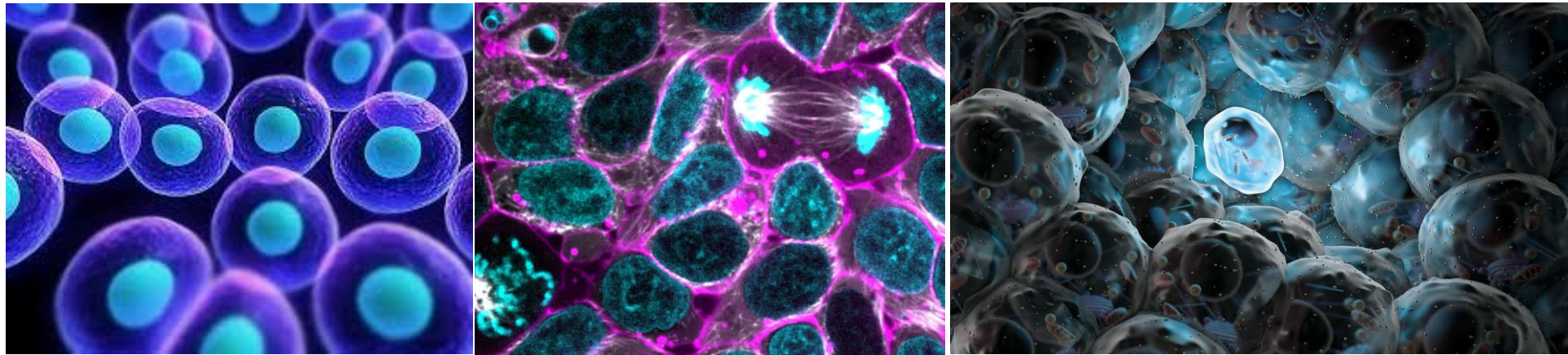


Cell Biology

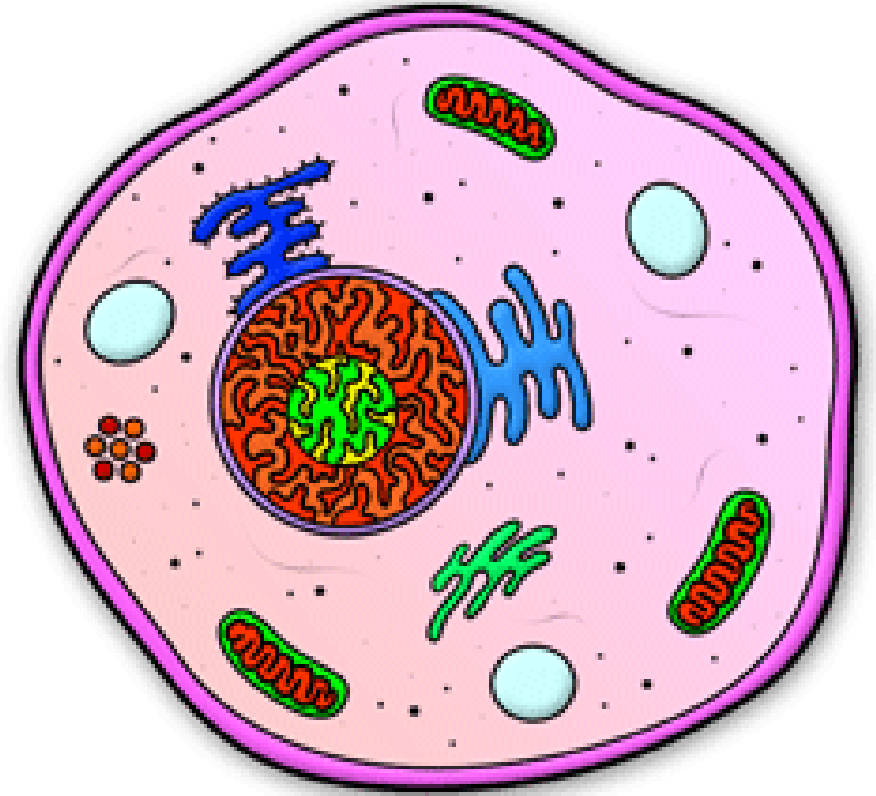


DAVE ARTHUR ROBLEDO

Biology Instructor

Cell Biology

Cell biology also known as *“cytology”* is the study of cell structure and function, and it revolves around the concept that the cell is the fundamental unit of life.



History of Cell Biology



- The term “**cell**” was first introduced by an English scientist, **Robert Hooke**, in 1667.
- He used one of the earliest microscopes to examine thin slices of cork from the bark of a tree.

History of Cell Biology

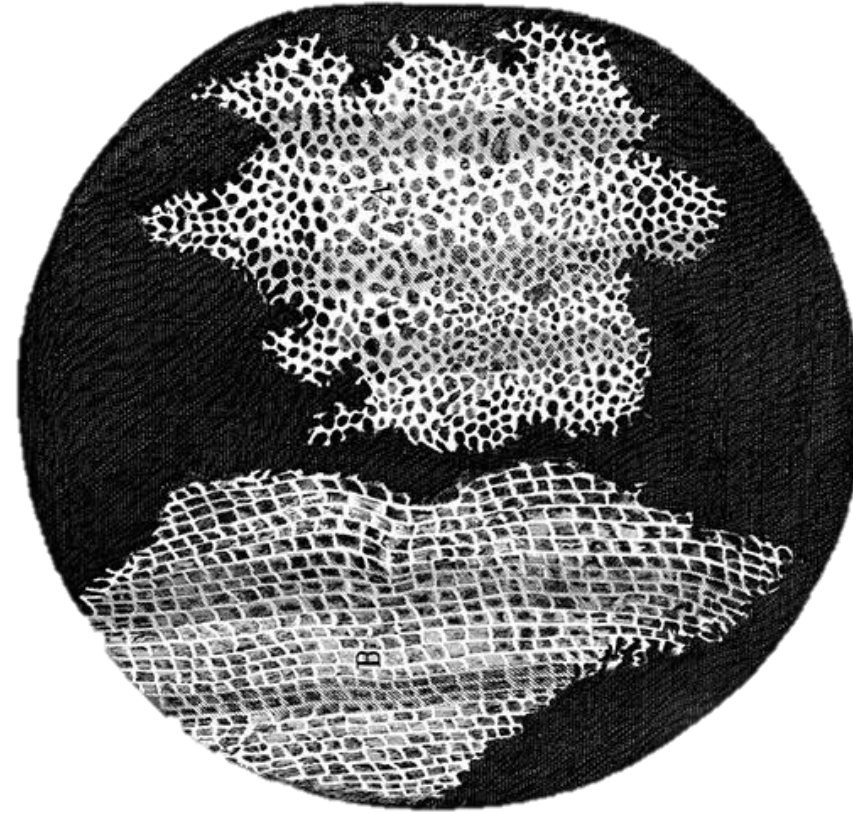


- Hooke saw closely-packed little boxes with thick walls – “cells” just like the cells in honeycombs or prison.
- In fact, Hooke only saw the walls of dead plant cell.

History of Cell Biology



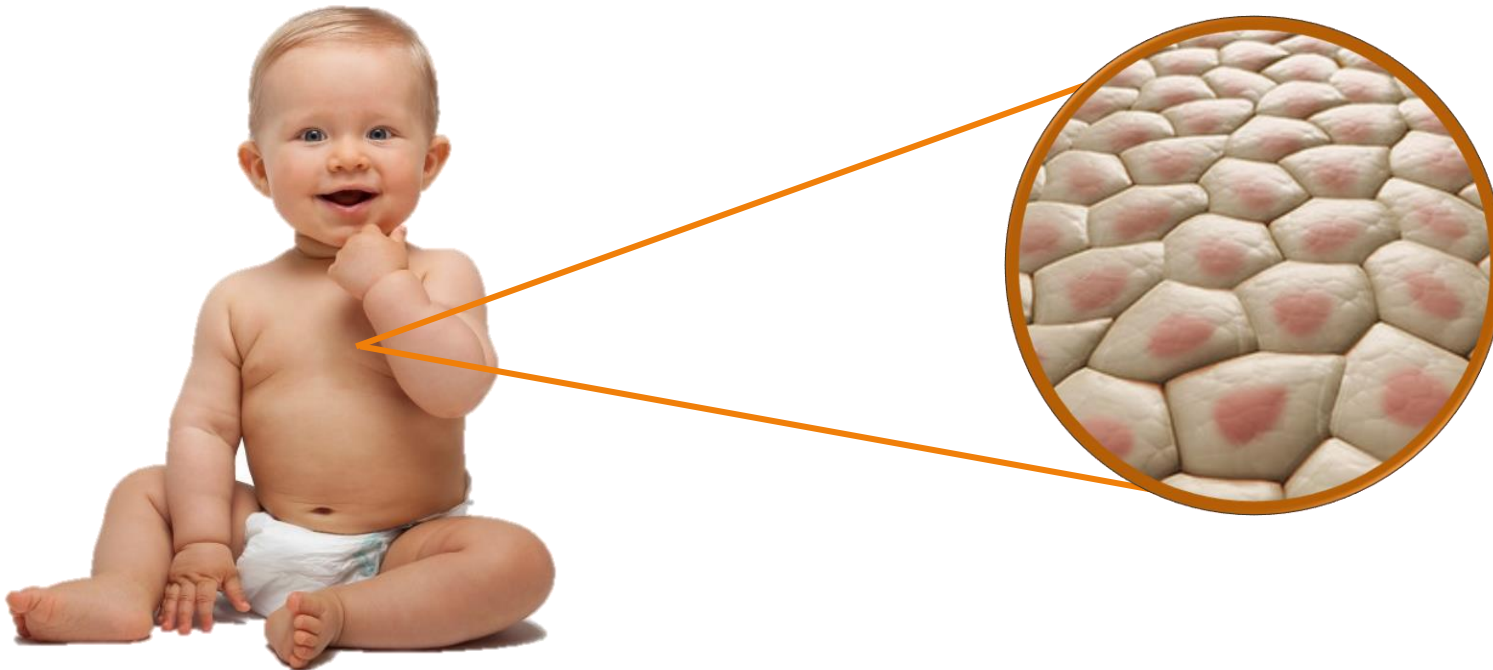
Microscope



Cork cells

Cells

Cells are the building block of life. They are the simplest units that exhibit the characteristics of life.



Cell Theory

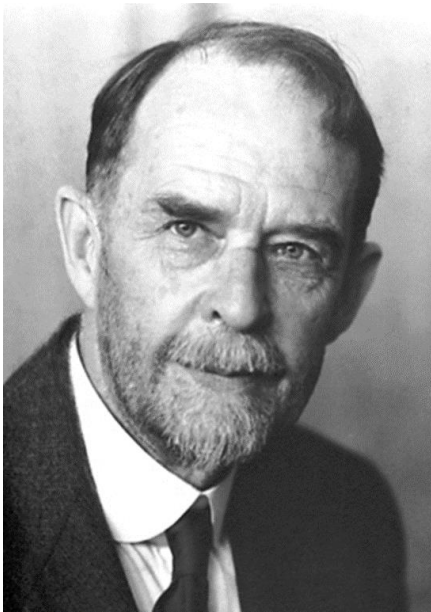
Cell Theory is one of the basic principles of biology.

3 Principles of Cell Theory

1. Cell is the basic unit of structure and organization in organisms.
2. All living organisms are composed of cells.
3. Cells arise from pre-existing cells.

Cell Theory

“Cell is the basic unit of structure and organization in organisms.”



Robert Hooke

2 Types of Organisms



Unicellular

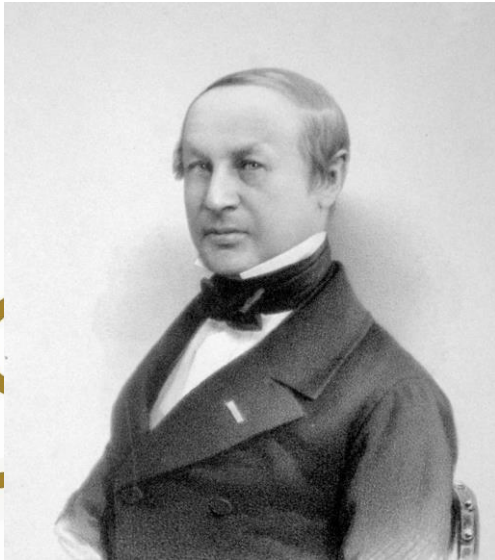


Multicellular

Cell Theory

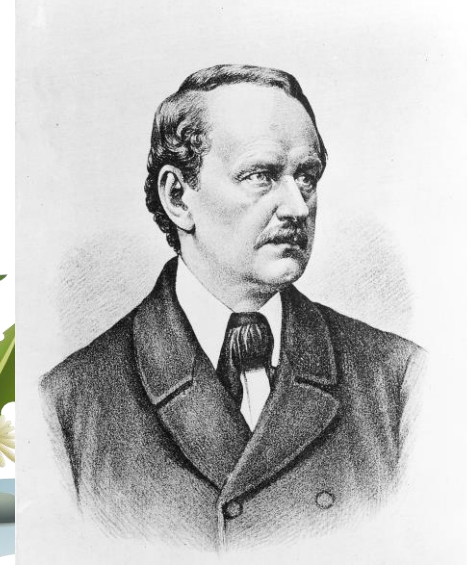
“All living organisms are composed of cells.”

Theodor Schwann



***All animals are made
up of cells.***

Matthias Schleiden



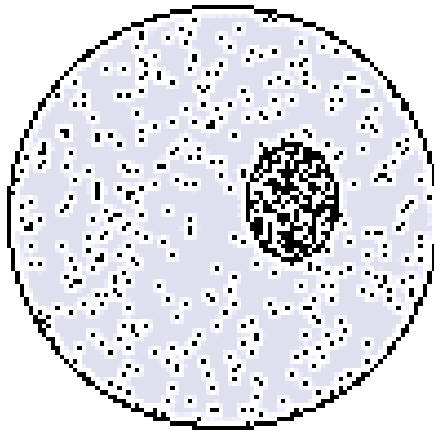
***All plants are made of
cells.***

Cell Theory

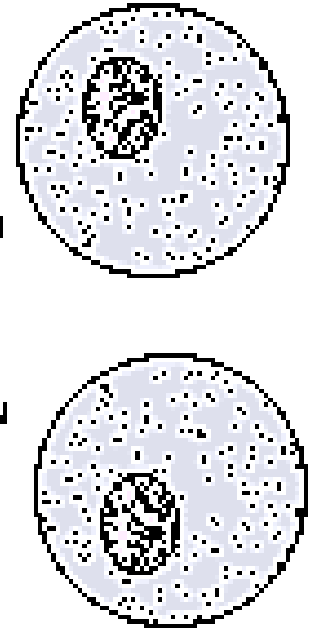
“Cells arise from pre-existing cells.”



Rudolf Virchow



All cells originate from
other preexisting cells
(cell division)



Parts of the Cell

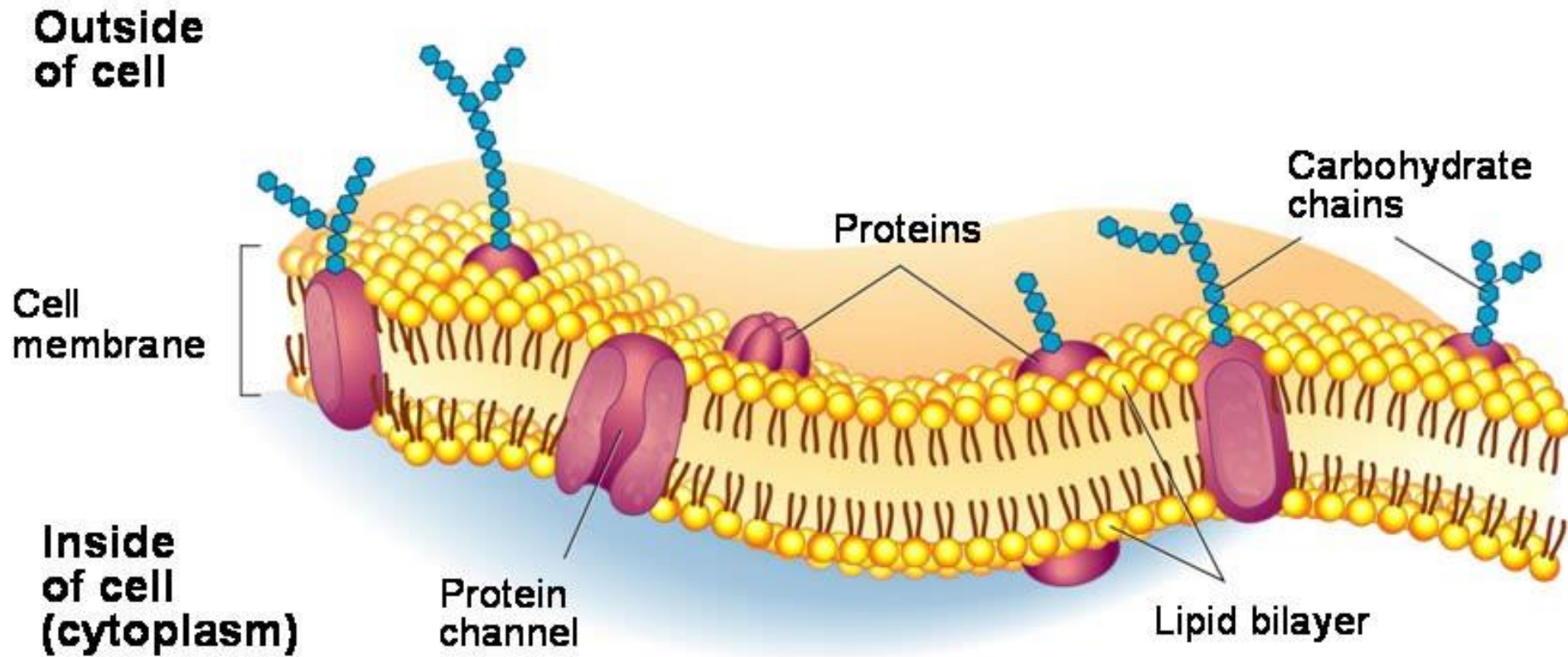
- **Cell** is the basic unit of life.
- **Protoplasm** – “*proto*” means first, “*plasm*” means form. The protoplasm of a cell is made up of three parts:
 1. Cell membrane
 2. Nucleus
 3. Cytoplasm

Cell Membrane

- **Cell membrane** is a.k.a. plasma membrane.
- It surrounds the cytoplasm of the cell.
- It is semi-permeable: allows only some substances to pass through it.
- Hence, it controls substances entering or leaving cell.

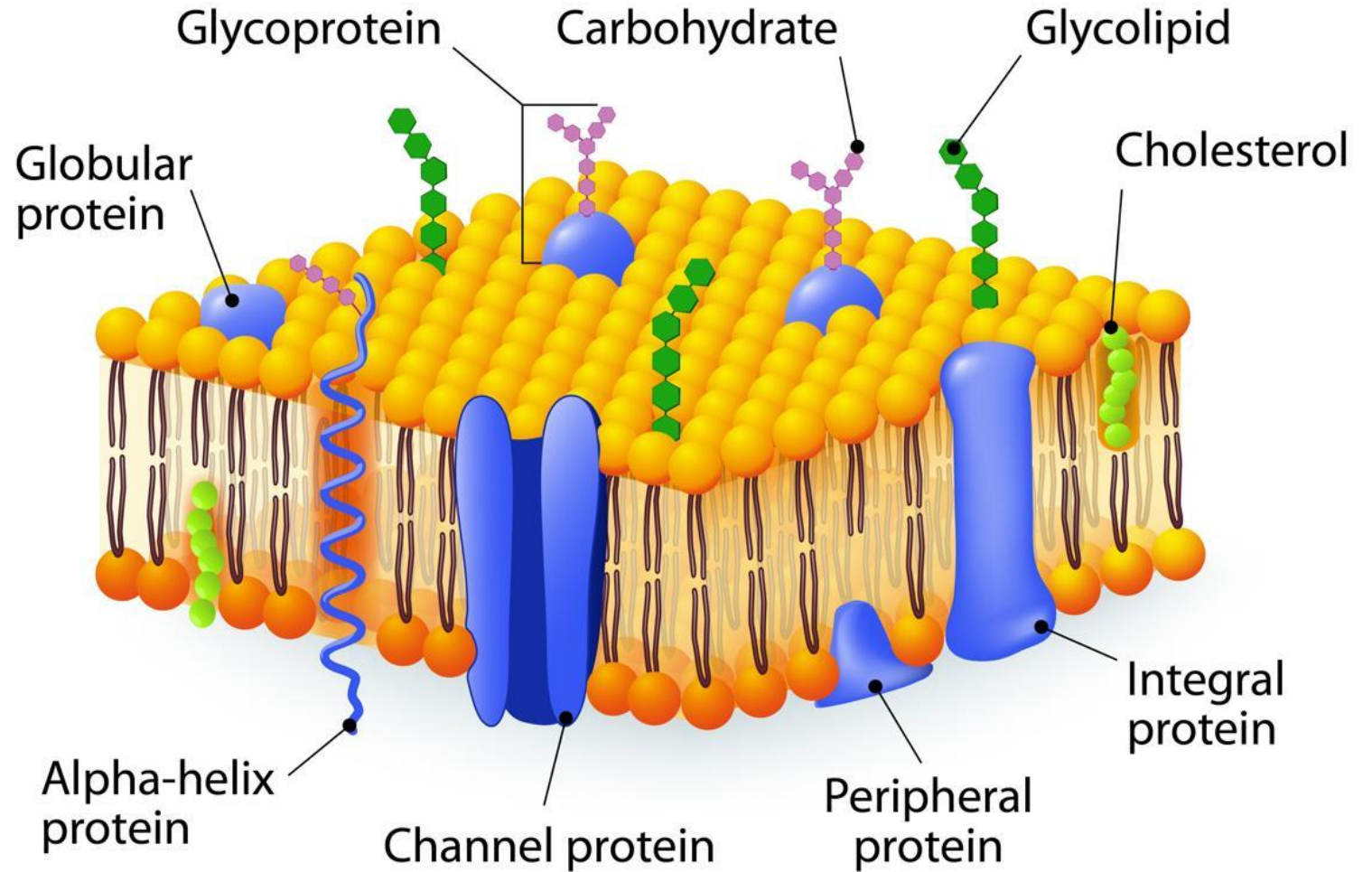
Cell Membrane

Cell membrane = *“gatekeeper of the cell”*



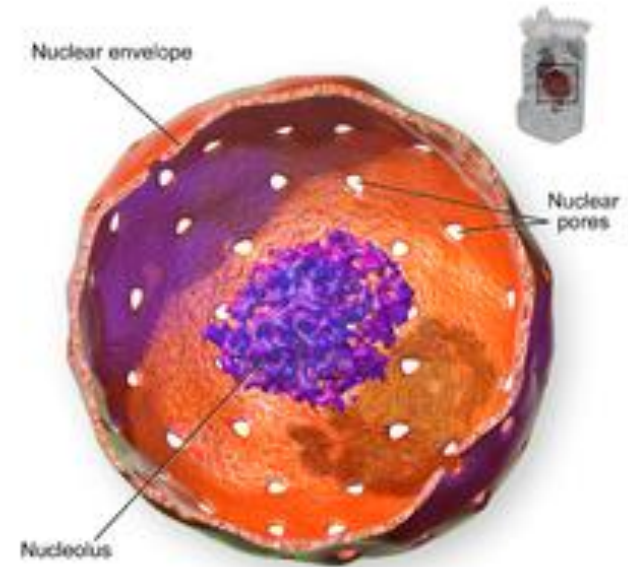
Cell Membrane

According to
Singer & Nicolson,
Cell membrane is
described as
“fluid mosaic”.



Nucleus

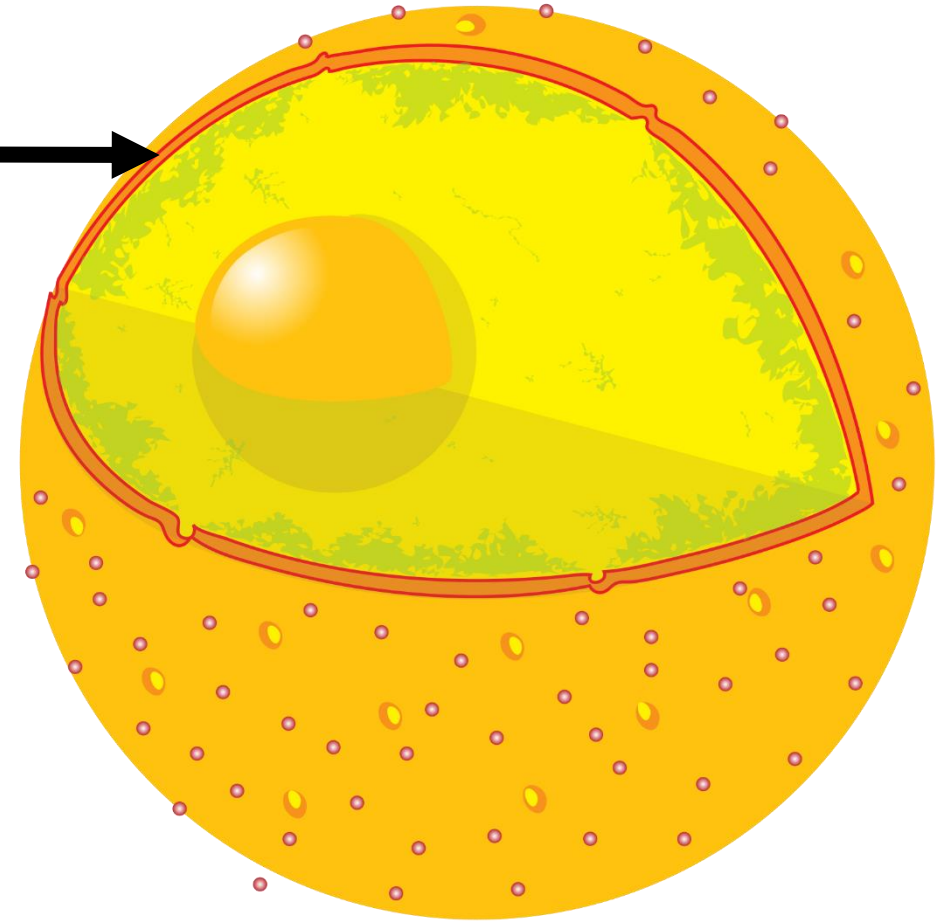
- **Nucleus** is a.k.a the “control center of the cell.”
- It controls cell activities such as cell growth and the repair of worn-out parts and cell division.
- It contains **DNA**.
- It is surrounded by double-layer membrane.



Parts of the Nucleus

Nuclear envelope

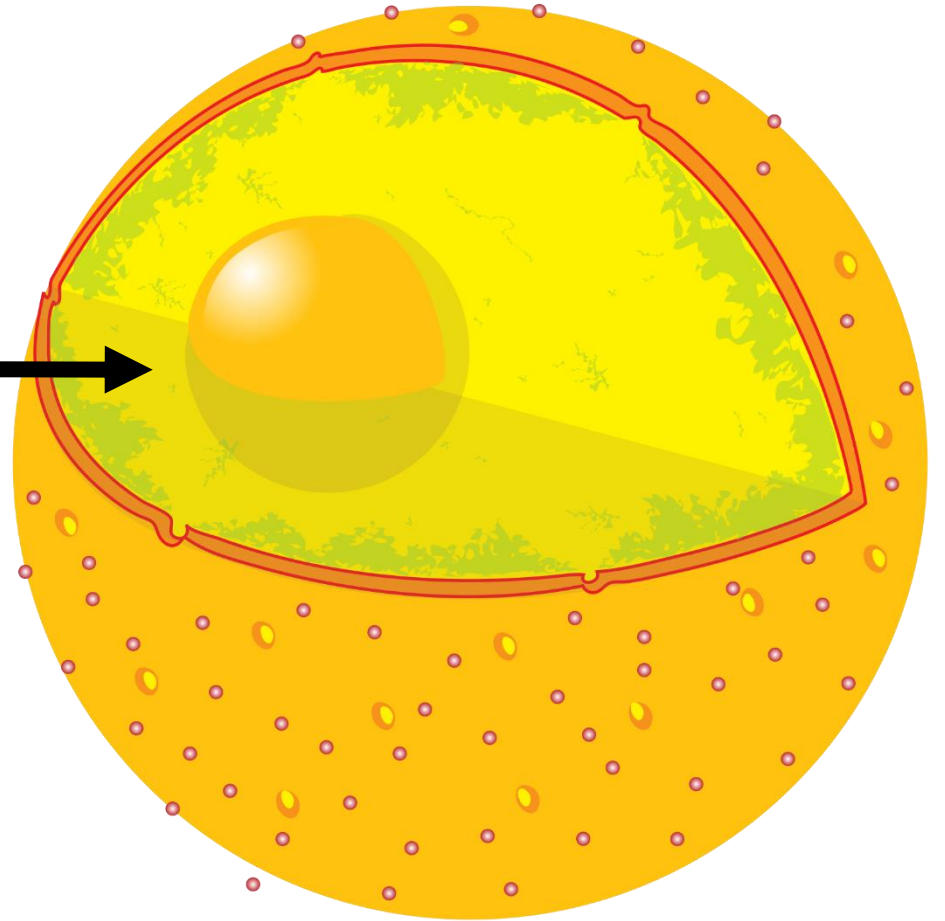
It is a double-layer membrane which separates the contents of the nucleus from the rest of the cytoplasm.



Parts of the Nucleus

Nucleoplasm

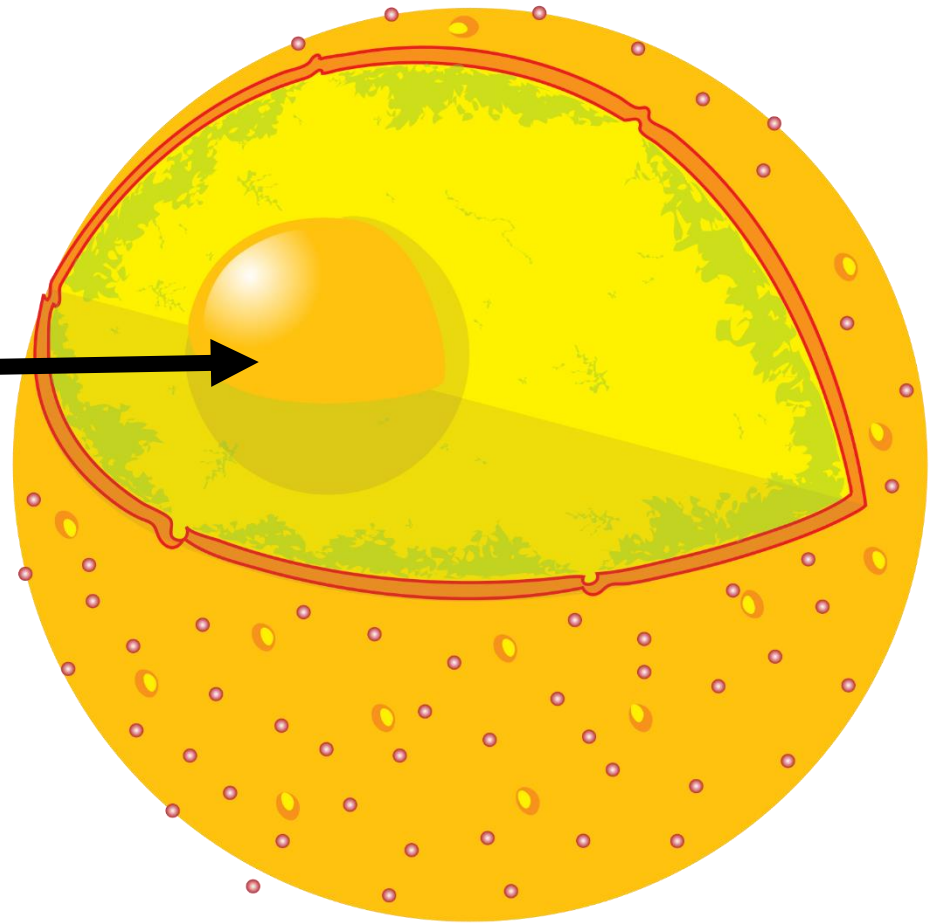
It is the dense material within the nucleus.



Parts of the Nucleus

Nucleolus

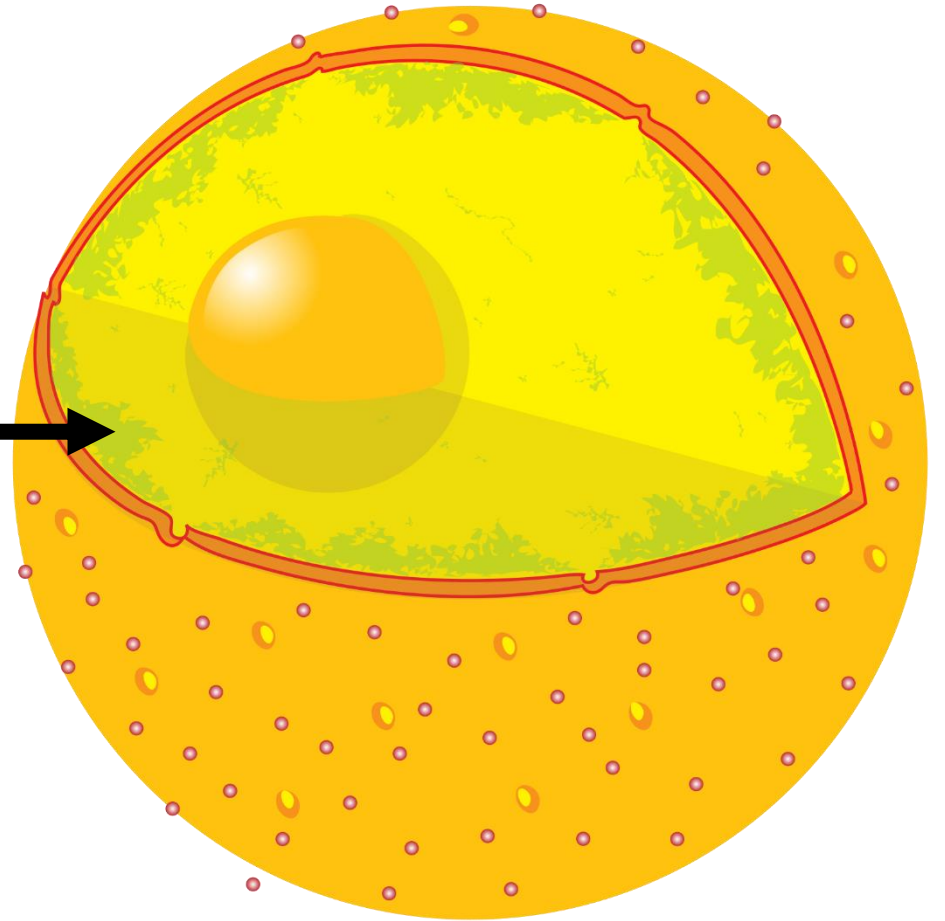
It is the largest structure in the nucleus of eukaryotic cells. It is best known as the site of ribosome biogenesis for protein synthesis.



Parts of the Nucleus

Chromatin

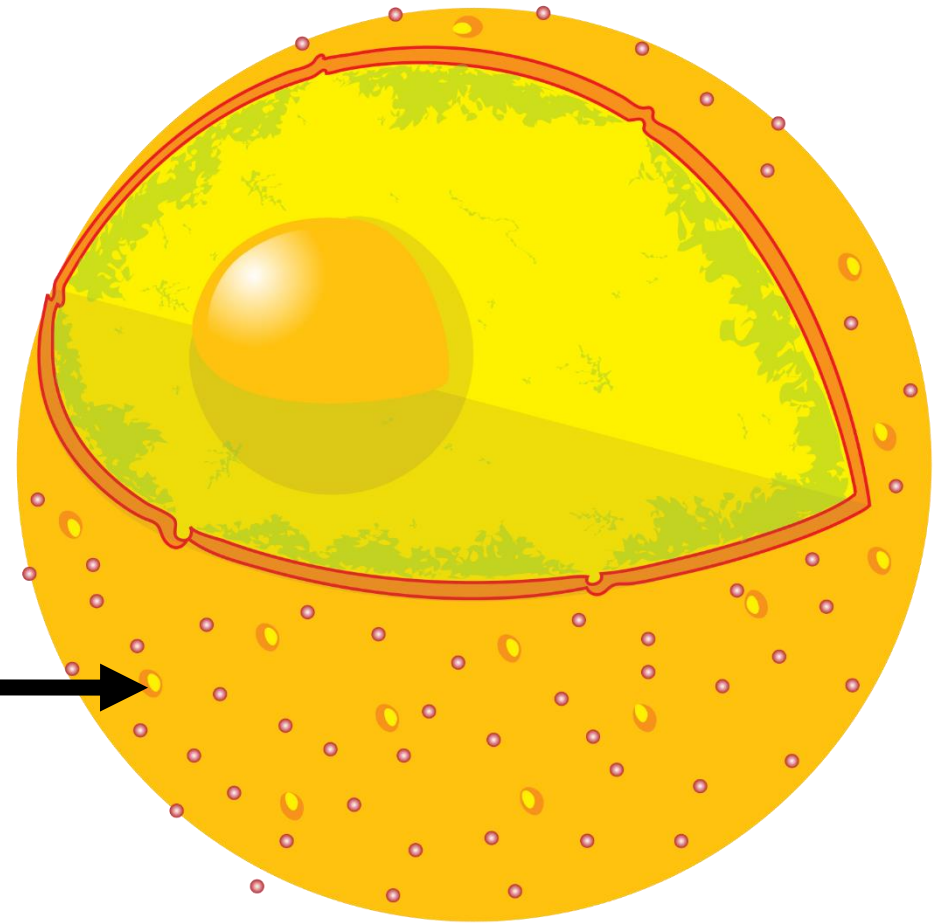
It is a complex of DNA and proteins called “histones” that forms chromosomes within the nucleus of eukaryotic cells.



Parts of the Nucleus

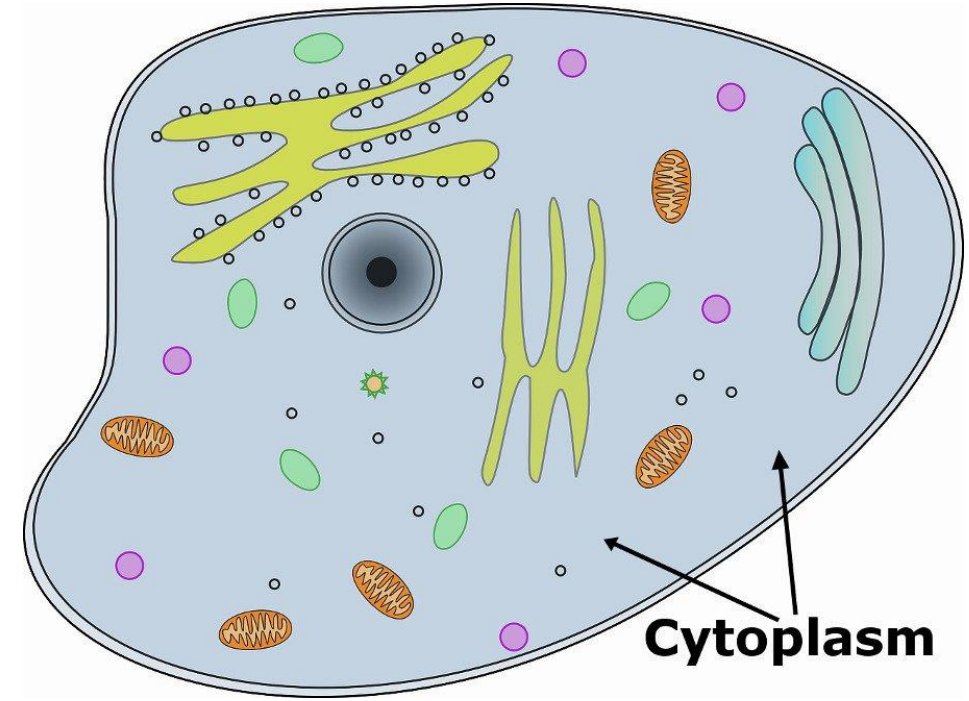
Nuclear pore

It is the channel in the nuclear envelope that regulates the transport of molecules between the nucleus and the cytoplasm.



Cytoplasm

- **Cytoplasm** is the part of the protoplasm between the cell surface membrane and the nucleus.
- **Cytoplasm** is the combination of jelly-like substance called “cytosol” and the organelles.



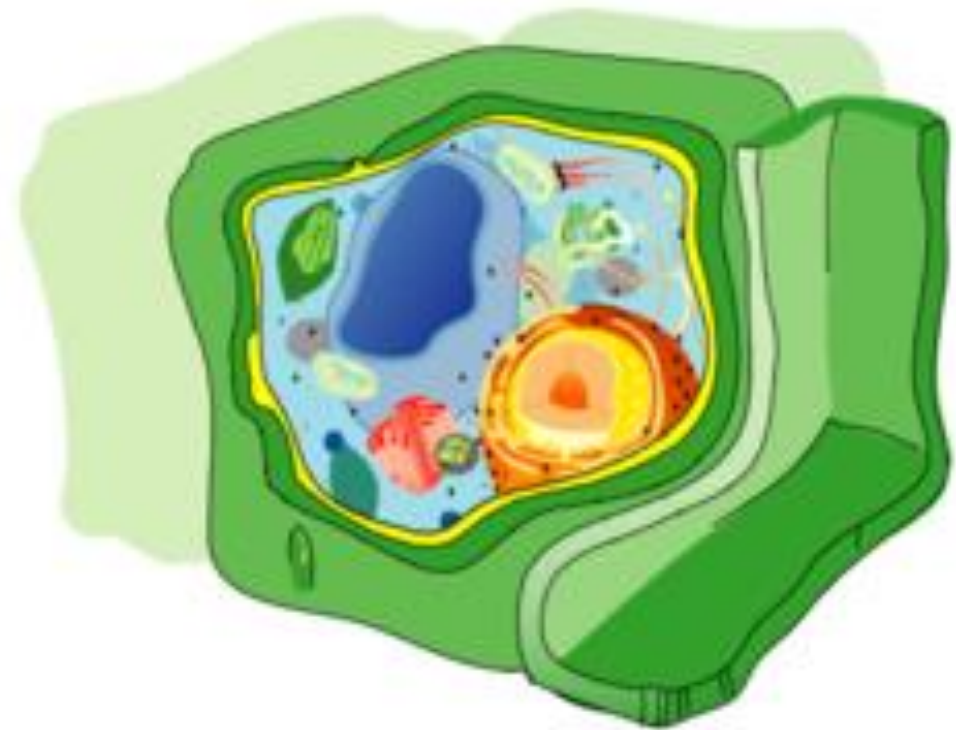
Organelles

- These parts are embedded within the cytoplasm.
- Organelles are often enclosed by their own membrane.

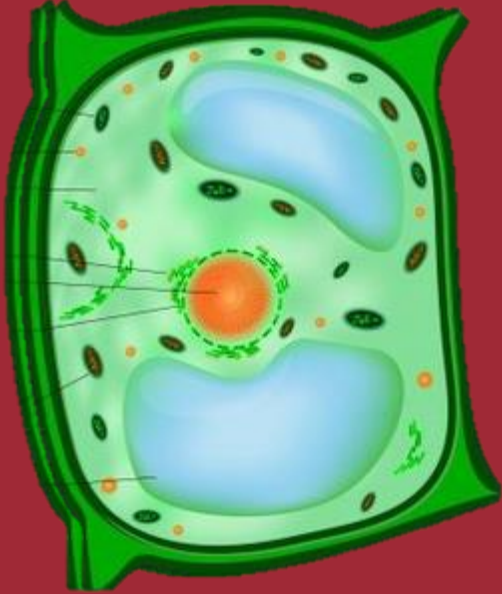
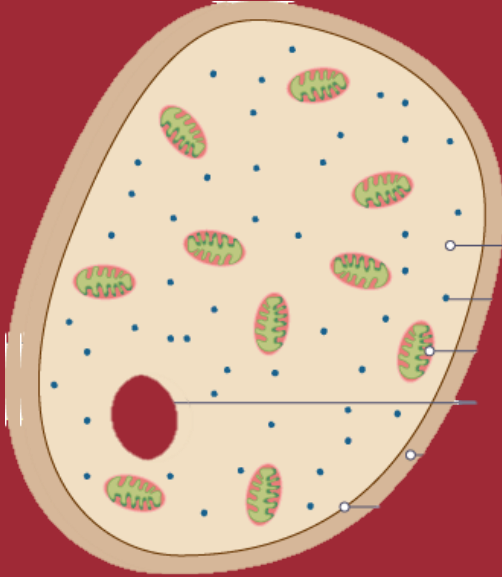
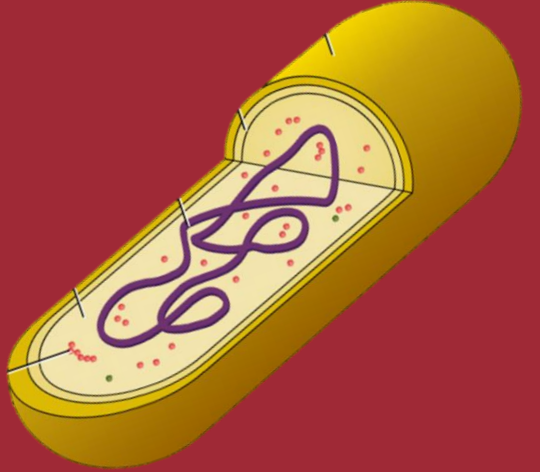
1. Cell wall
2. Endoplasmic Reticulum
3. Mitochondrion
4. Vacuole
5. Lysosomes
6. Peroxisomes
7. Chloroplast
8. Golgi apparatus
9. Centrioles

Cell Wall

- **Cell wall** is a rigid organelle. It provides support, protection and shape of the cell.
- It is present **ONLY** in:
 1. *Plants*
 2. *Fungi*
 3. *Bacteria*



Cell Wall

Structure			
Type	Plant	Fungi	Bacteria
Component	Cellulose	Chitin	Peptidoglycan

Endoplasmic Reticulum (ER)

- **ER** is also known as *“highway system”* of the cell.
- It is a network of membranous tubules within the cytoplasm, continuous with the nuclear membrane.



Endoplasmic Reticulum (ER)

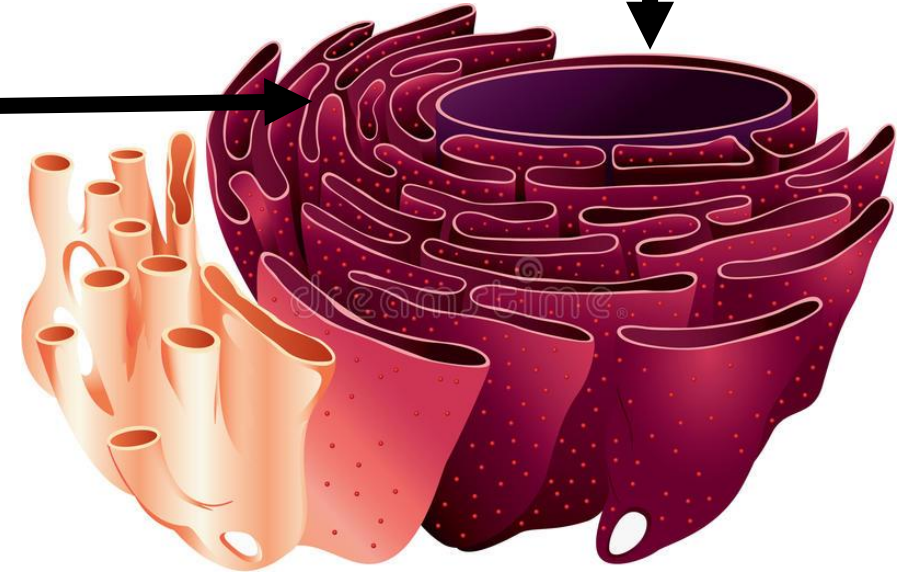
Rough ER

Rough ER is called rough because it has ribosomes attached to its surface.

Function:

Protein Synthesis

Nucleus



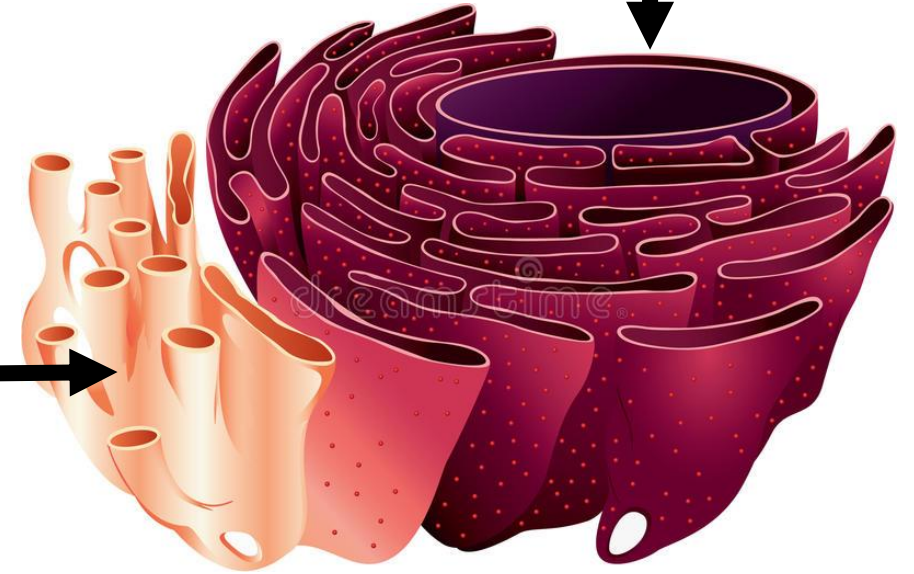
Endoplasmic Reticulum (ER)

Smooth ER

Smooth ER is not associated with ribosomes.

Function:
Lipid Synthesis

Nucleus



Mitochondrion

- **Mitochondrion** is a.k.a. *“powerhouse”* of the cell.
- Mitochondria are sausage-shape organelles that is considered the power generators of the cell, converting oxygen and nutrients into adenosine triphosphate (ATP).
- **ATP** is the energy of the cell.

Parts of Mitochondrion

Cristae

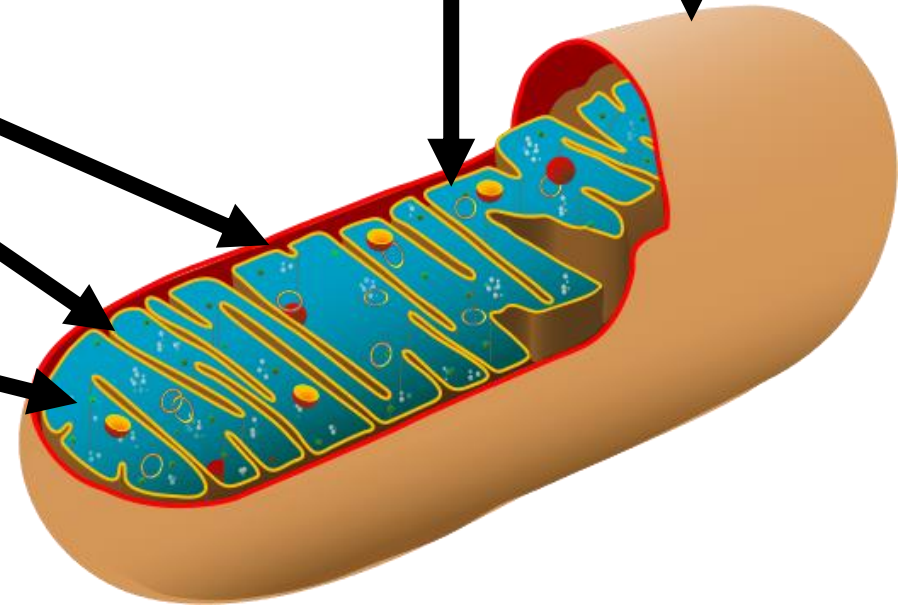
It is the infolding of the inner membrane.

Matrix

It is the liquid inside the mitochondrion.

Outer Membrane

Inner Membrane

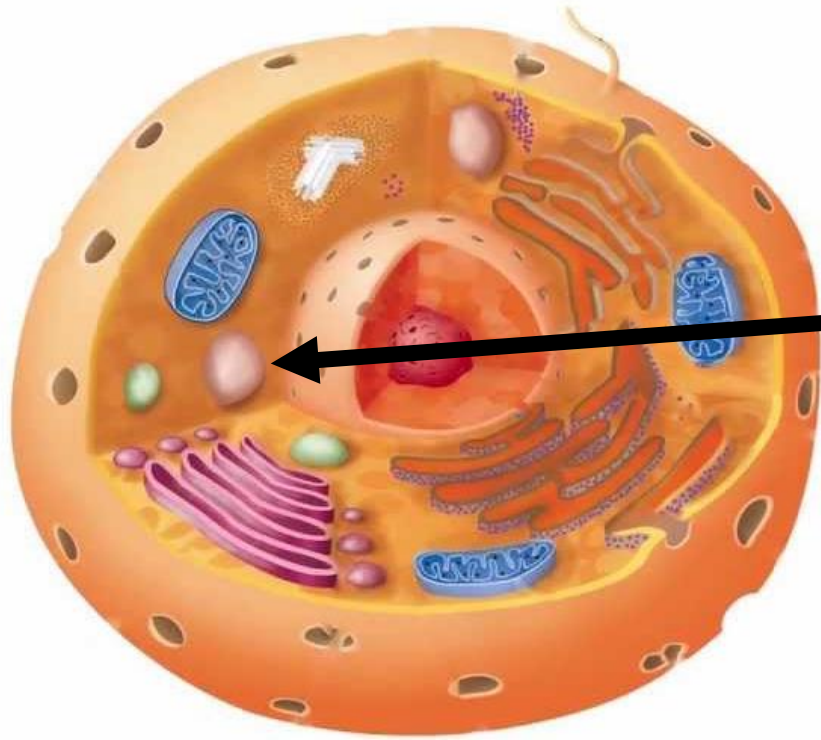


Vacuoles

- **Vacuole** is a.k.a. *“storage tank”* of the cell.
- It is a space within a cell that is empty of cytoplasm, lined with a membrane, and filled with fluid.
- Function: *storage of food, water and wastes.*

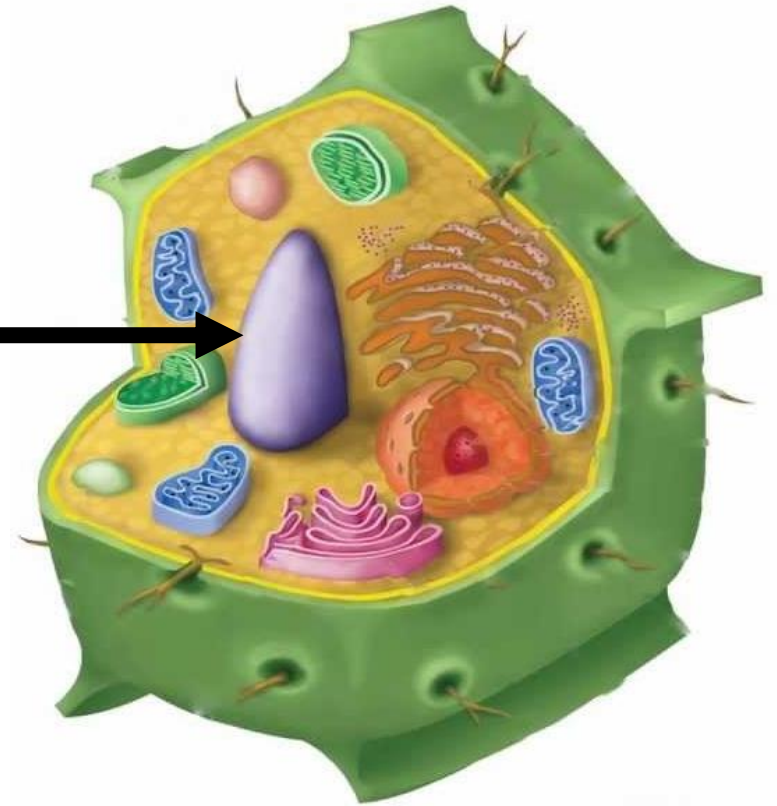
Vacuoles

Animal Cell



Vacuole

Plant Cell

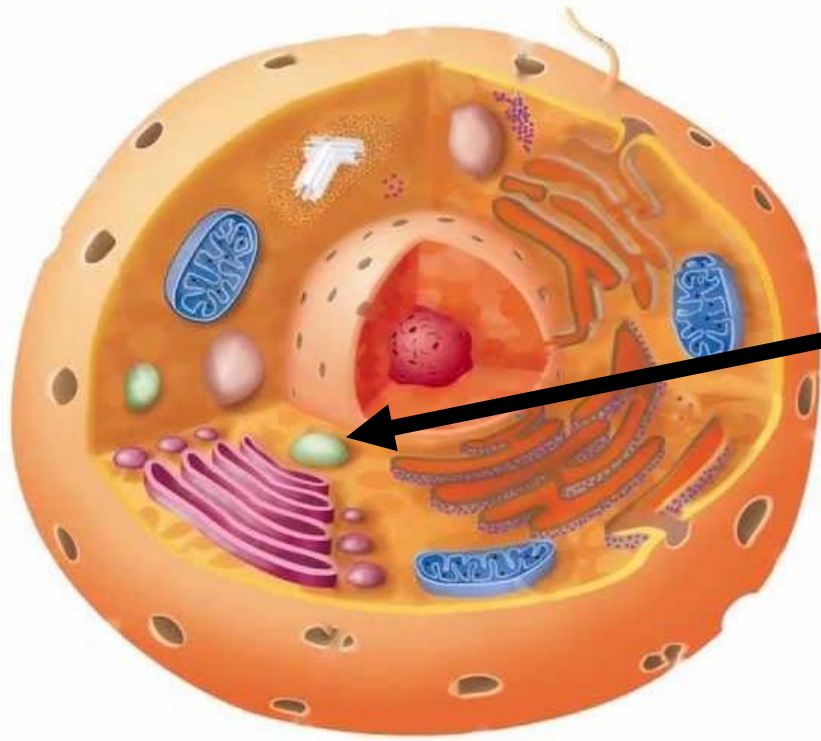


Lysosomes

- **Lysosome** is a.k.a. *“suicide bags”* of the cell.
- An organelle in the cytoplasm of the cells containing hydrolytic enzymes enclosed in a membrane.
- Function:
 1. used to digest food and protection.
 2. break down the cell when it dies.

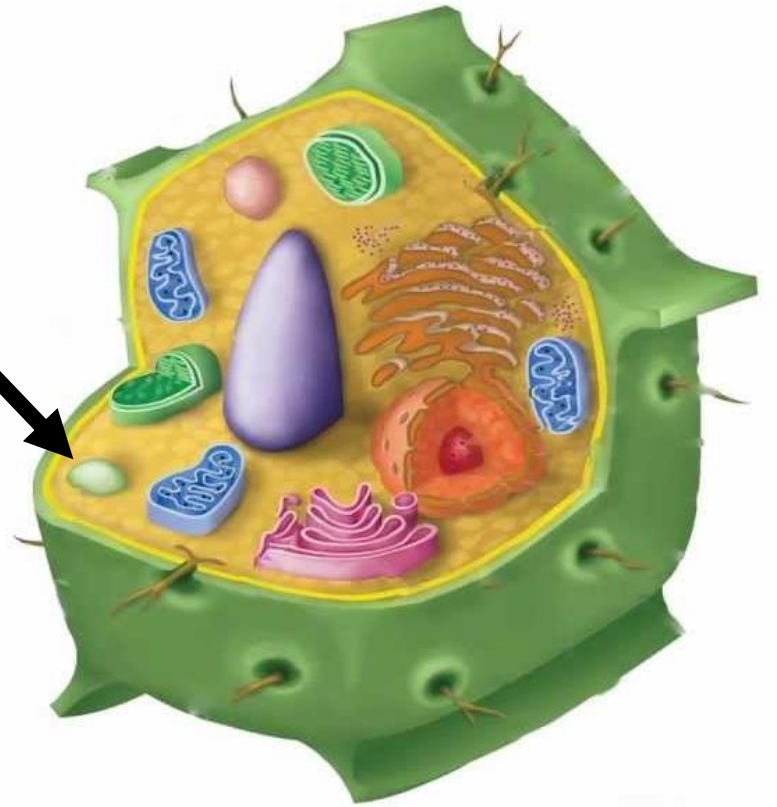
Lysosomes

Animal Cell

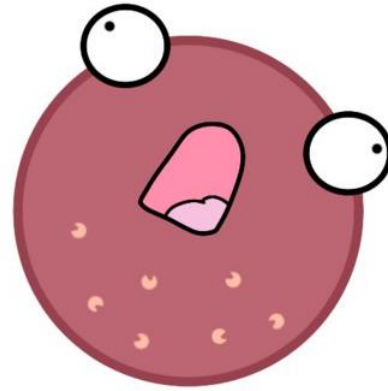
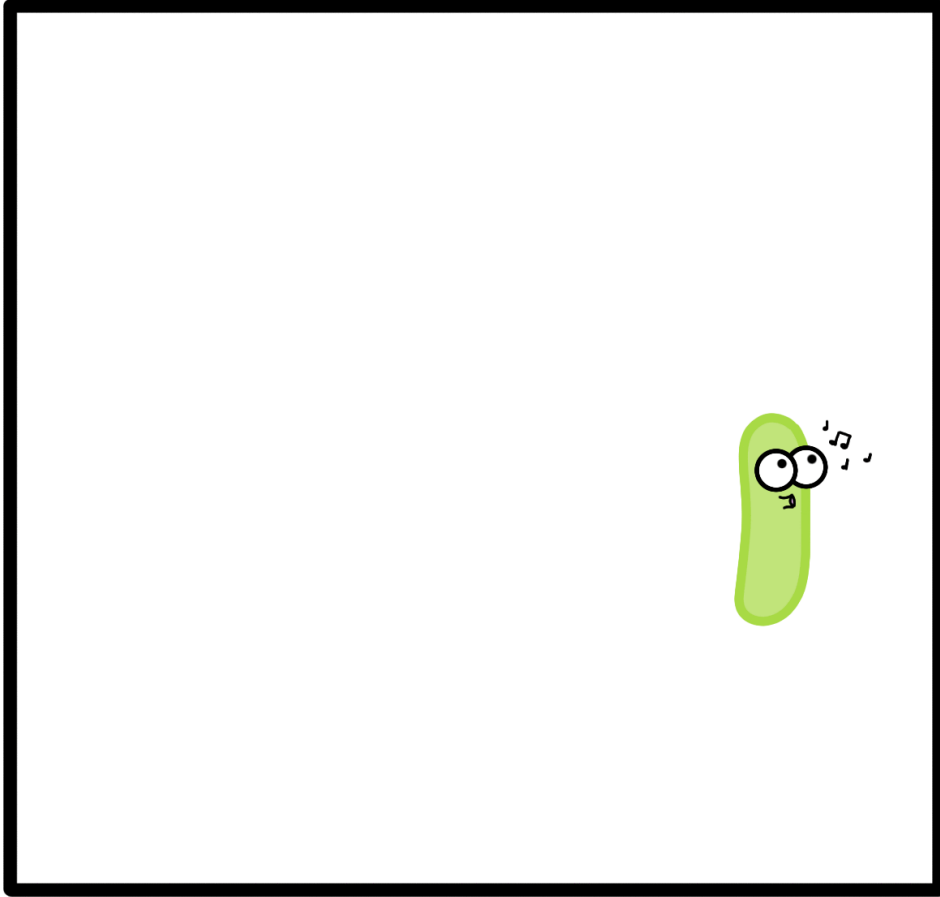


Lysosome

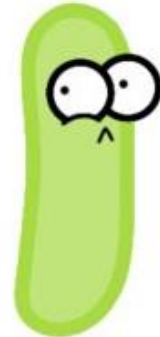
Plant Cell



Lysosomes for Protection



Lysosome



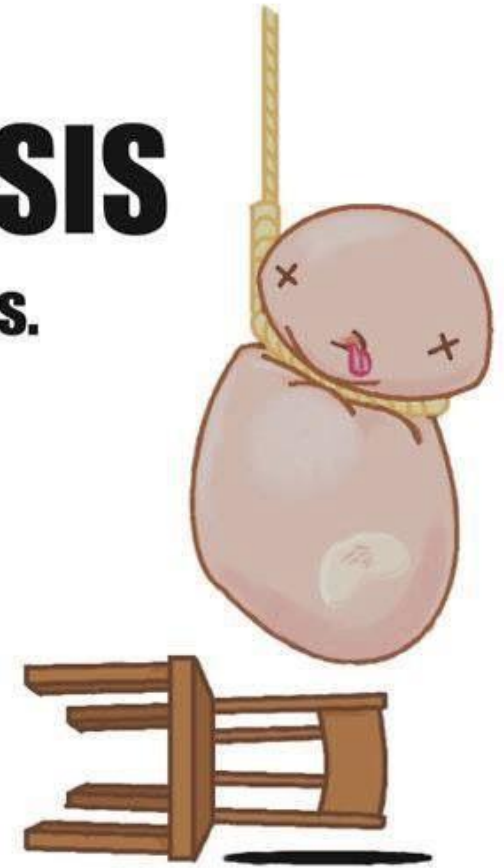
Bacterium

Lysosomes for Cell Suicide

Apoptosis is the death of cells that occurs as a normal and controlled part of an organism's growth or development.

APOPTOSIS

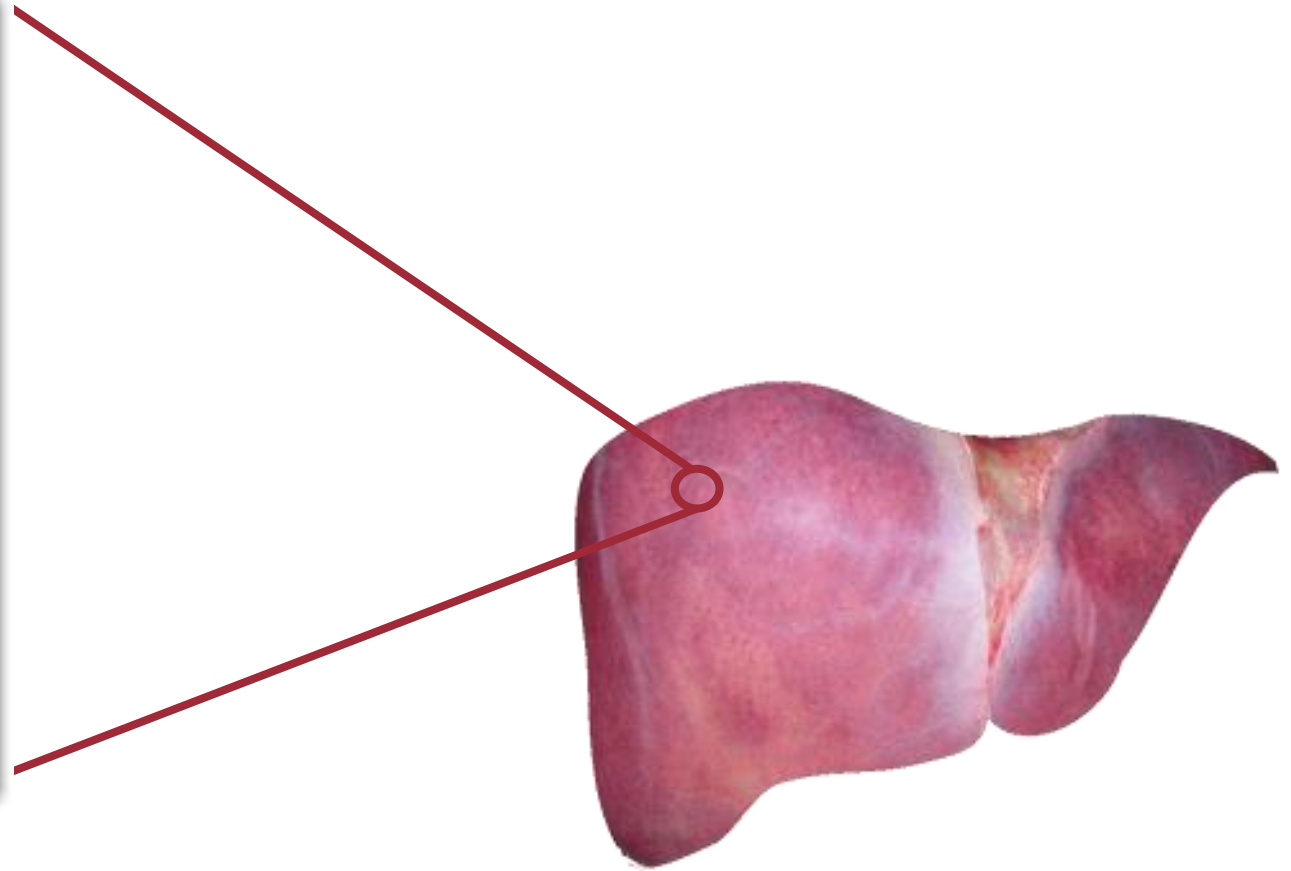
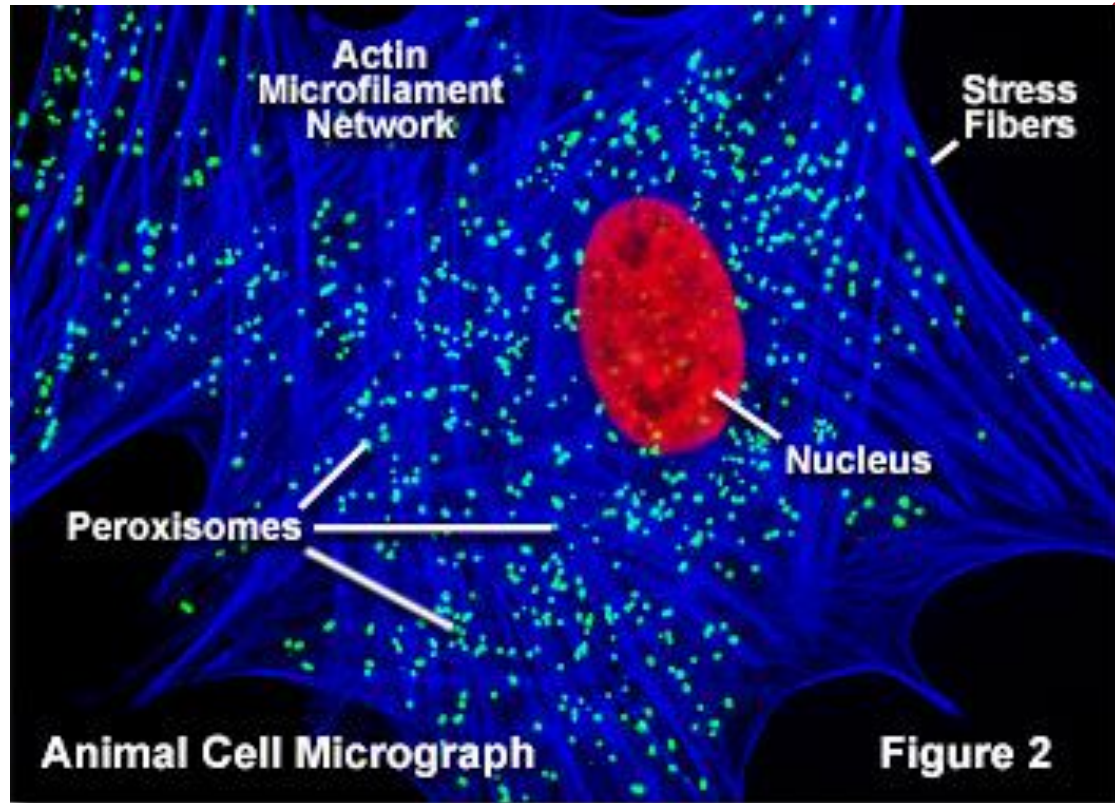
Know the signs.



Peroxisomes

- It is small organelle that is present in the cytoplasm of many cell that contains enzymes.
- Functions:
 1. *absorb nutrients that the cell has acquired.*
 2. *play a part in the way organisms **digest alcohol (ethanol)**.*

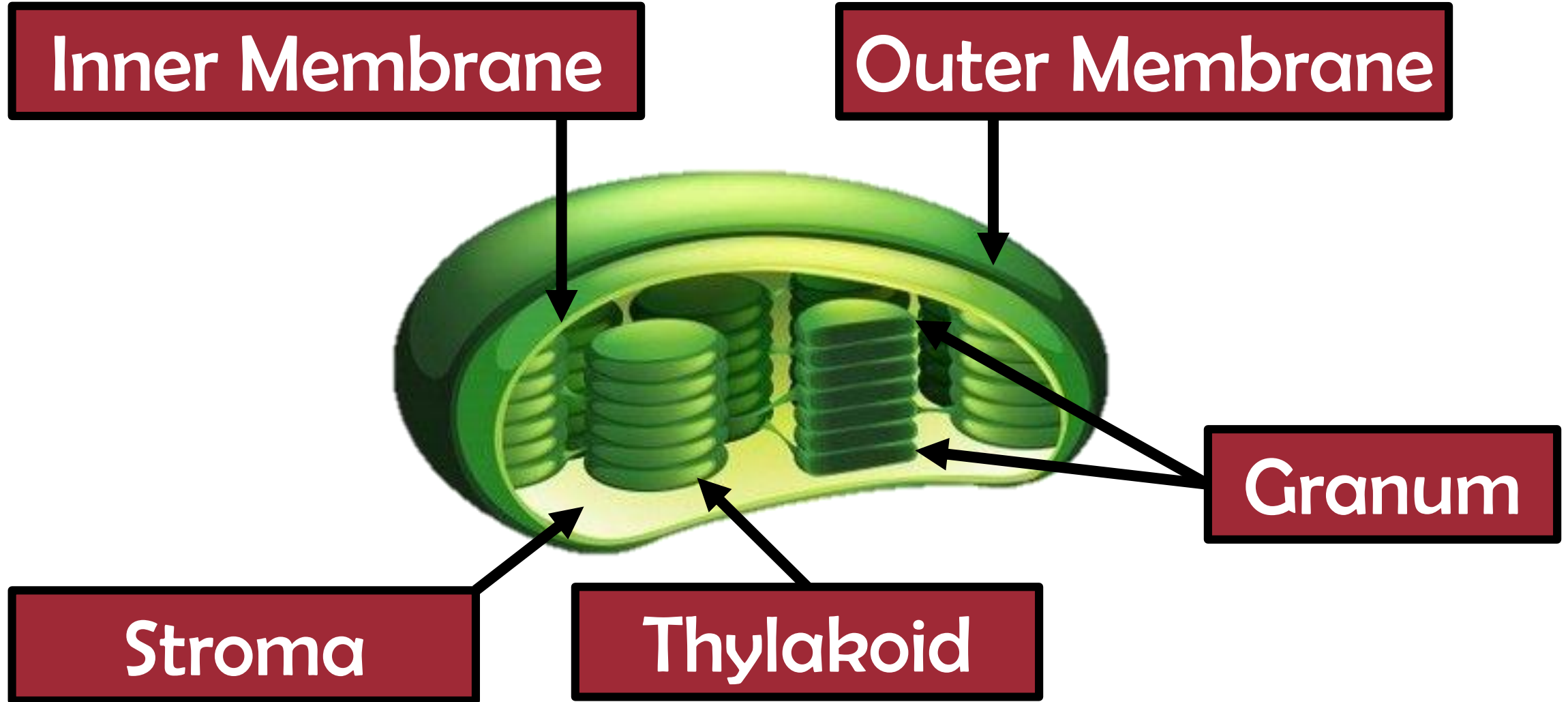
Peroxisomes



Chloroplast

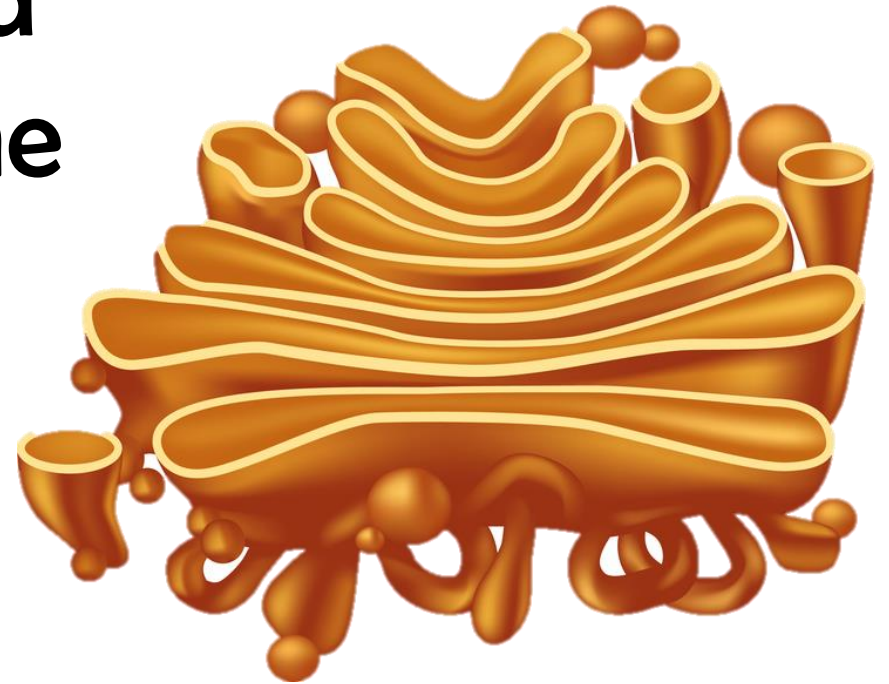
- Chloroplasts are organelles found in plant cells and eukaryotic algae that conduct photosynthesis.
- Chloroplasts absorb sunlight and use it in conjunction with water and carbon dioxide gas to produce food for the plant.

Parts of Chloroplast



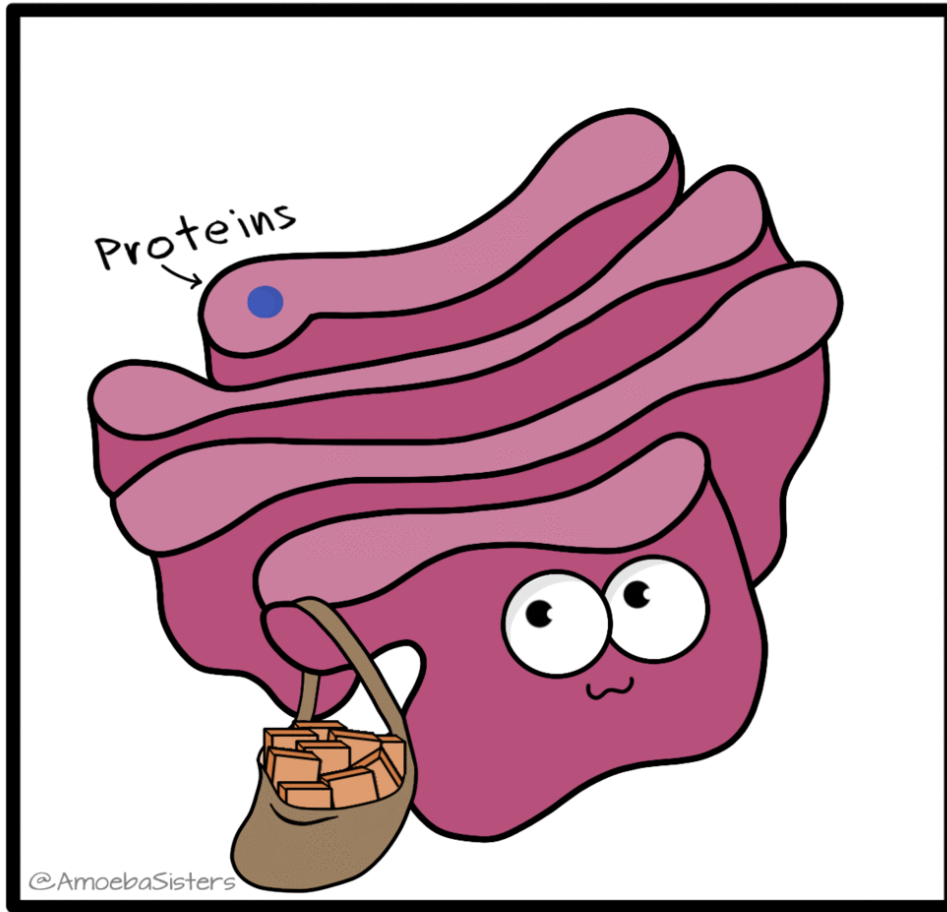
Golgi Apparatus

- It is the “**post office**” of the cell.
- It is a complex of **vesicles** and folded membranes within the cytoplasm of most cells,.
- **Function:**
 1. *waste secretion*
 2. *intracellular transport.*

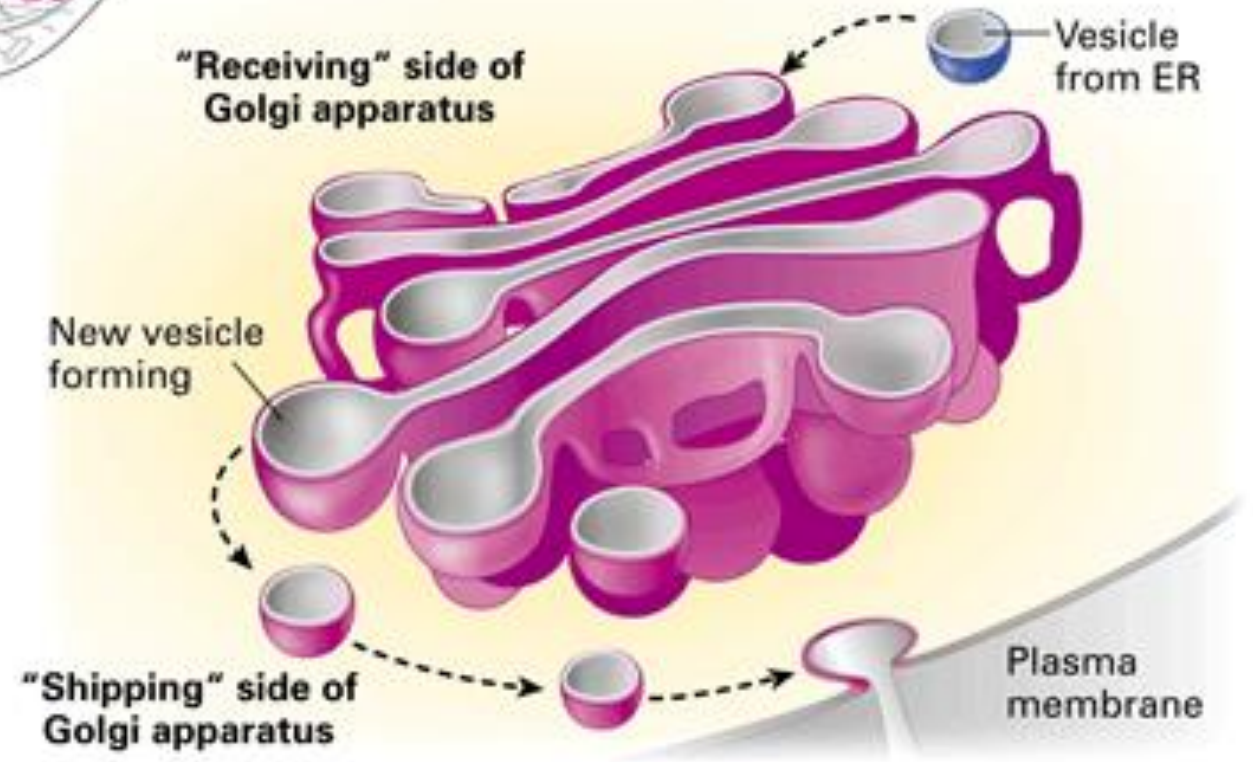


Golgi Apparatus

Golgi Apparatus



Post office of the cell

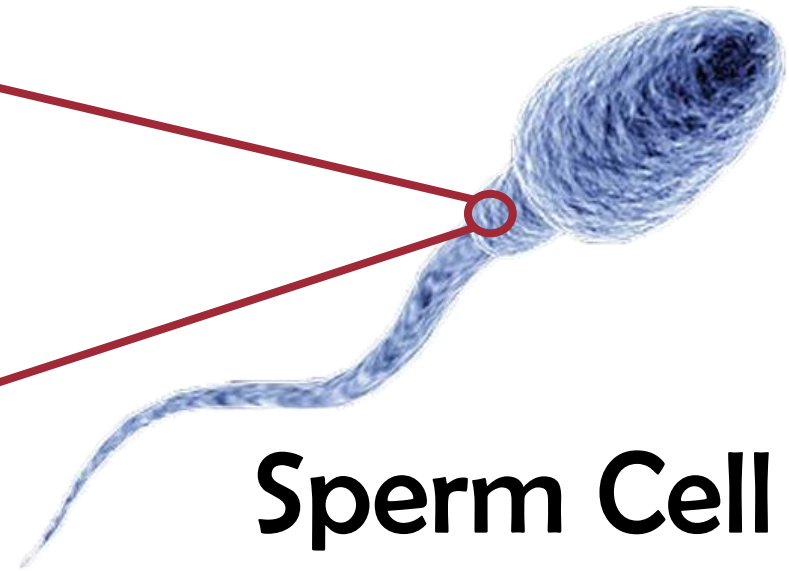
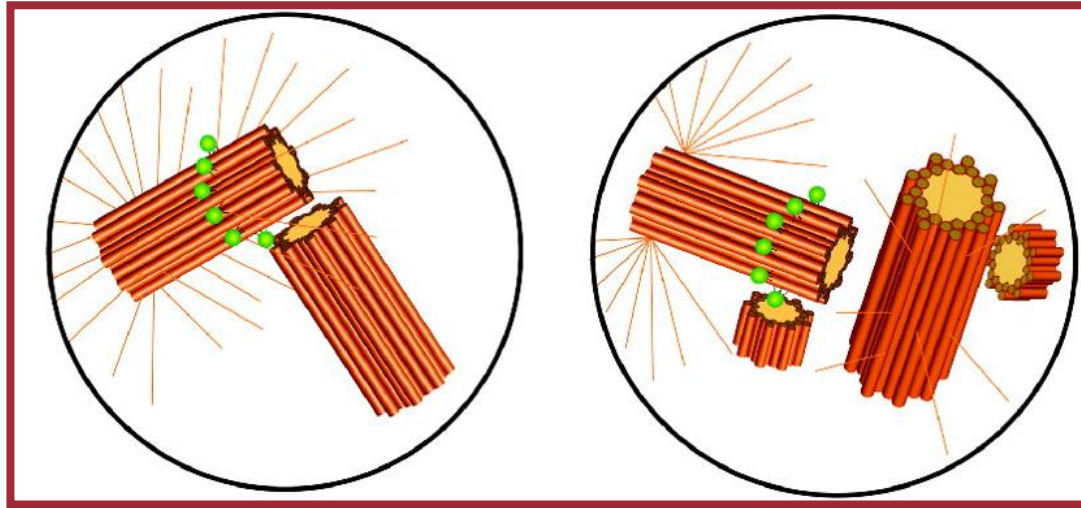


Centrioles

- These are minute cylindrical organelles near the nucleus in **animal cells**, occurring in pairs and involved in the development of spindle fibers in cell division.



Centrioles in Sperm Cell



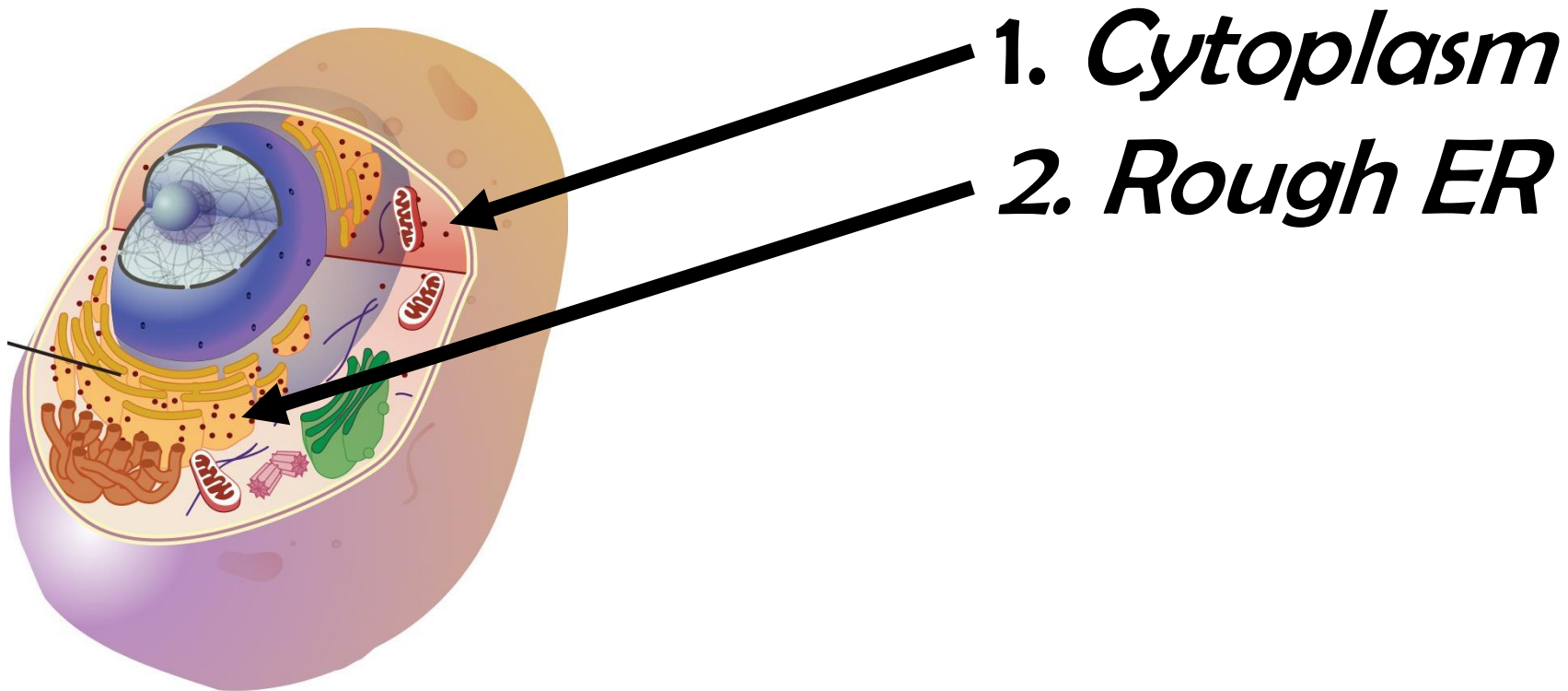
Sperm Cell

Ribosome

- Ribosome is **NOT** considered as an organelle because *it lacks membrane covering.*
- It is a complex molecular machine, found within all living cells, that serves as the site of protein synthesis.

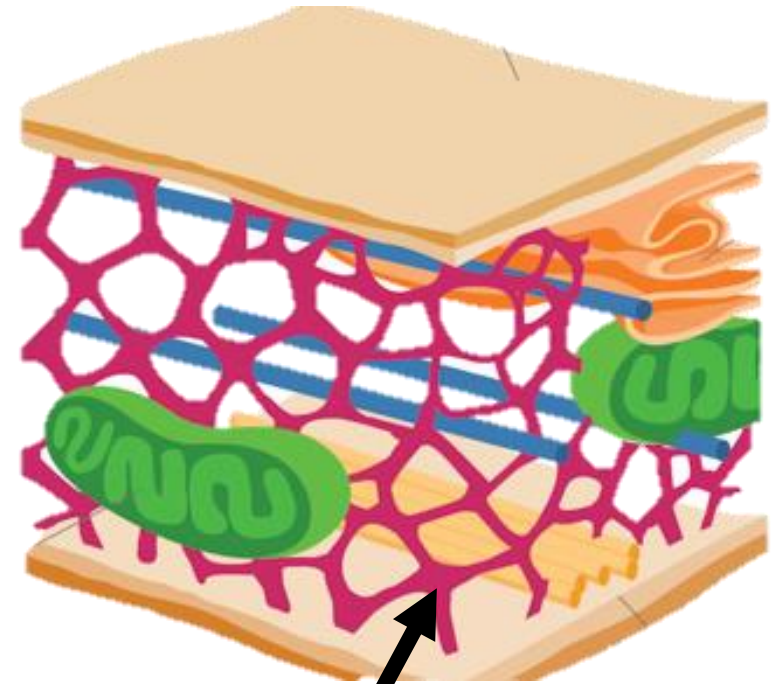
Ribosome

- Ribosomes can be found in **ALL** types of cells. It can be located in:



Cytoskeleton

- Cytoskeleton is also known as “**framework**” of the cell.
- These structures give the ***cell shape*** and help organize the cell's parts.
- It is also present in **ALL** types of cell.



Cytoskeleton

3 Components of Cytoskeleton

Microfilament

Actin filament

Actin subunit

Microtubule

Microtubule

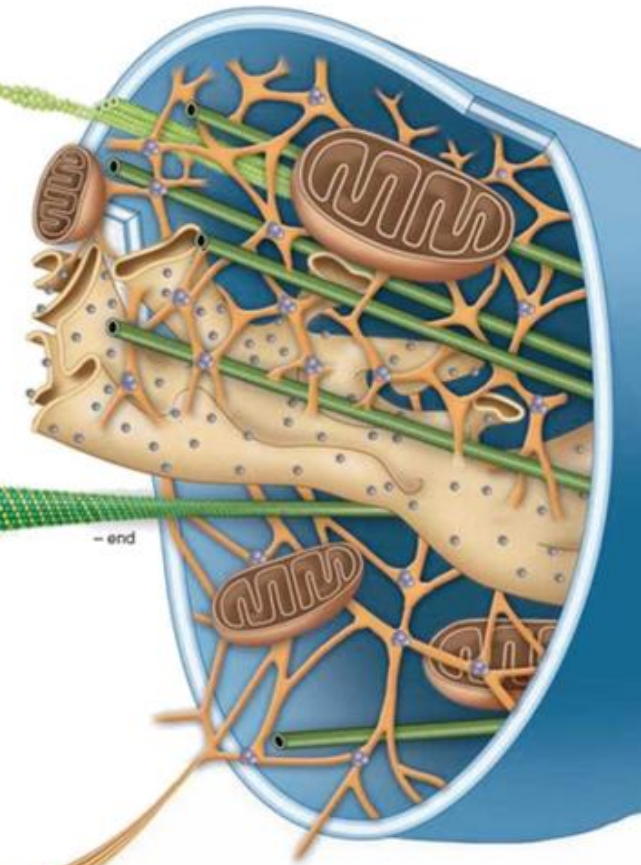
Tubulin subunit

- end

+ end

Intermediate
Filament

Intermediate filament



How do cells move around?



*White blood cell
chasing a bacterium.*



*Actual footage of
swimming sperm cells.*

How do cells move around?



*Movements of
paramecium*



Amoeba

Cell Motility

- **Cell Motility** is required for many important physiological processes during cell development, such as *cell migration* and *cell regeneration*.

3 Locomotive Structures of Cell

1. Cilia
2. Flagella
3. Pseudopodia

Cilia

- **Cilia** is hair-like filament that is numerous on tissue cells of most animals and provides the means for locomotion of protozoans and other cells.

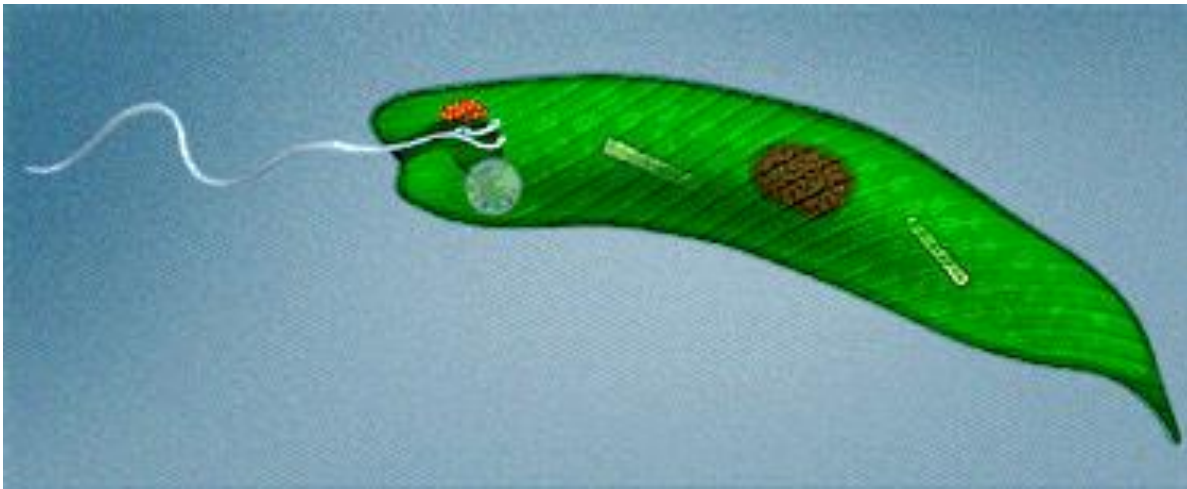


Cilia



Flagella

- **Flagellum** is a whip-like structure that allows a cell to move.

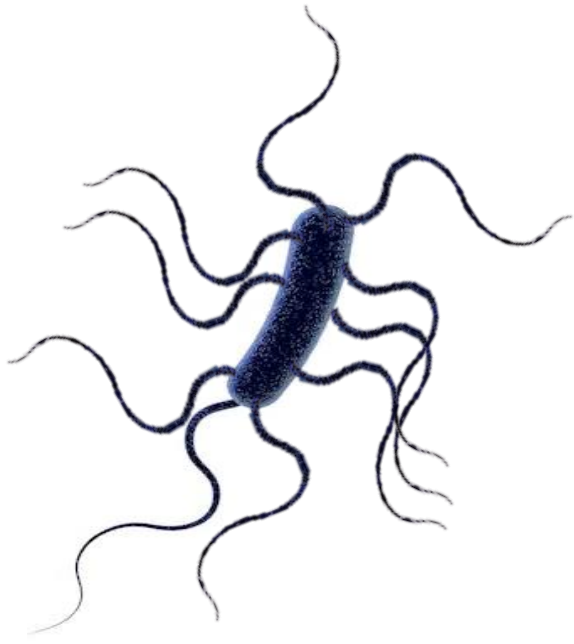


Euglena



Sperm cells

4 Types of Flagellar Arrangement



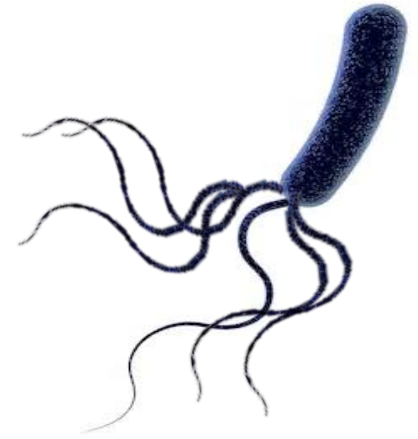
Peritrichous



Monotrichous



Amphitrichous



Lophotrichous

Pseudopodia

- “*Pseudo*” means **false** and “*Podia*” means “**foot**”.
- It is **cytoplasm-filled** projection of an eukaryotic cell membrane or a unicellular protist.
- Function:
Movement and Ingestion



Amoeba

2 Classifications of Cells

Eukaryotic

“Eu” means **true** and
“karyo” means **nucleus**.

This is a type of cell
with **true nucleus**.

Prokaryotic

“Pro” means **before** and
“karyo” means **nucleus**.

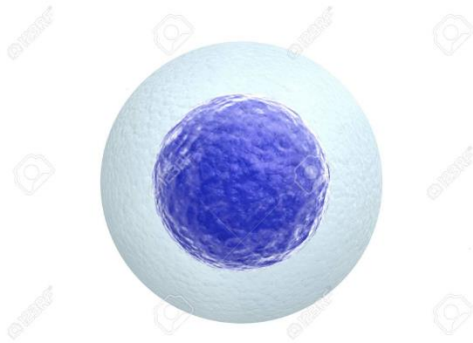
This is a type of cell
without nucleus.

Difference of Eukaryotes and Prokaryotes

Eukaryotic

SIZE:

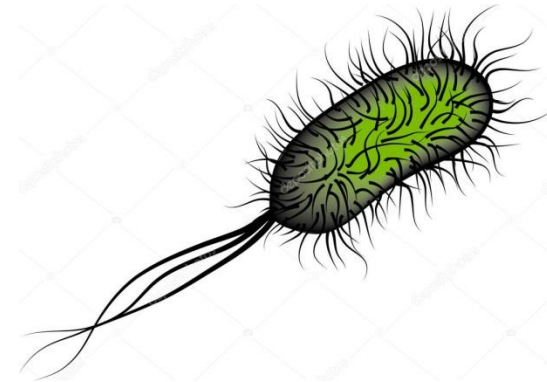
*Larger than 10
micrometres.*



Prokaryotic

SIZE:

*Smaller than 10
micrometres.*



Difference of Eukaryotes and Prokaryotes

Eukaryotic

DNA:

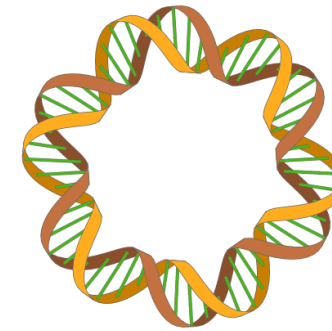
DNA is linear and enclosed within a nucleus.



Prokaryotic

DNA:

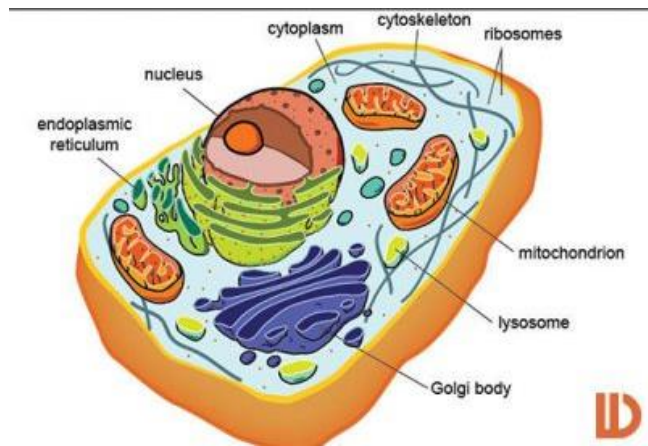
DNA in a ring form and free in cytoplasm.



Difference of Eukaryotes and Prokaryotes

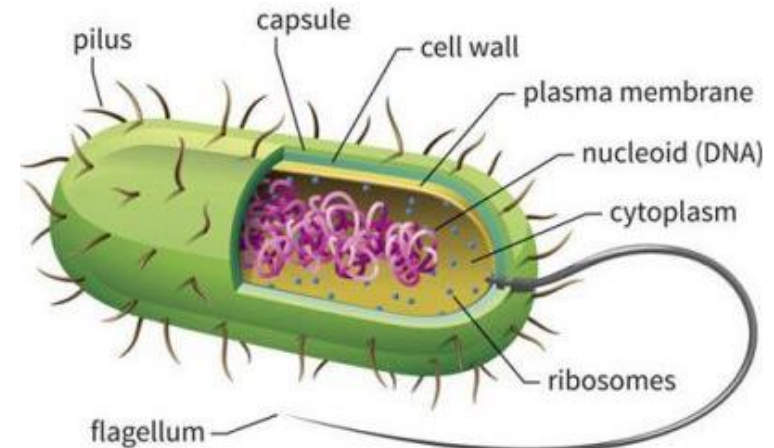
Eukaryotic

Organelles:
With organelles



Prokaryotic

Organelles:
Without organelles

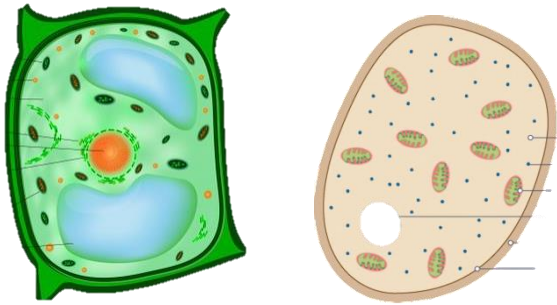


Difference of Eukaryotes and Prokaryotes

Eukaryotic

Cell wall:

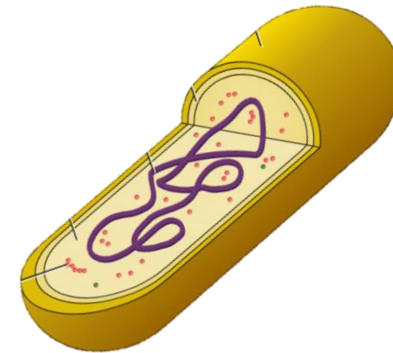
*Cell wall is made up of
cellulose or **chitin**.*



Prokaryotic

Cell wall:

*Cell wall is made up
of **peptidoglycan**.*



Similarities of Eukaryotes and Prokaryotes

Eukaryotic

Prokaryotic

They both have:

Ribosomes

Cell membrane

DNA

Cytoskeleton

Cell wall (different composition)

Comparative Cell Biology



Animal Cell

VS



Plant Cell

Similarities of Animal and Plant Cells

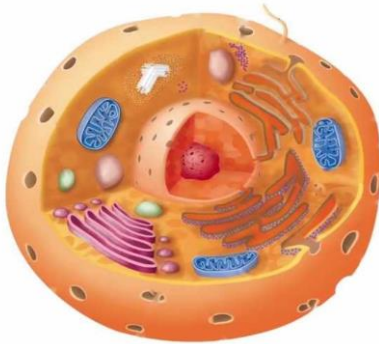
Animal		Plant
<i>They are both eukaryotic cell.</i>		
<i>They both have:</i>		
Cell membrane	Golgi apparatus	Cytoplasm
Nucleus	Mitochondrion	Rough ER
DNA	Lysosomes	Smooth ER
Cytoskeleton	Ribosomes	Peroxisomes

Difference of Animal and Plant Cells

Animal

Size:

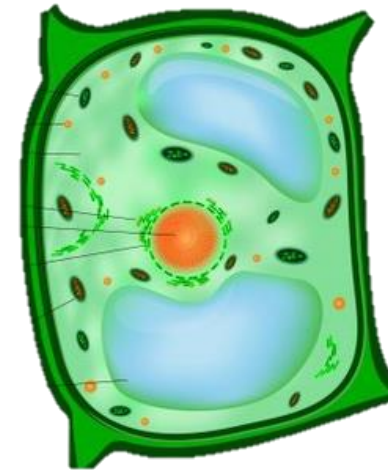
Smaller



Plant

Size:

Larger

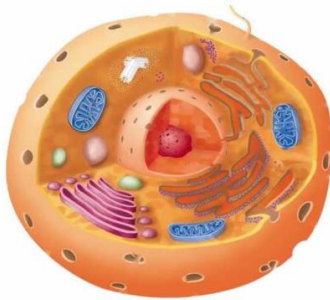


Difference of Animal and Plant Cells

Animal

Shape:

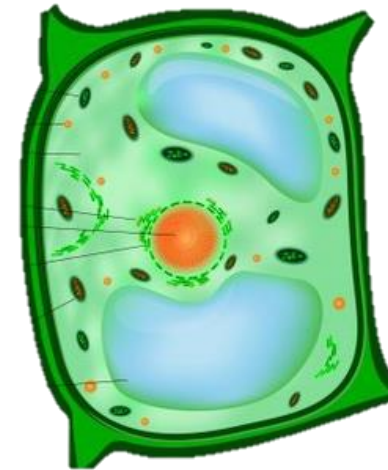
Do not have definite shape.



Plant

Shape:

Have a fixed shape.

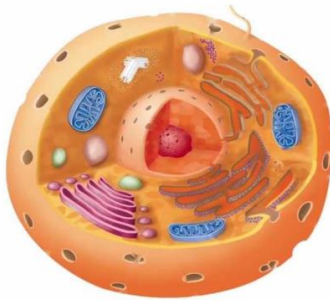


Difference of Animal and Plant Cells

Animal

Cell wall:

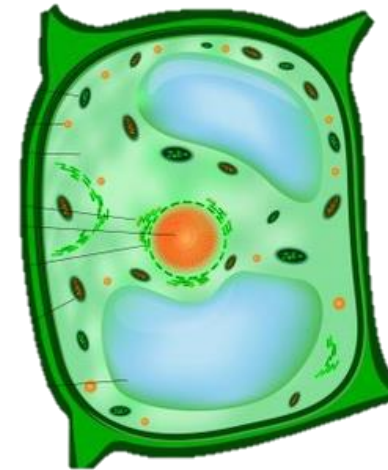
Absent



Plant

Cell wall:

Present

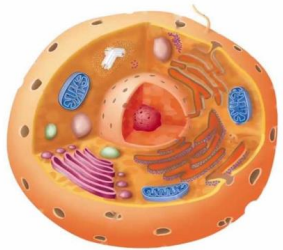


Difference of Animal and Plant Cells

Animal

Vacuole:

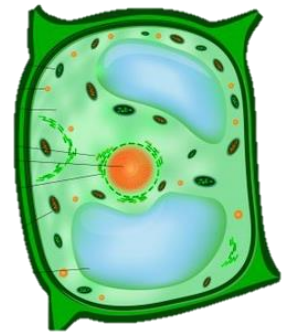
Usually absent. If present, vacuoles are small.



Plant

Vacuole:

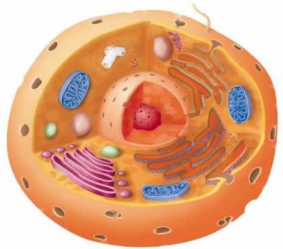
Have a large central vacuole.



Difference of Animal and Plant Cells

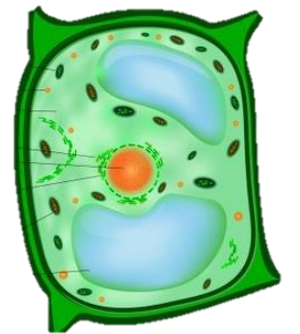
Animal

Chloroplast:
Absent



Plant

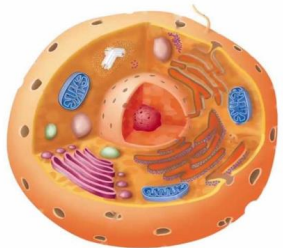
Chloroplast:
Present in green plants.



Difference of Animal and Plant Cells

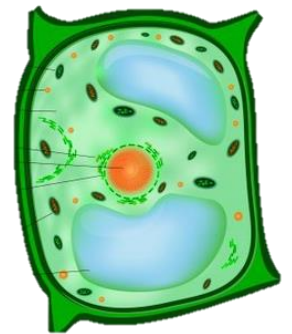
Animal

Centrioles:
Present



Plant

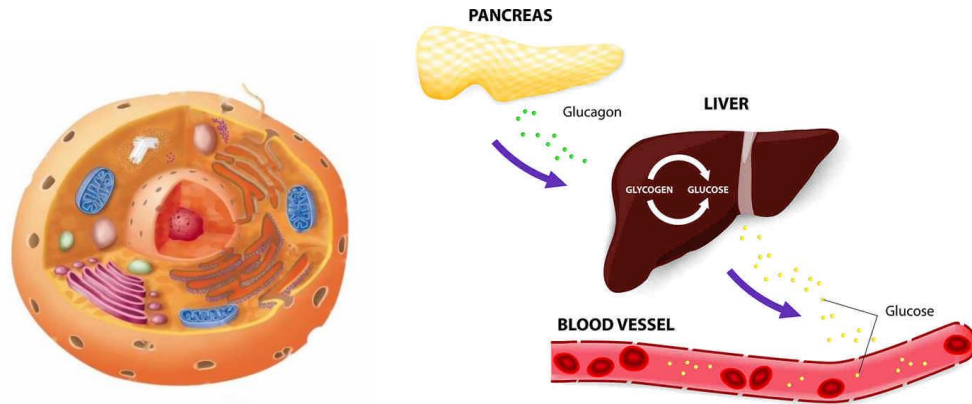
Centrioles:
Absent



Difference of Animal and Plant Cells

Animal

Food storage:
Glycogen



Plant

Food storage:
Starch



Review of Animal Cell

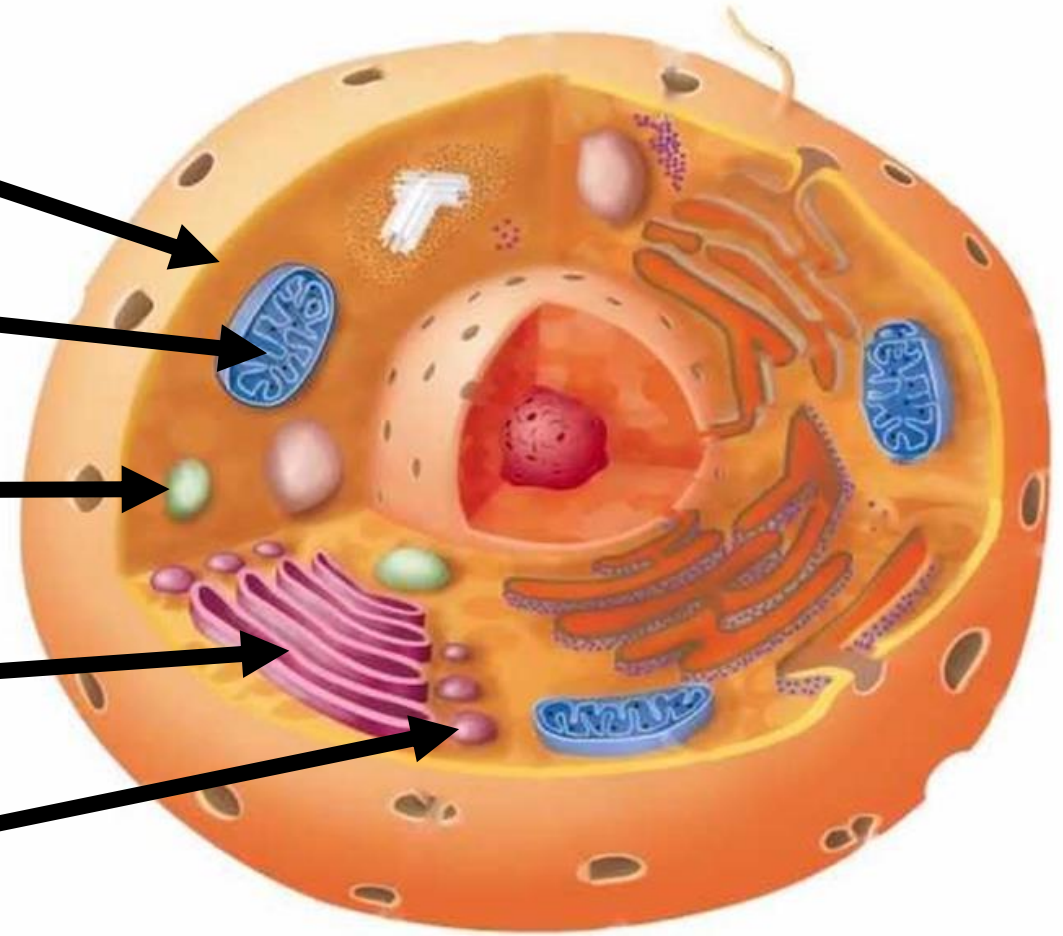
Cell membrane

Mitochondrion

Lysosomes

Golgi Apparatus

Vesicles



Review of Animal Cell

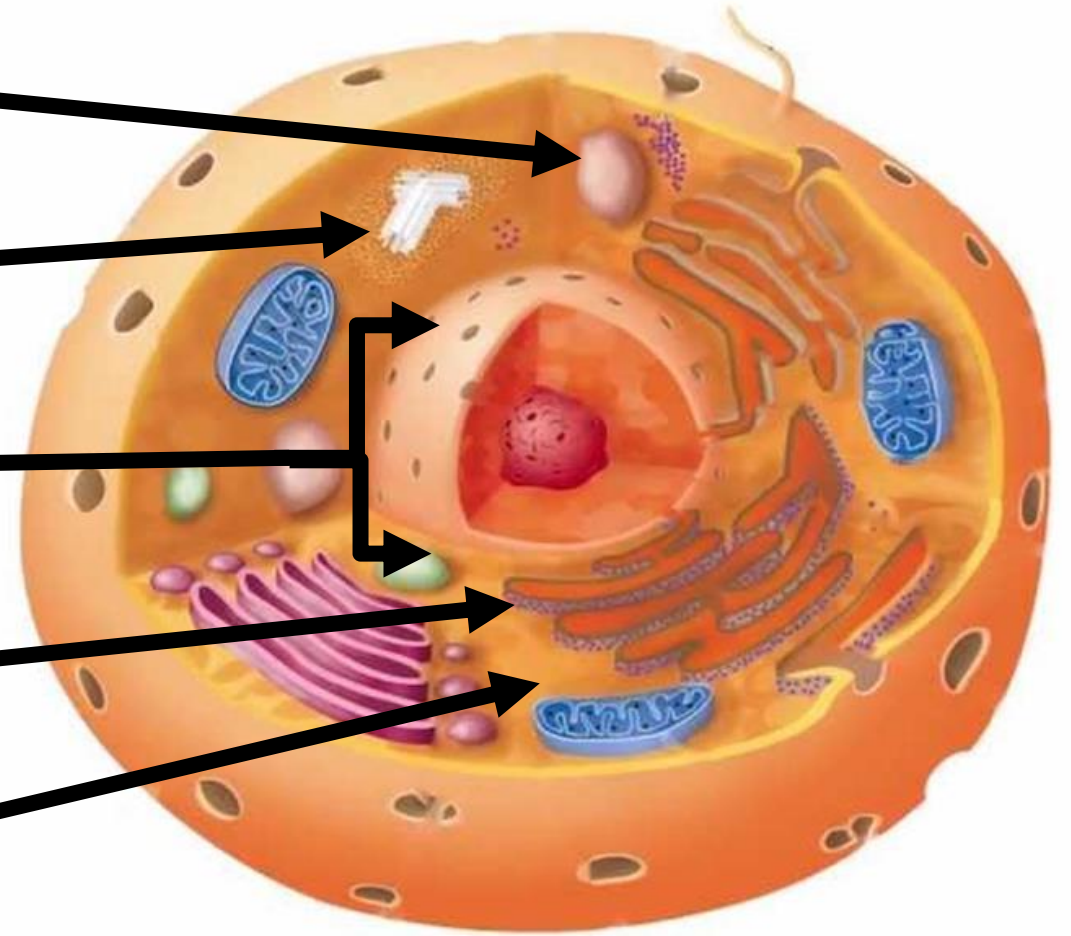
Vacuole

Centrioles

Nucleus

Rough ER

Cytoplasm



Review of Animal Cell

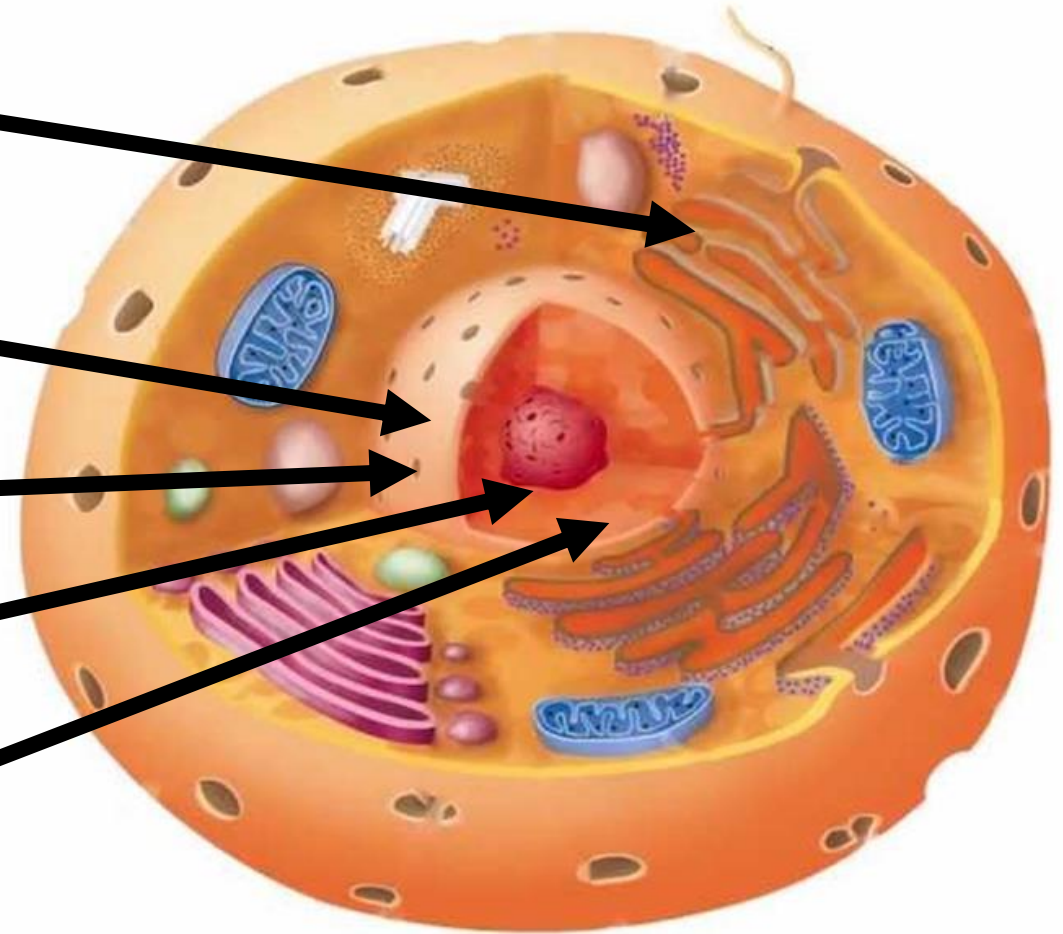
Smooth ER

Nuclear envelope

Nuclear pore

Nucleolus

Nucleoplasm



Review of Plant Cell

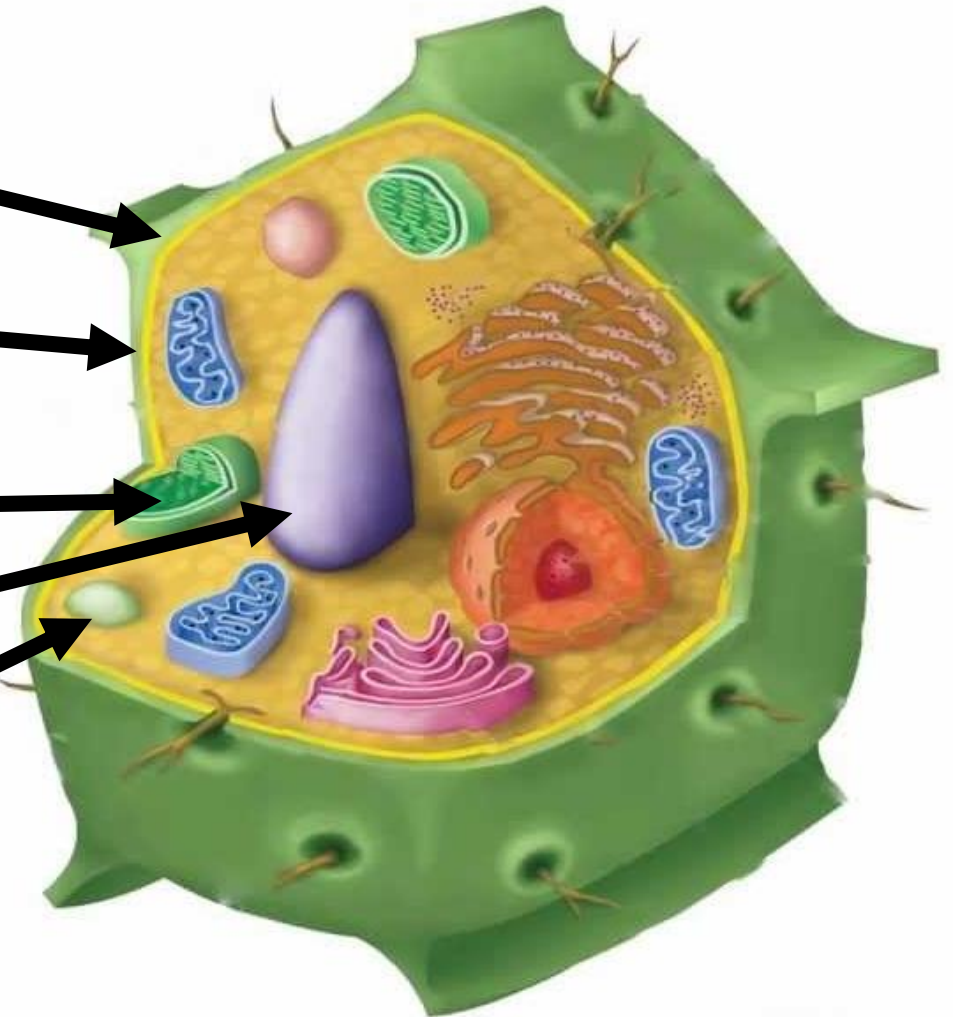
Cell Wall

Cell membrane

Chloroplast

Vacuole

Lysosome



Review of Plant Cell

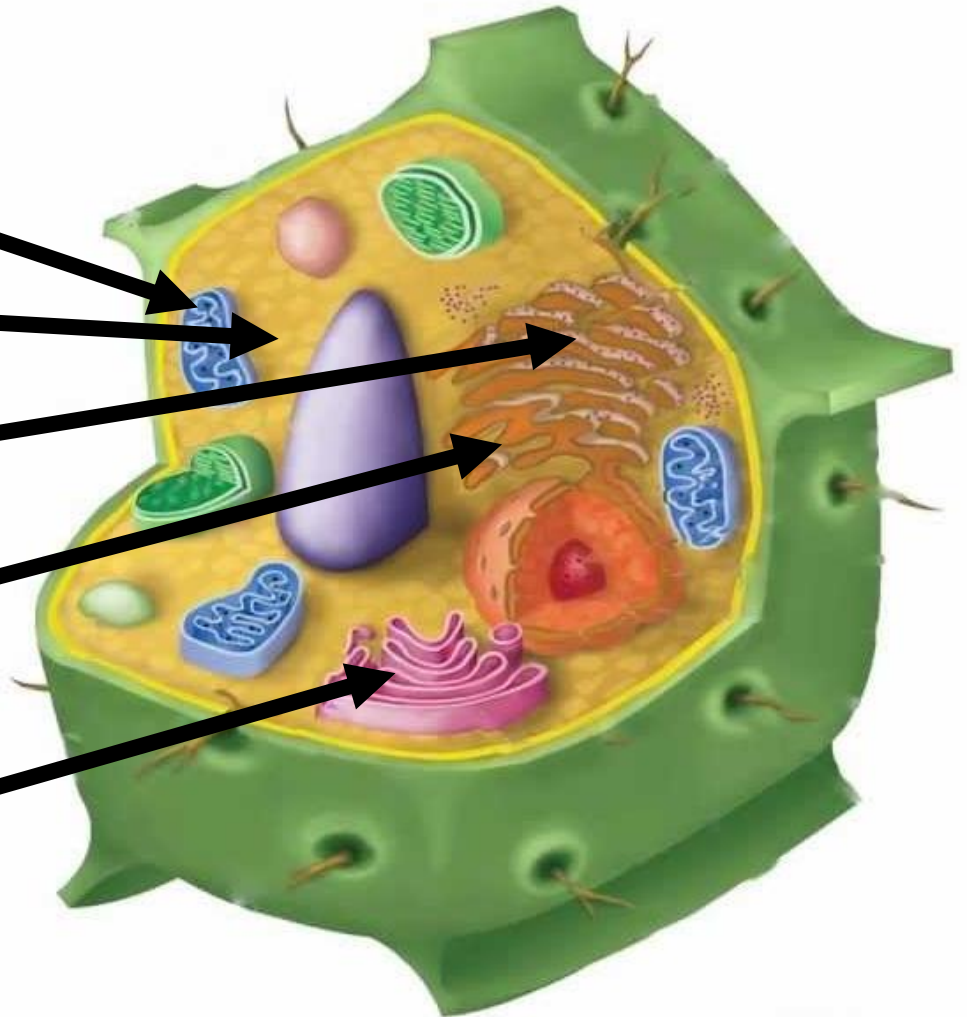
Mitochondrion

Cytoplasm

Rough ER

Smooth ER

Golgi Apparatus



- THANK YOU! -