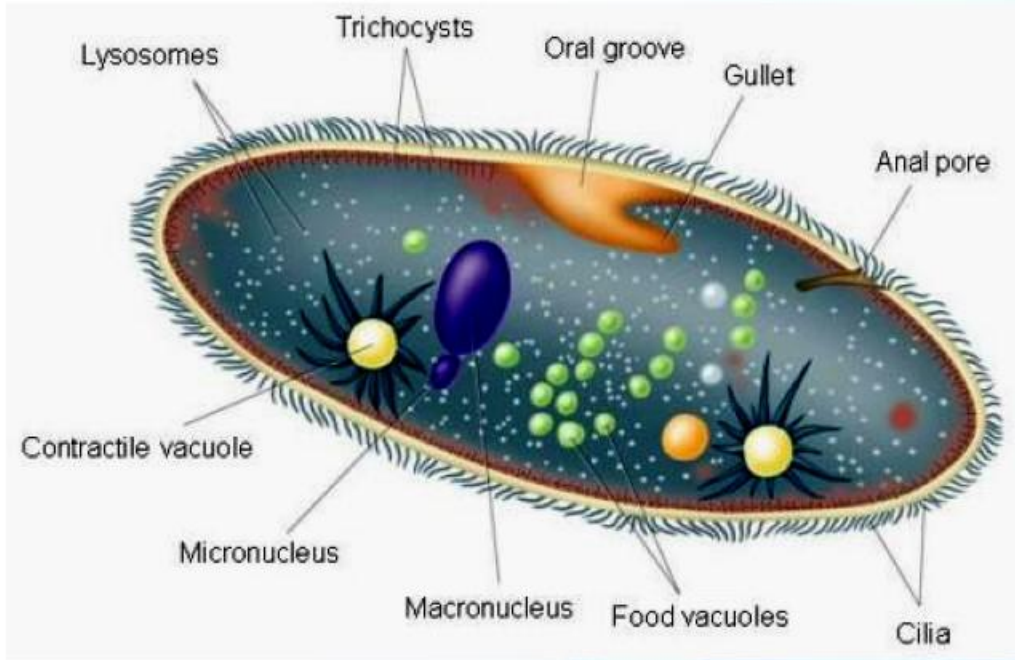
Membrane bound space found in the cytoplasm. Contain water, sap, **excretory product**, etc.

In plant cell, **vacuole occupies 90% of space**.

Function : In plants **tonoplast (single membrane of vacuole)** facilitates transport of **ions and other substances**.

Contractile vacuole for excretion in ***Amoeba and food vacuoles*** *formed in* **protists for digestion of food.**



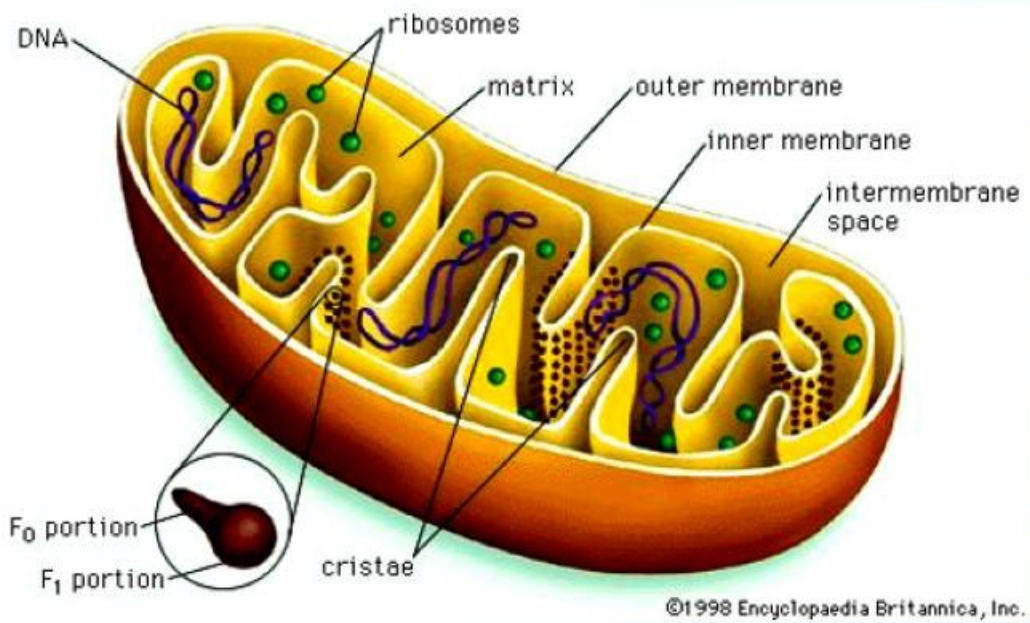


Mitochondria

Double membraned structure. Out membrane smooth and inner membrane forms a **number of infoldings** called **cristae**

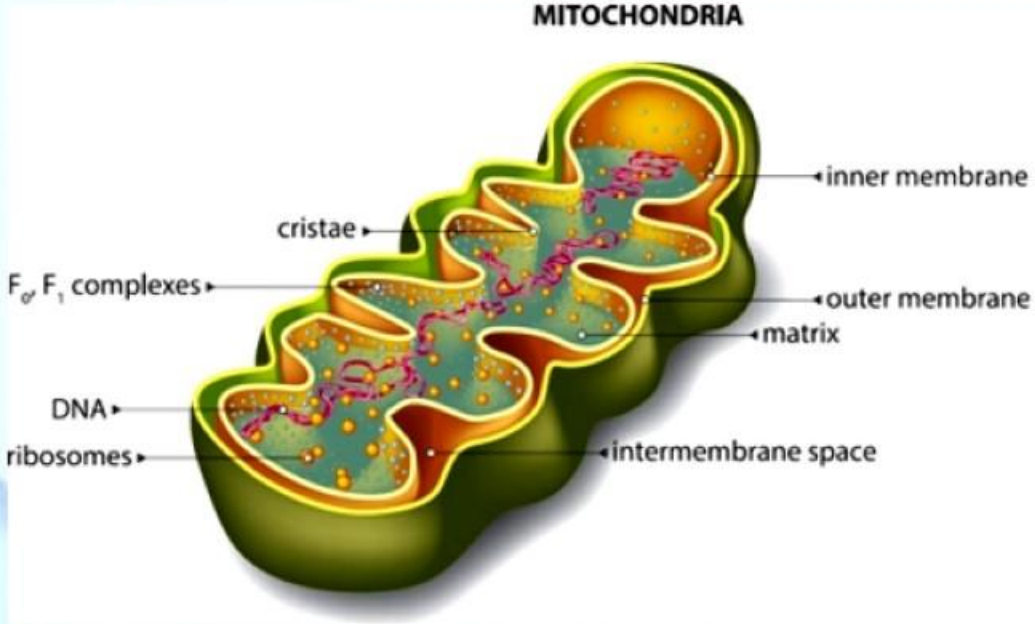
The cristae increase the surface area.

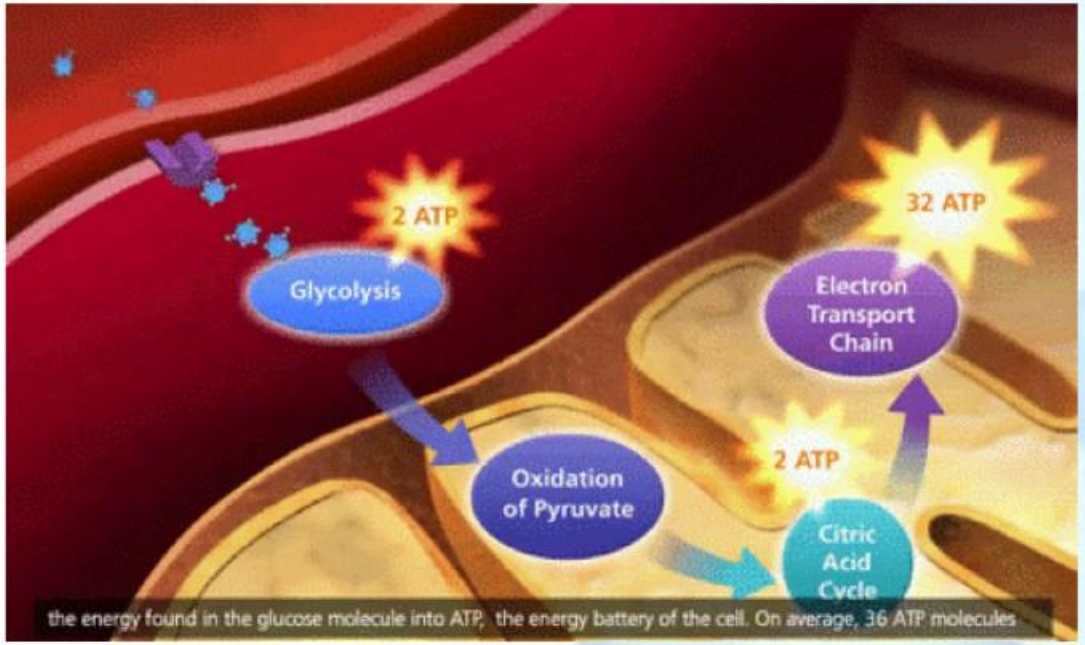
The inner compartment is having matrix.



Function : Sites of aerobic respiration

It called **power houses of cell** as produce cellular energy in the form of **ATP**.

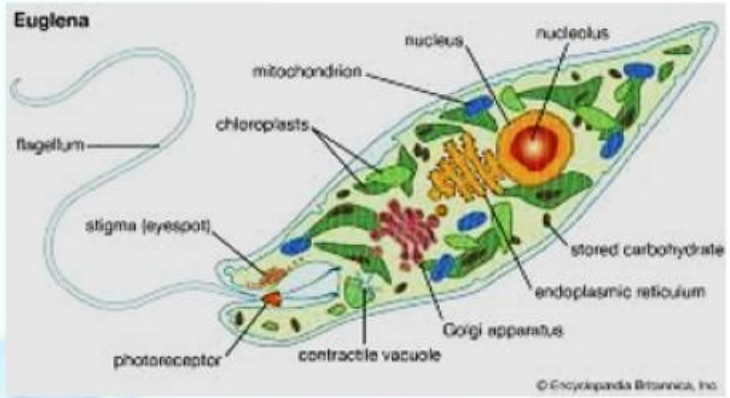




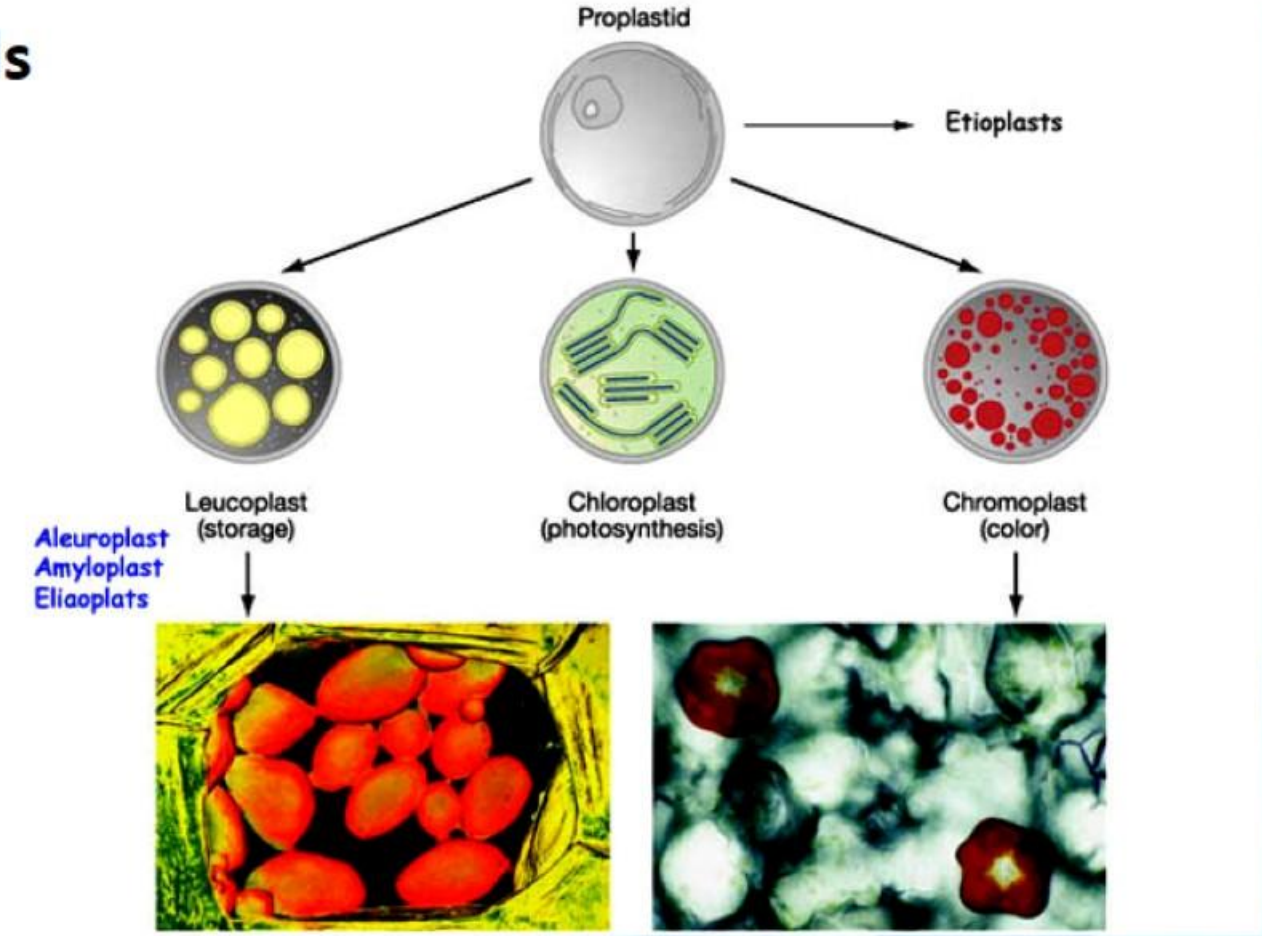
Matrix possesses **single circular DNA molecule**, a few **RNA molecules**, ribsomes (70S). It divides by binary fission.

Plastids

Found in **plant cells and in euglenoids**.

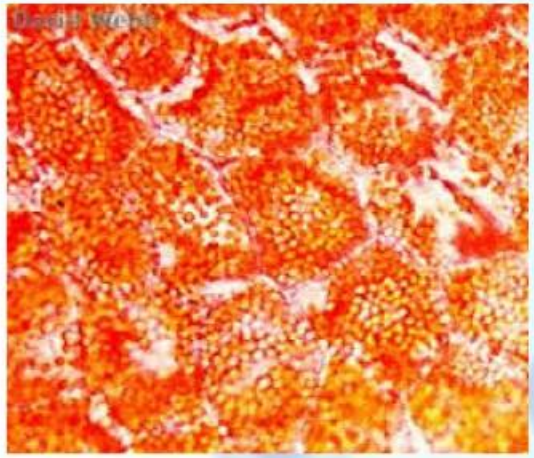


Chloroplasts, **chromoplasts** and leucoplasts **are 3 types of plastids** depending on pigments contained.



CHROMOPLAST :

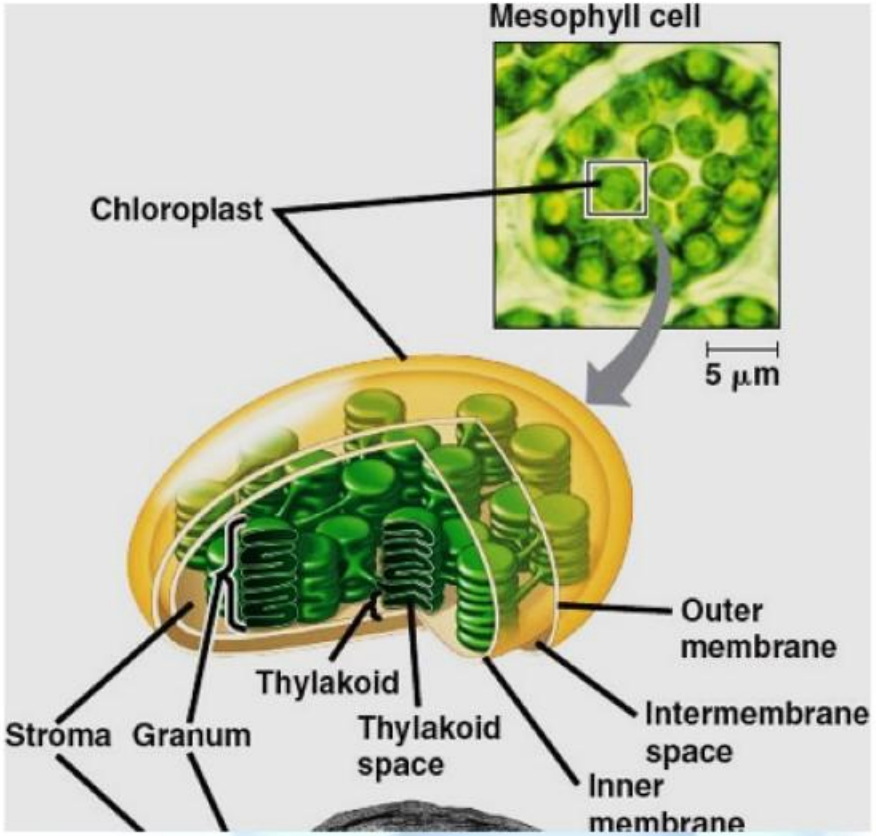
Coloured plastids, give colour to petals and fruit



Chloroplast

Chloroplasts are **double membrane-bounded** organelles present in **plant cells**.

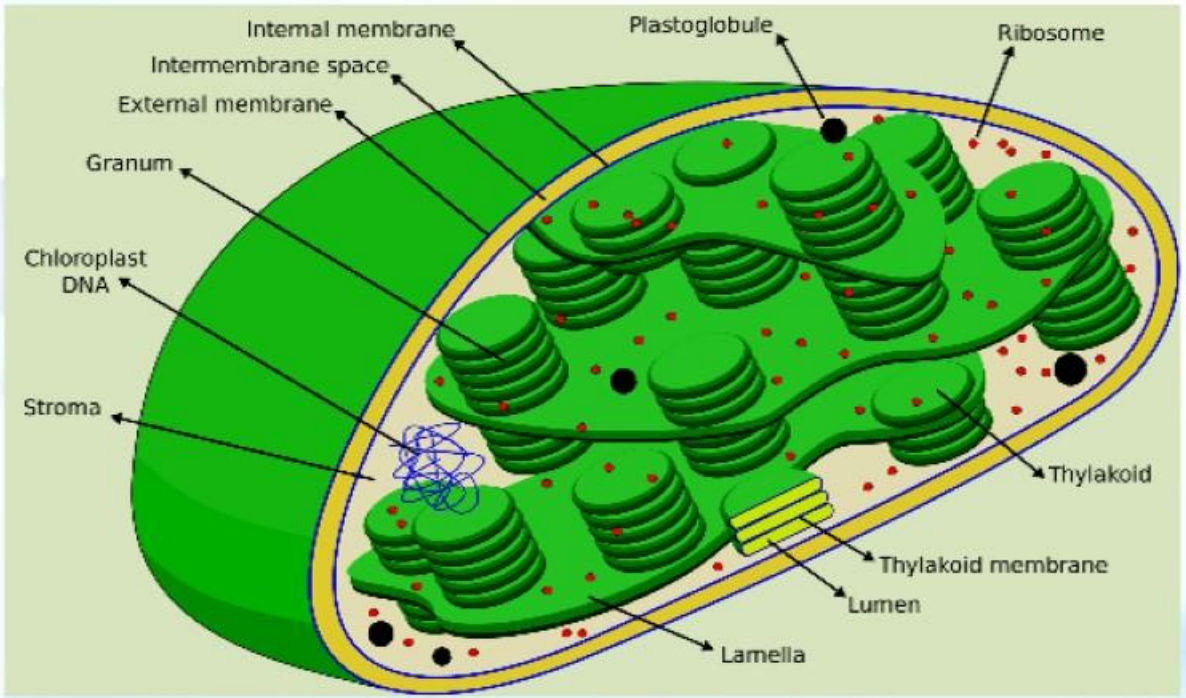
Mainly found in **mesophyll cells** of the leaves.
Various shapes, **1 per cell to 20 -40 in a plant cell.**

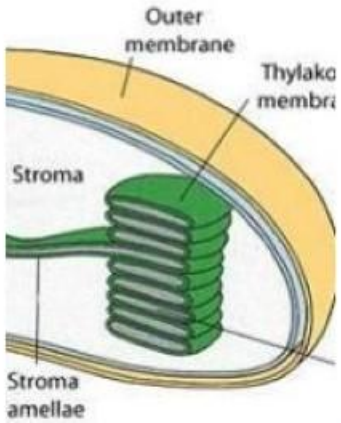


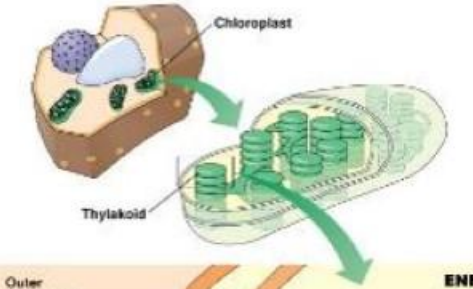
In the stroma, the space inside chloroplast contain **DNA** and **ribosomes.**

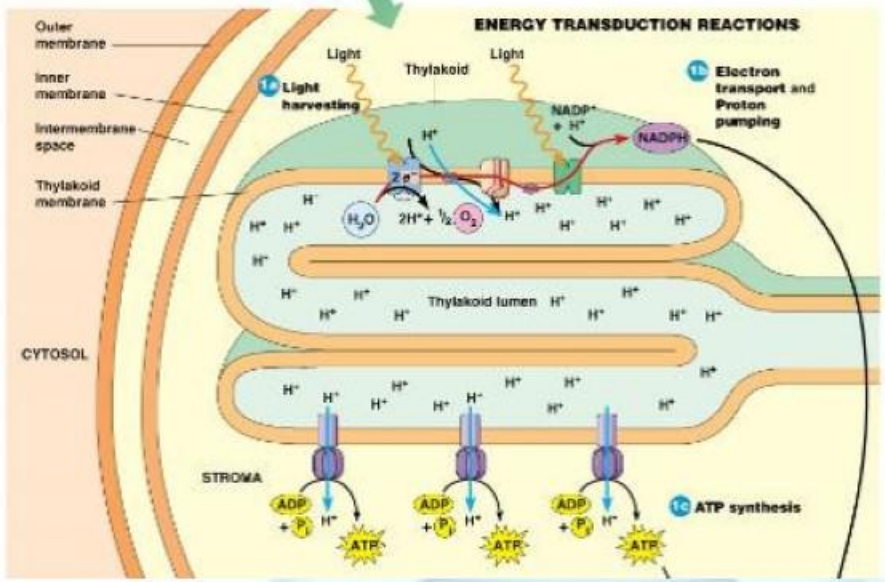
In Grana, flattened sacs -thylakoids **contain chlorophyll**, trap **sunlight for photosynthesis**

Stroma lamella connects **thylakoids of grana**





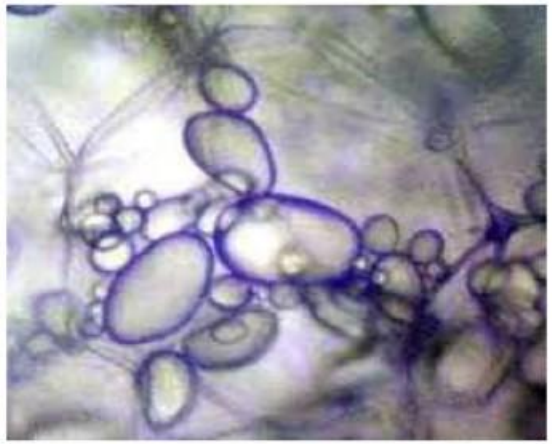


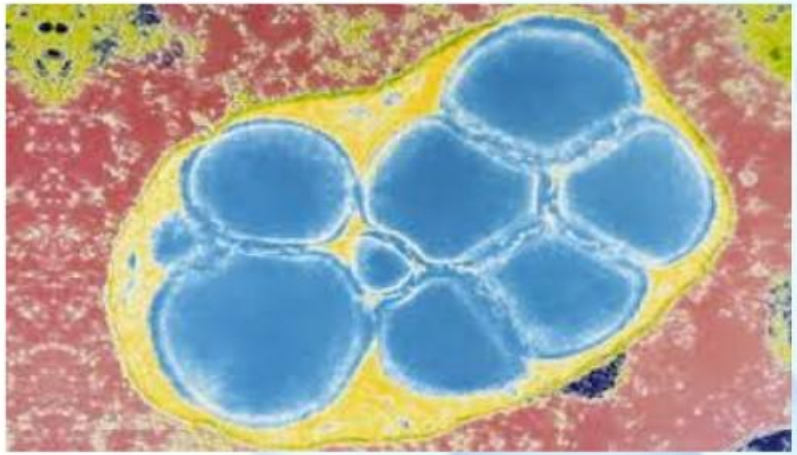


Leucoplast

Colourless plastids that are found in storage **parenchyma and other colourless tissues**

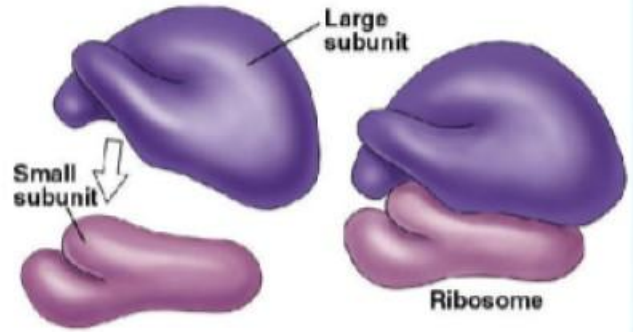
Amyloplasts (carbohydrates)
Elaioplasts (oils)
Aleuroplasts (proteins).



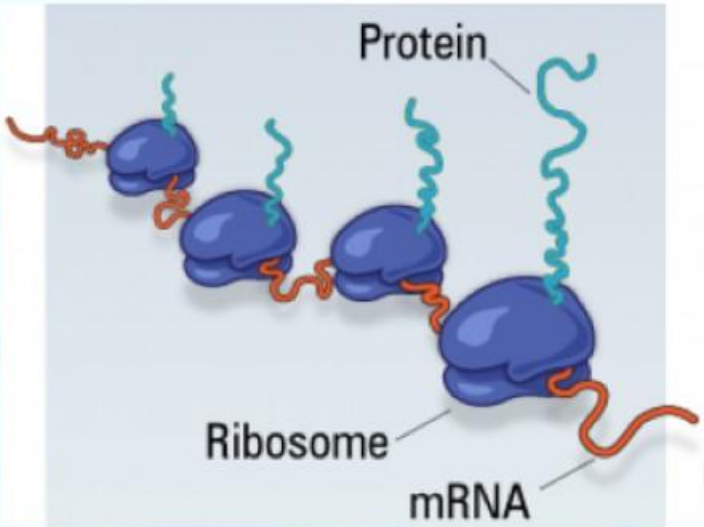


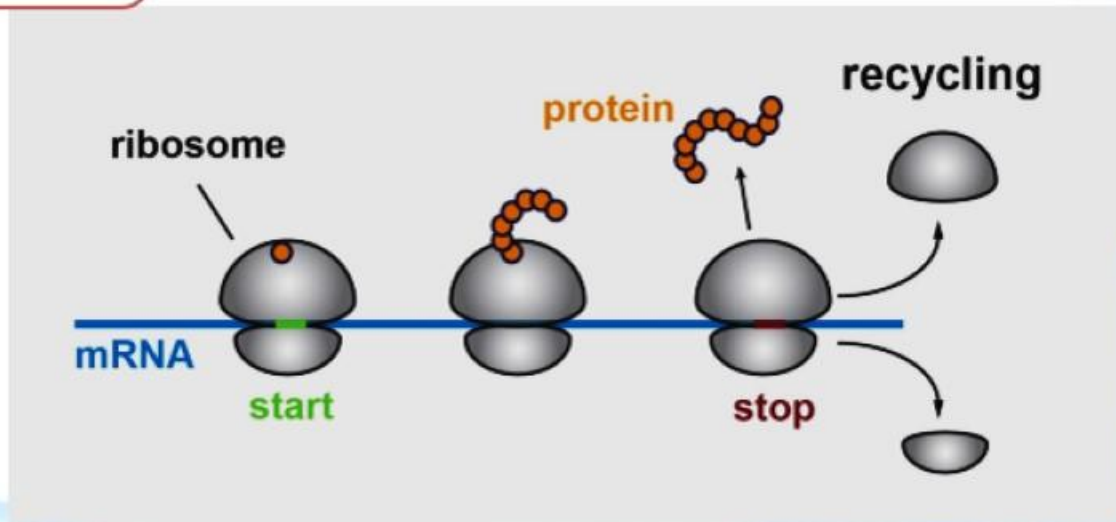
Ribosomes

Composed of **RNA and proteins**; without membrane.
Eukaryotic ribosomes are 80S. S = **Svedberg units**



Function : Site of protein synthesis



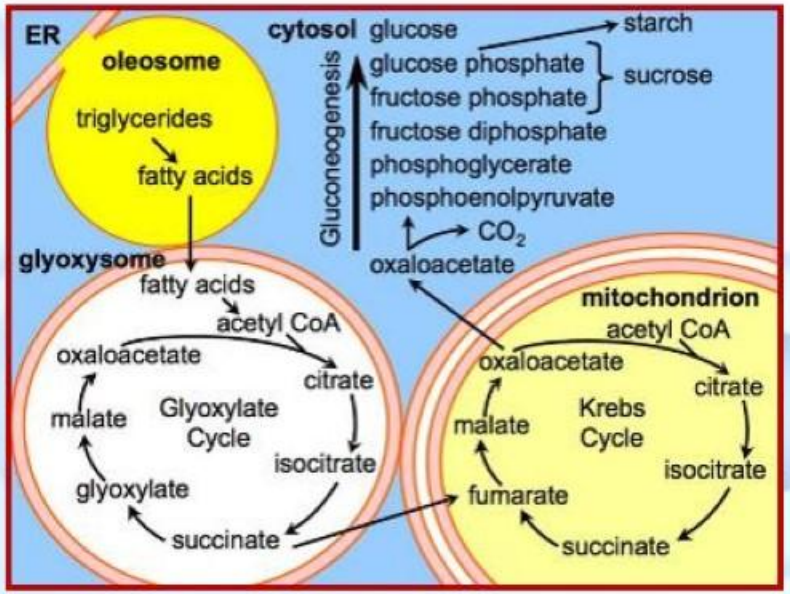


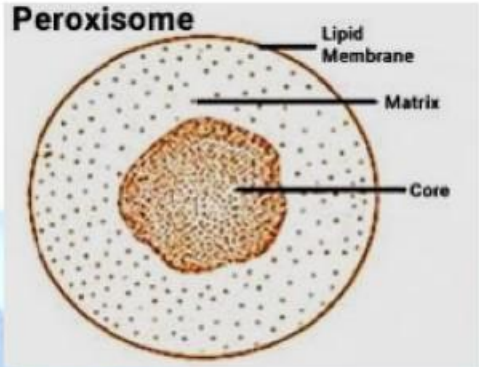
Microbodies

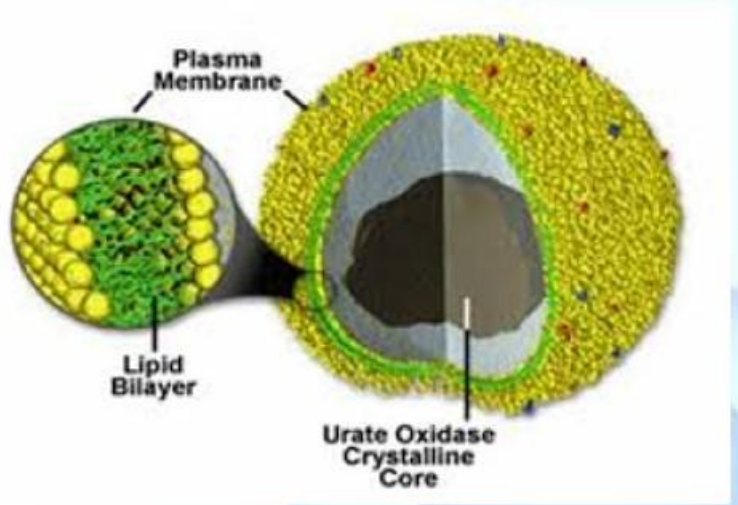
Microbodies contain enzymes that **facilitates the breakdown of fats, alcohols and amino acids.**

It is a type of organelle that is found in the cells of **plants, protozoa, and animals.**

It also involved in **detoxification of peroxides** and in **photorespiration in plants**



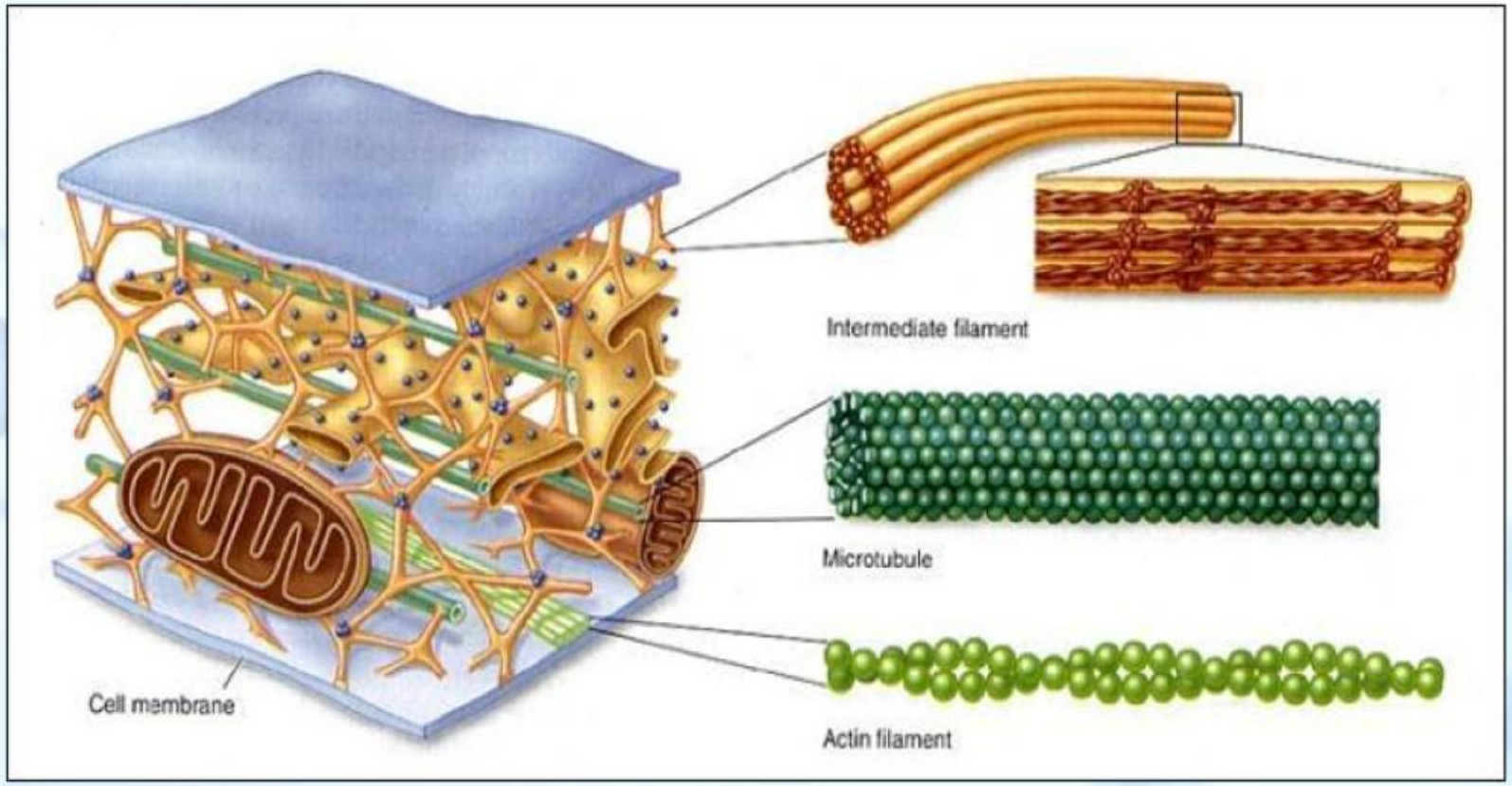




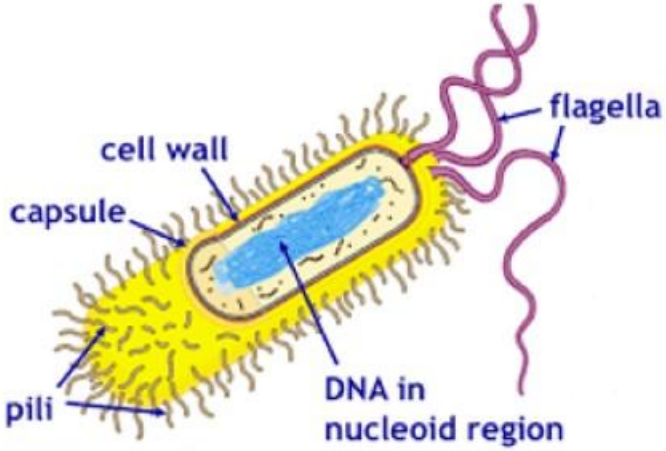
Cytoskeleton : Network of filaments.

Proteinaceous structure in cytoplasm made up of **microtubules and micro filaments**.

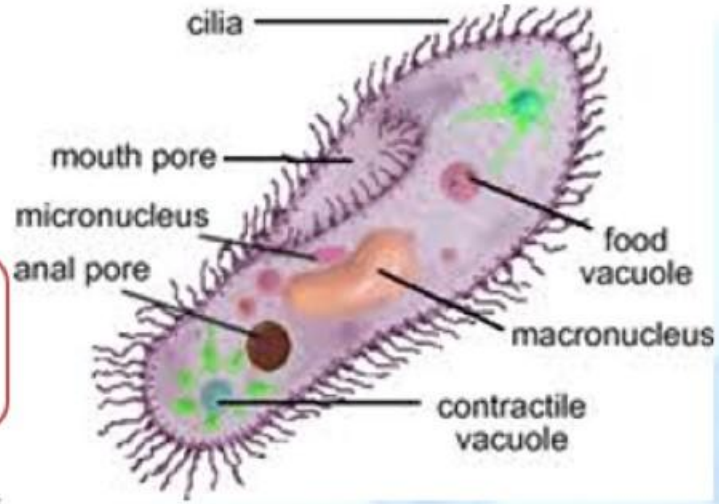
Function : **Mechanical support**, motility, maintenance of **the shape of the cell**.



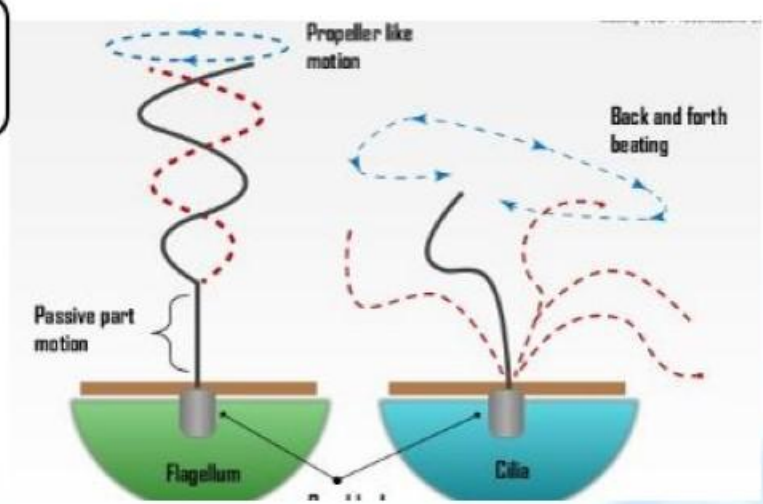
Cilia and Flagella

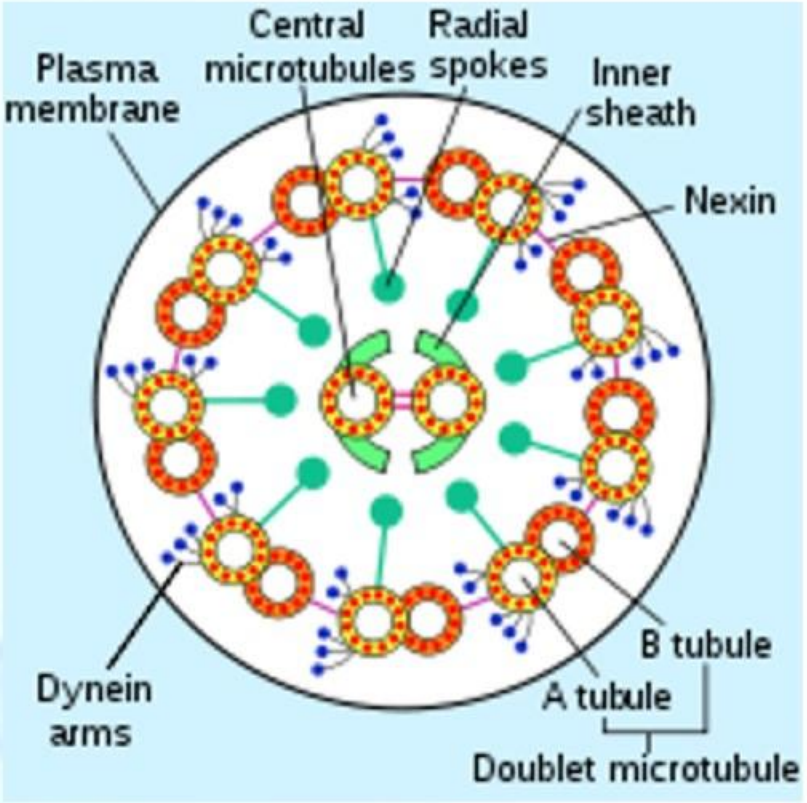


Cilia are small structures which work like oars which help in movement.



Flagella are longer and responsible for cell movement.





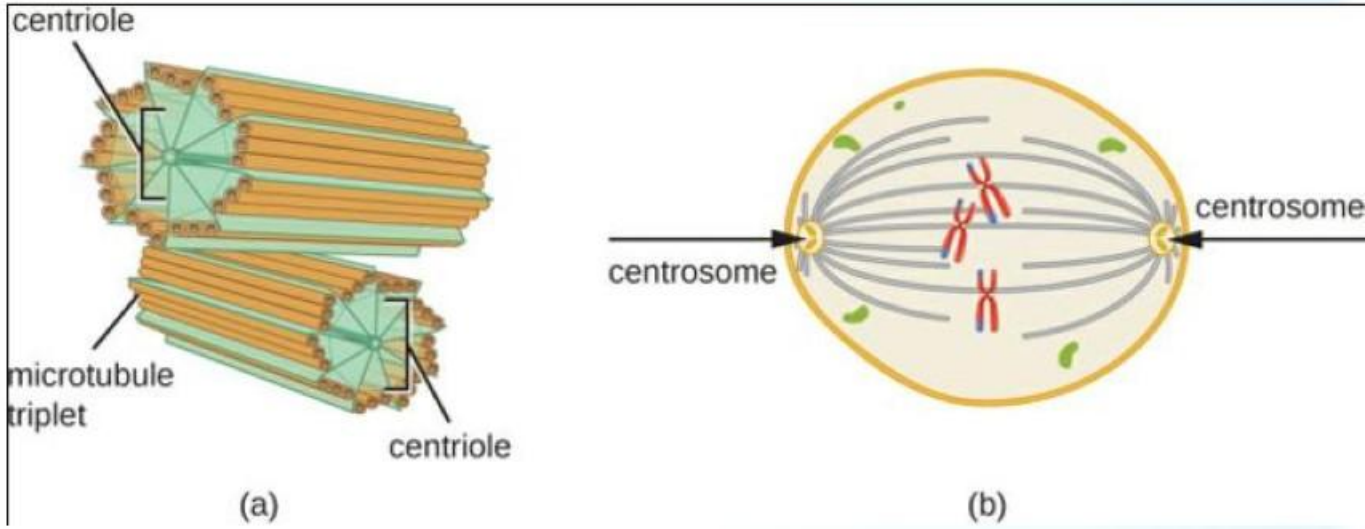
They are covered with a plasma membrane. Core is called axoneme with 9 + 2 arrangement of axonemal microtubules.

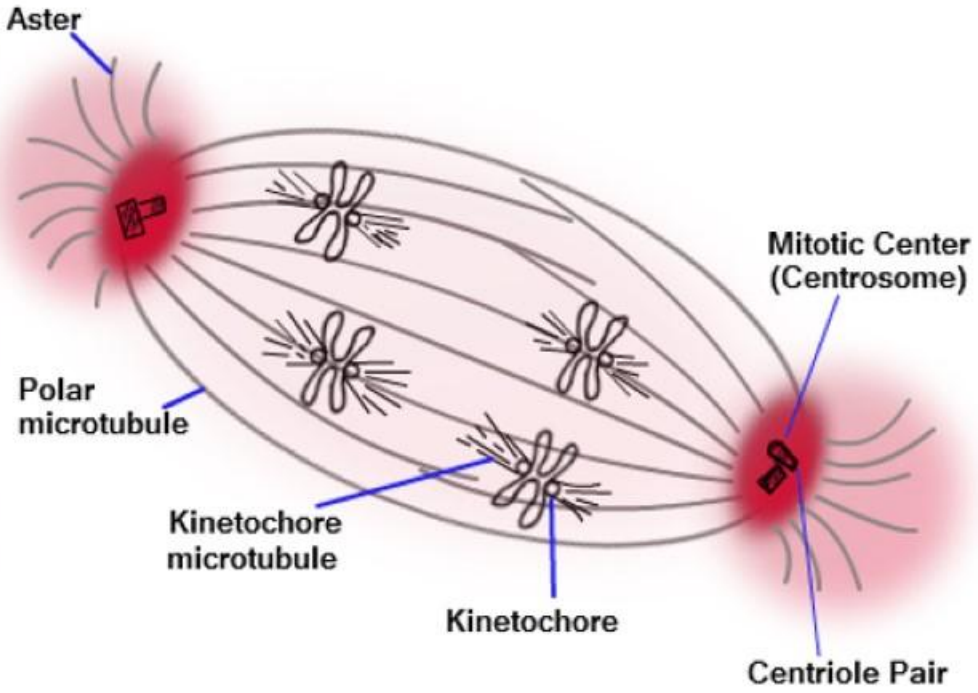
Central tubules are connected by bridges and enclosed by a central sheath, which connected to peripheral doublets by radial spokes

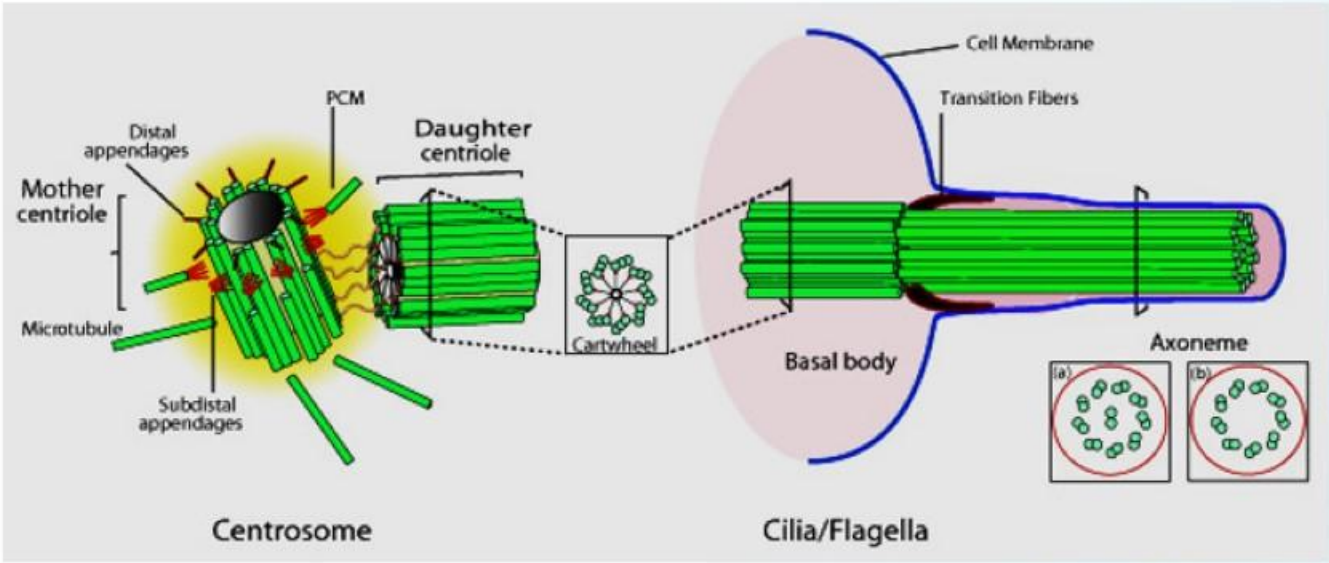
Centrosome and Centrioles

Centrosome contains two cylindrical structures called centrioles. Surrounded by amorphous pericentriolar material.

Has 9 + 0 arrangement. Centrioles form the basal body of cilia or Flagella



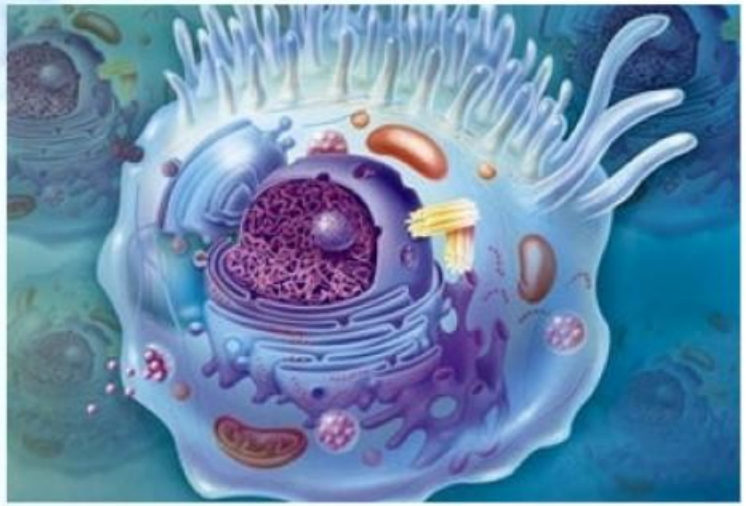




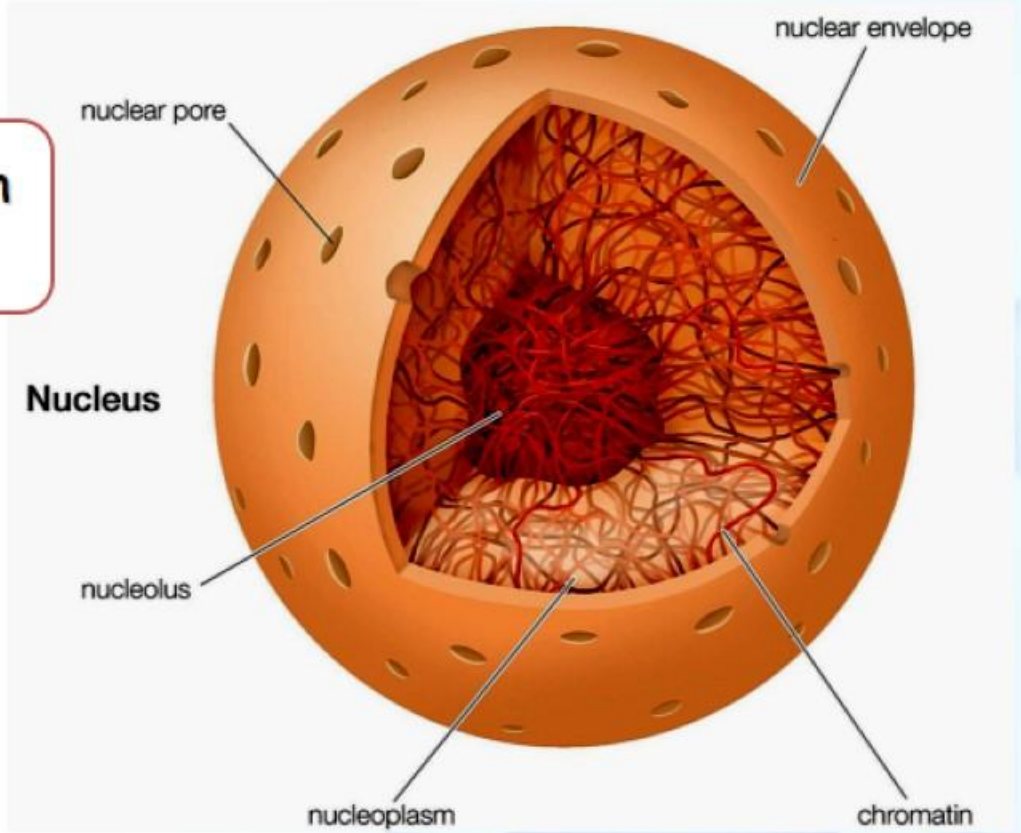
Form Spindle fibres for cell division in animal cells.
They produces spindle apparatus during cell division.

Form the basal body of flagella and cilia

Nucleus



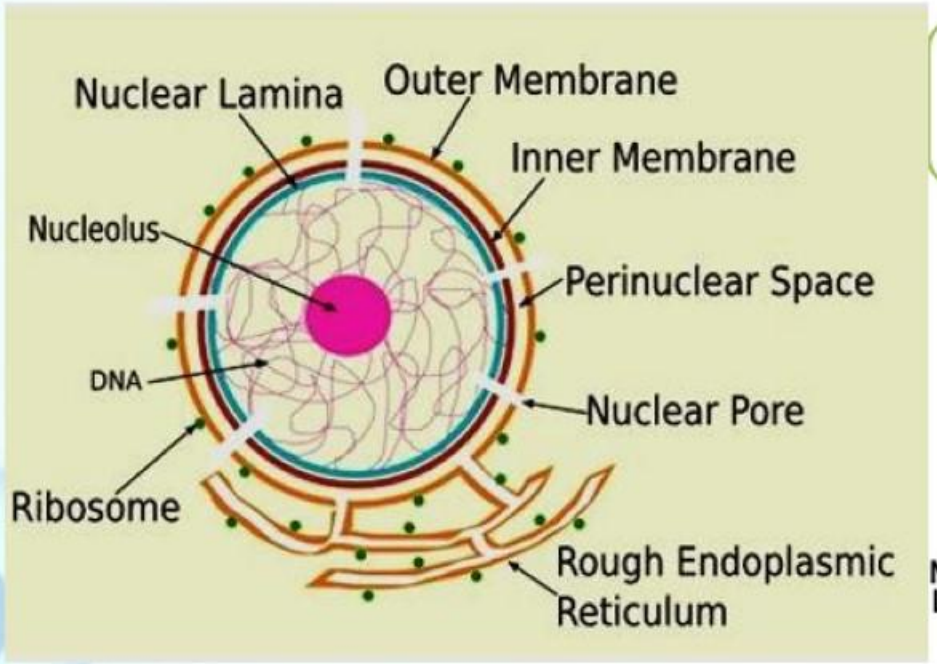
It has **double membrane,** in between **perinuclear space.**



It contain Chromatin, nuclear matrix and nucleoli **(site for rRNA synthesis).**

Size and number of nucleolus more when cells are **metabolically active**

The outer membrane continuous with endoplasmic reticulum with ribosomes



Nuclear pore used to communicate nucleoplasm and cytoplasm

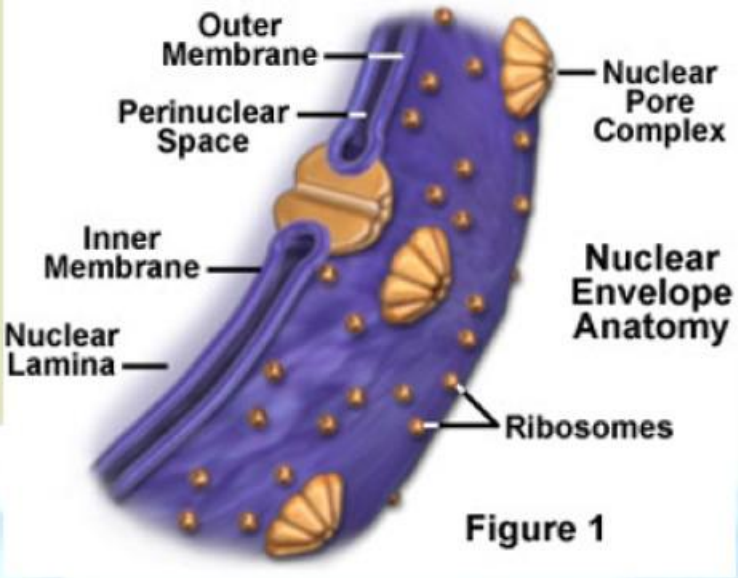
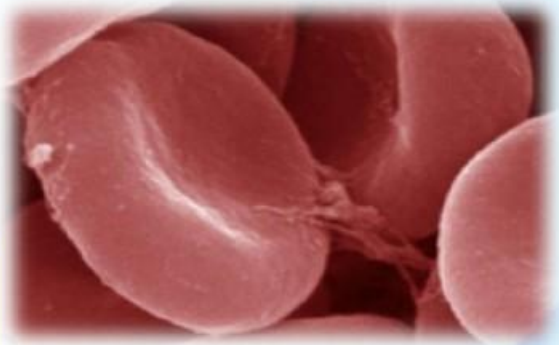
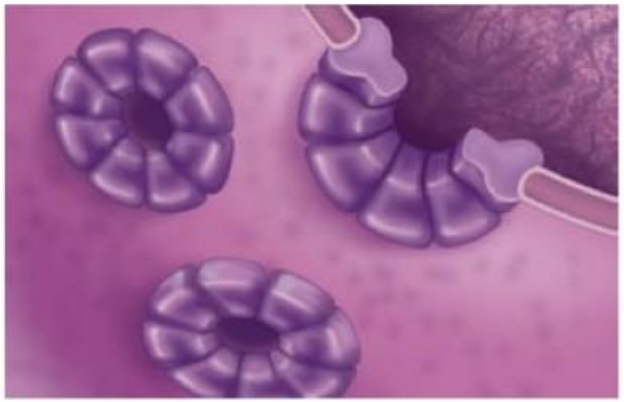


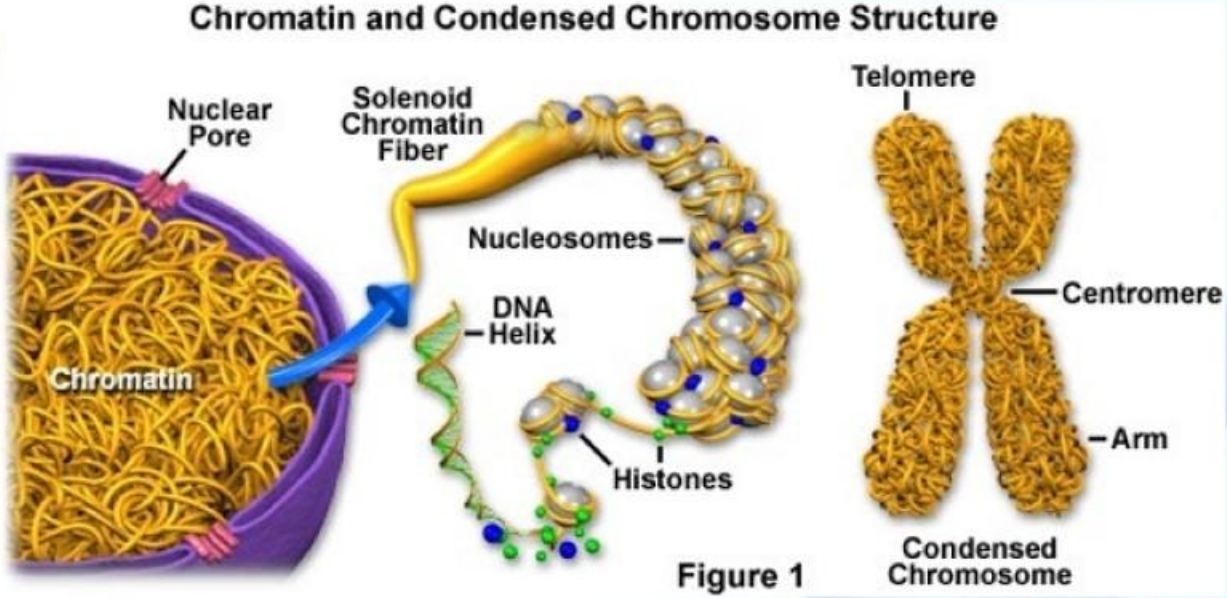
Figure 1



No nucleus in Erythrocytes (RBC) of mammals and sieve tubes in vascular plants.

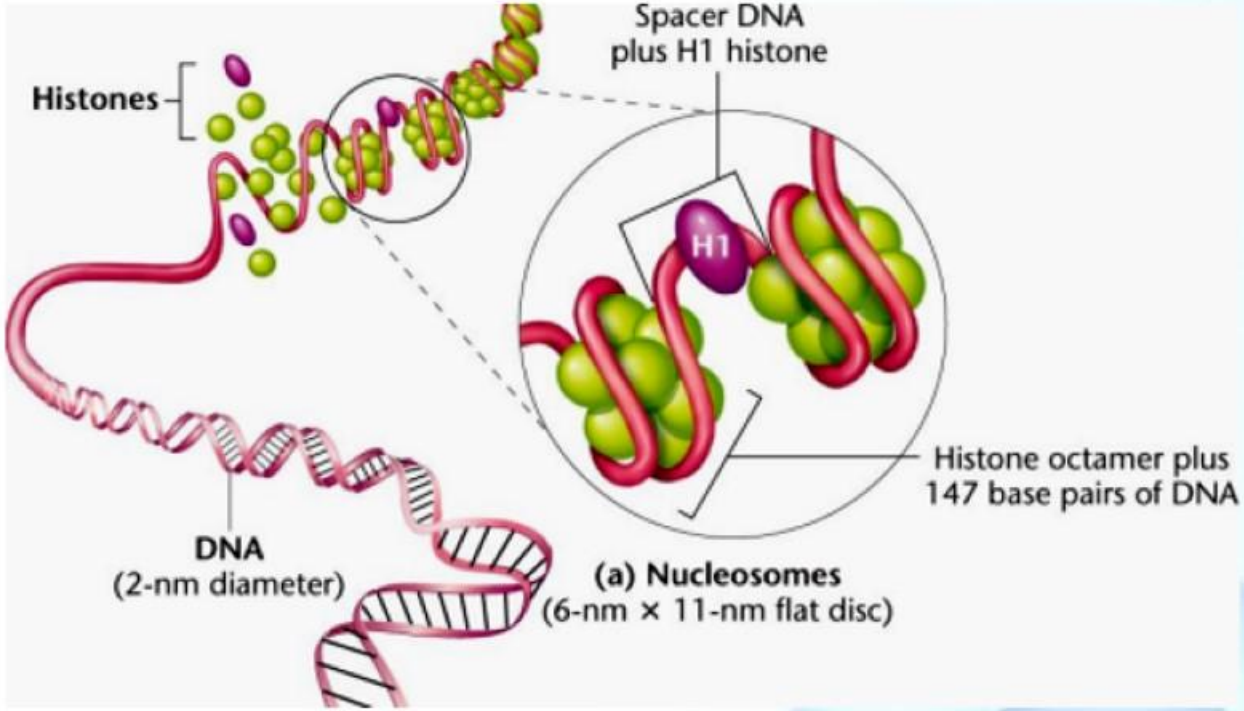
Chromatin = DNA + nonhistone proteins.

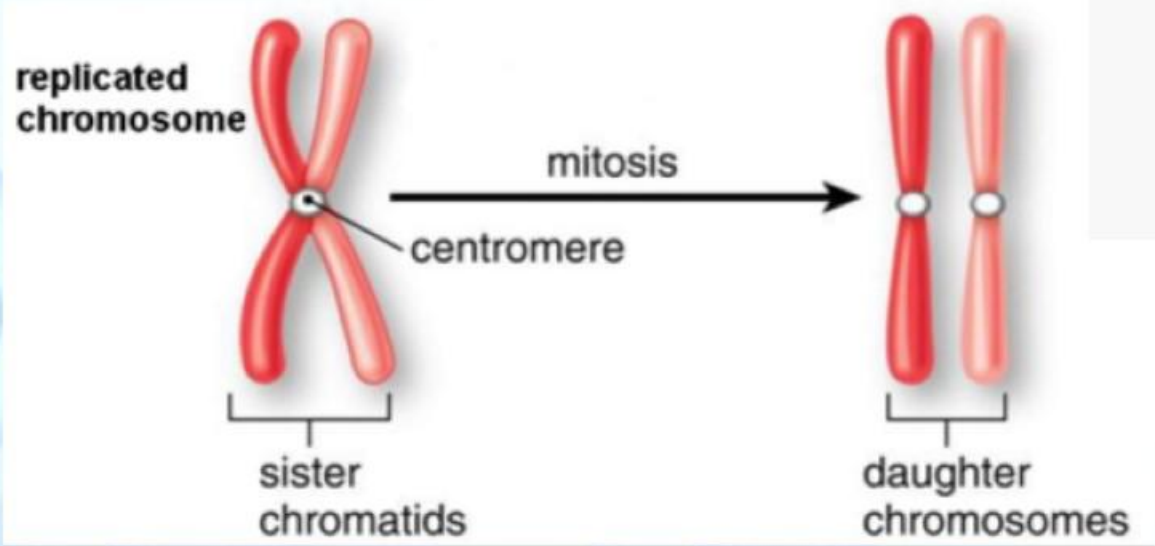




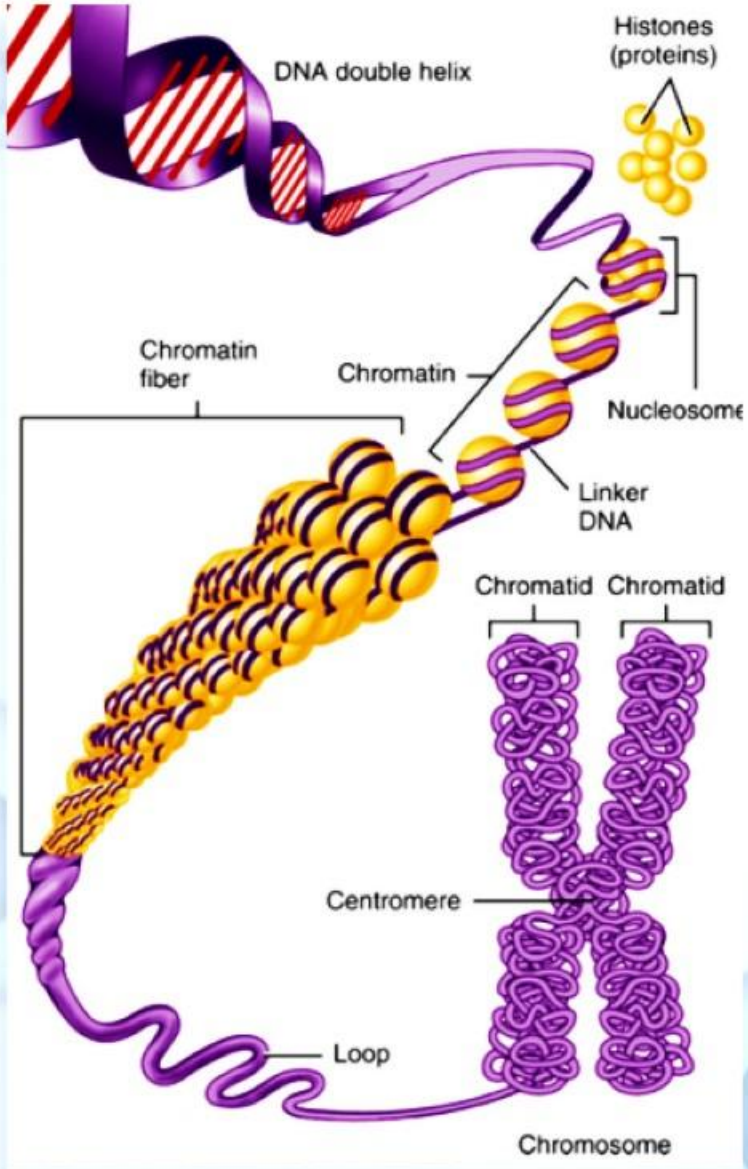
During cell division chromatin
coiled in to chromosomes

Chromosomes : DNA + Histone protein + Nonhistone protein.

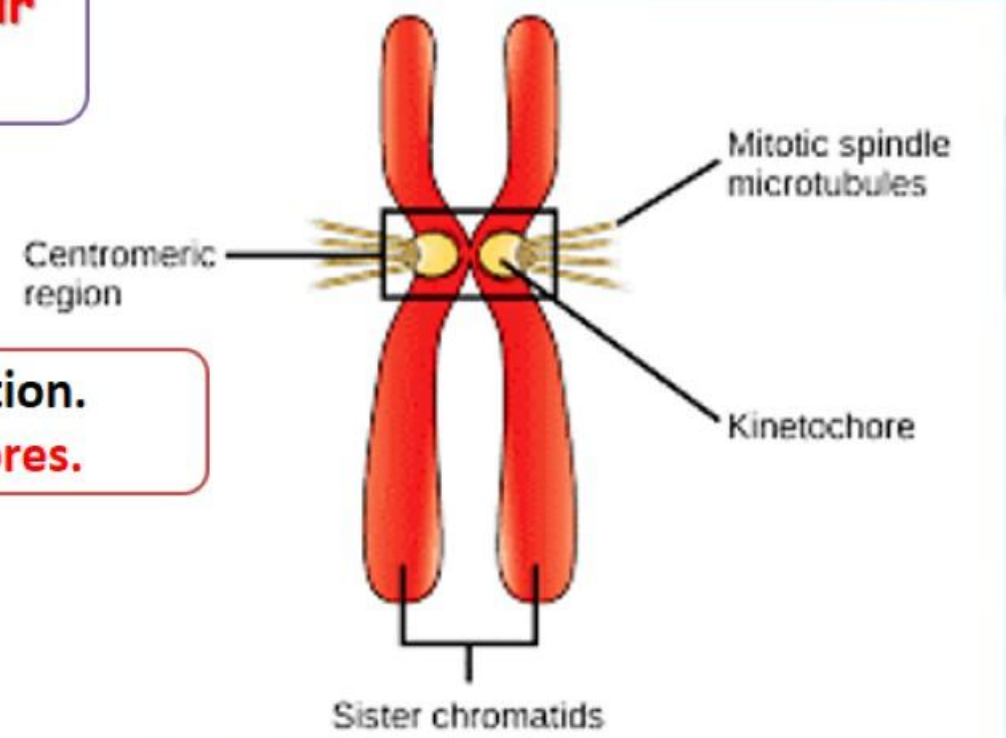




Chromosomes



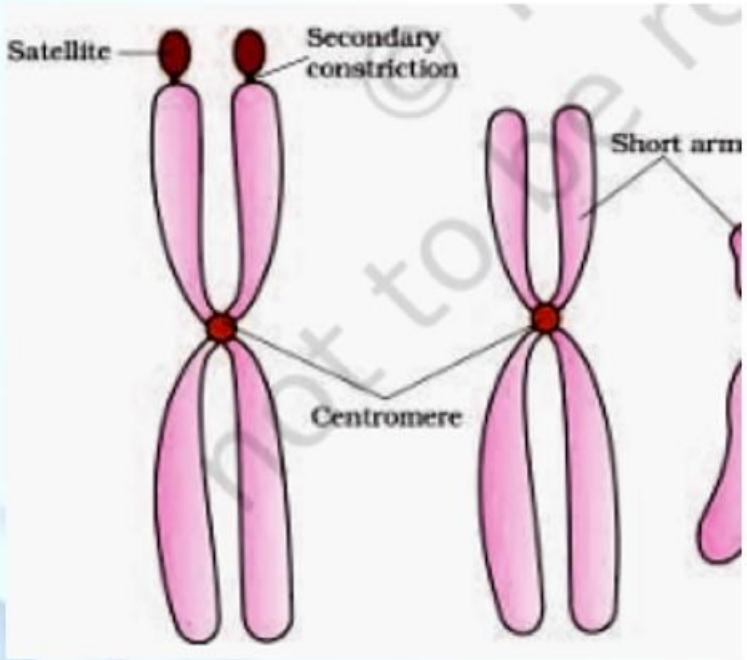
Human cell has 23 pair of chromosomes



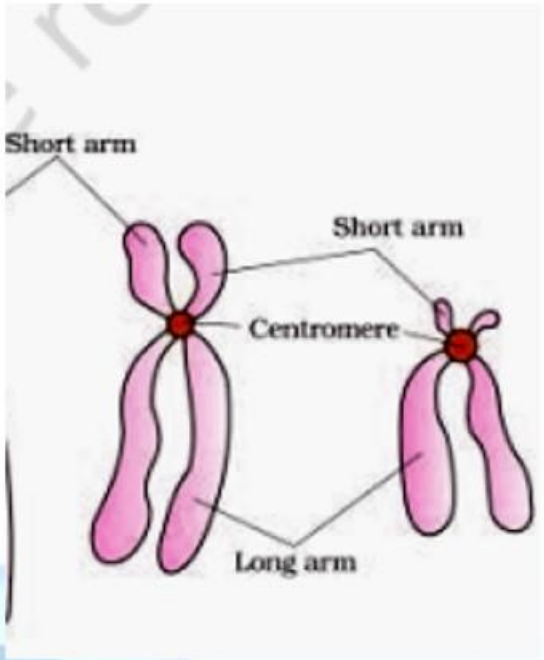
Centromere : Primary constriction.
The disc is known as kinetochores.

Chromosomes (on basis of position of centromere)

Metacentric : Middle centromere.



Sub-metacentric : Centromere nearer to one end of chromosomes



Acrocentric : Centromere situated close to its end.

Telocentric Has terminal centromere

Satellite

The non-staining **secondary constructions of some chromosomes** which gives the appearance of **small fragment called satellite.**