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# Unit 3 - The Cell - Anatomy and Physiology Notes

- *Know the Cell Theory*
- *Compare and contrast the structure of prokaryotic cells with that of eukaryotic cells.*
- *Identify Cellular Organelles and Functions*

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# Menu

## Early Discoveries

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# Menu

## Vacuoles

Cytoplasm / Cytoskeleton / Cell Wall

Cell / Plasma Membrane

# Early Discoveries

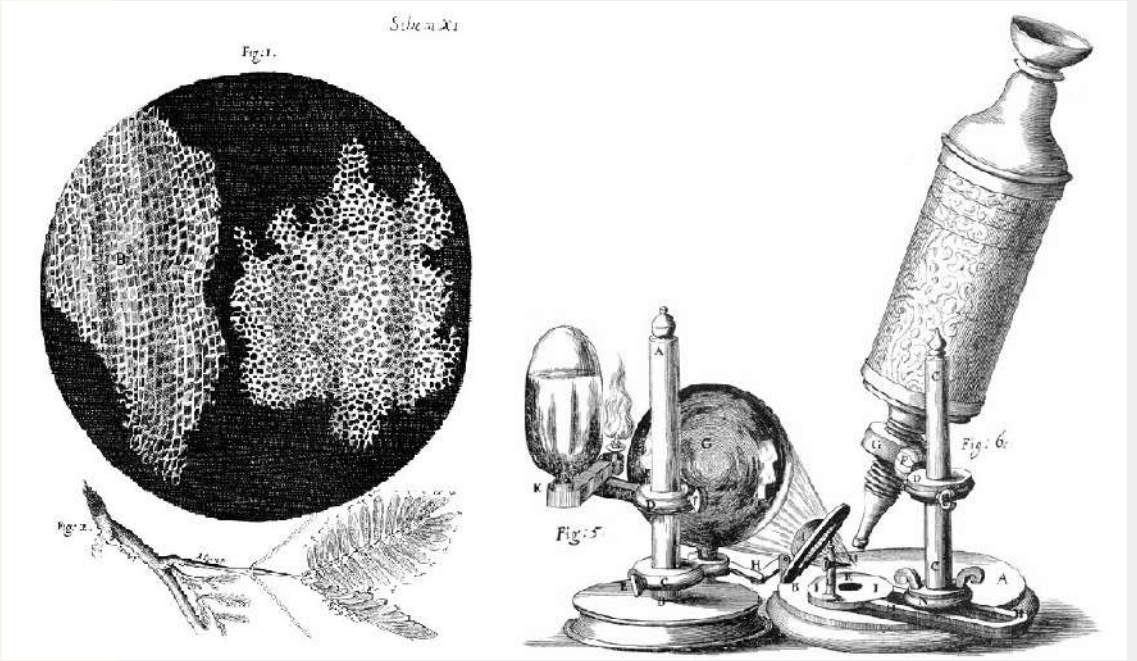
## I. Discoveries:

B. In 1665, **Robert Hooke** used a microscope to examine a thin slice of cork.

3. What he saw looked like small boxes.
4. He called these boxes “cells”, after the rooms that monks lived in.

B. In 1673**, Anton Van Leeuwenhoek** (a Dutch microscope maker), was first to view organisms (living things).

1. Leeuwenhoek used a simple, handheld microscope to view pond water & scrapings from his teeth.



# Discoveries Continued

C. In 1838, a German botanist named **Matthias Schleiden** concluded that all plants were made of cells.
    1. Schleiden is a cofounder of **cell *theory.***
D. In 1839, a German zoologist named **Theodore Schwann** concluded that all animals were made of cells.
    1. Schwann also co-founded cell theory.
E. In 1855, a German medical doctor named **Rudolph Virchow observed,** under the microscope, cells dividing.
    1. He reasoned that all cells come from other pre-existing cells by **cell division.**

# Cell Theory

## 01

The What

All living things are made of cells

## 02

**The Why**

Cells are the basic unit of structure and function in an organism (basic unit of life)

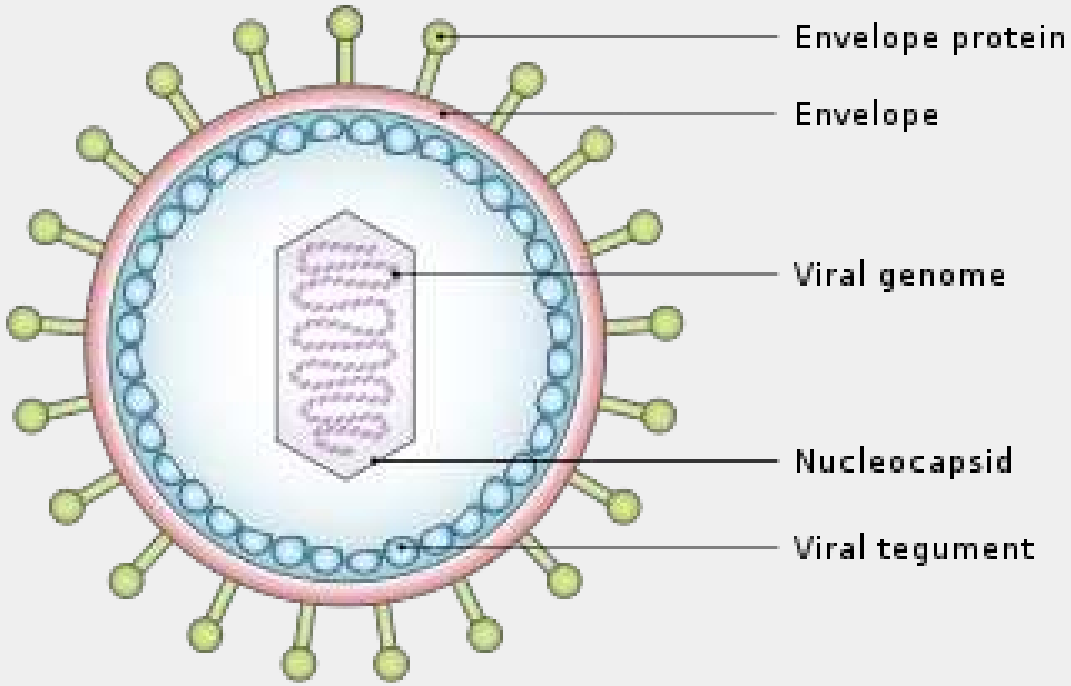
## 03

**The How**

Cells come from the reproduction of existing cells (cell division)

# But what about Viruses

3. What is living? Viruses
    a. Viruses are nonliving.
    b. They have some properties of life but not others
    c. Viruses cannot be killed.
    d. They can't maintain a constant internal state (*homeostasis*).
    e. Disease-causing, nonliving particle.
    f. Composed of an inner core of **nucleic acid**.
    g. Enclosed by one or two **protein** coats.
    h. Reproduces only in living cells - a host




3.

# Cell Size

## 01

### Surface Area

1. Factors Affecting Cell Size
    b. **Surface area** (plasma membrane surface) is determined by multiplying length times width (L x W)

## 02

### Volume

b. **Volume** of a cell is determined by multiplying length times width times height (L x W x H)

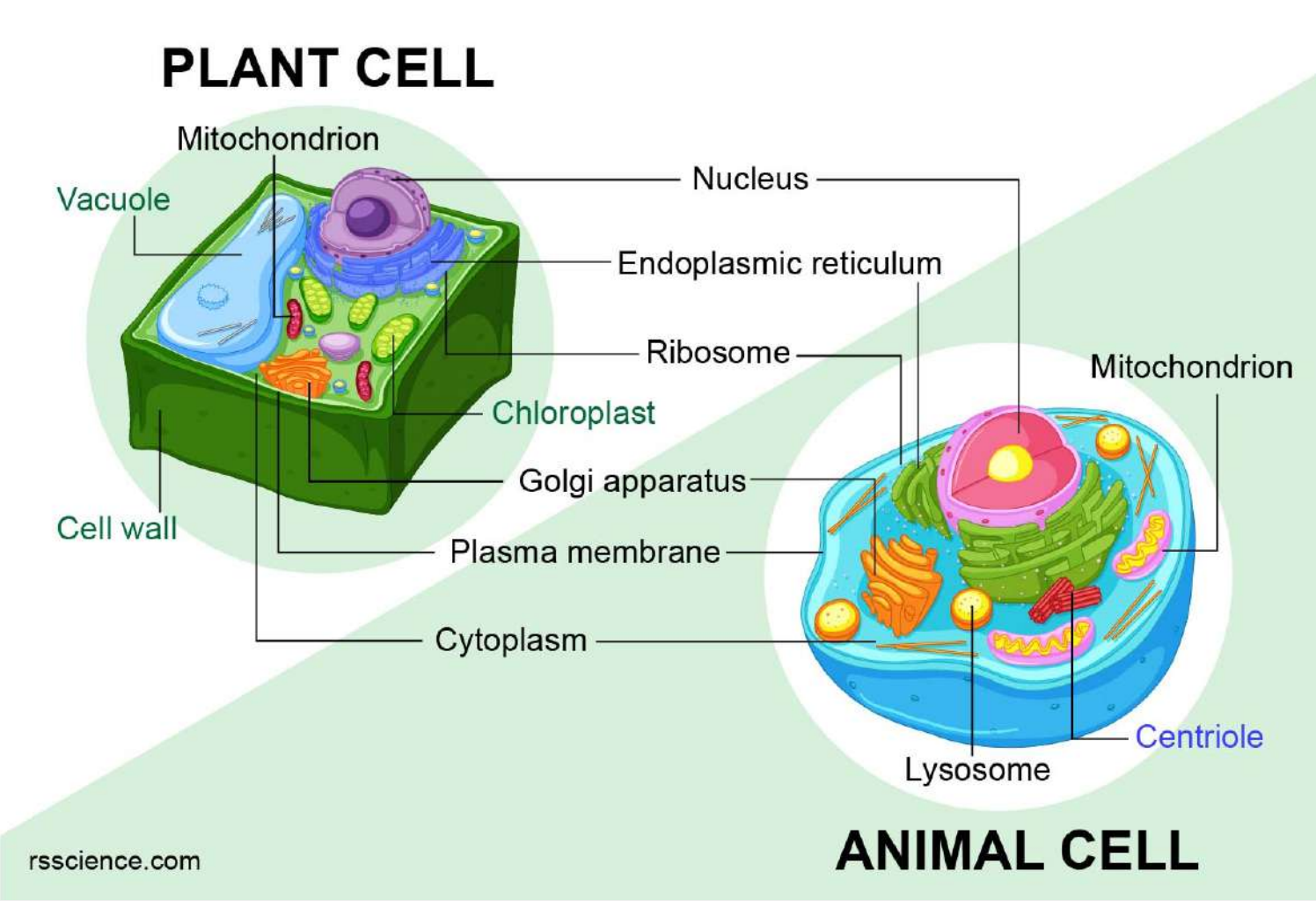
c. Therefore, Volume increases **FASTER** than the surface area

## 03

### Basic Cell Structures

2. **Eukaryotes** are cells that have a **nucleus** and **membrane-bound organelles**
3. Includes protists, fungi, plants, and animals
4. More **complex** type of cells
5. Contain 3 basic cell structures:
    a) **Nucleus**
    b) **Cell Membrane**
    c) **Cytoplasm** with **organelles**
    d) er, then the cell must divide
    e) Therefore, the cells of an organism are close in size

# Eukaryotes- Up Close



# Cells - Overview

## 01

### General

A. Cells are the basic units of organisms

B. Cells can only be observed under microscope

C. Basic types of cells:

   4. **Prokaryotic**
   5. **Eukaryotic**

**D. Although <u>ALL</u> living things are made of cells, organisms may be:**

   1. **Unicellular** – composed of one cell

## 02

### Prokaryotes

   1. **Multi-cellular-** composed of many cells that may organize into tissues, etc.

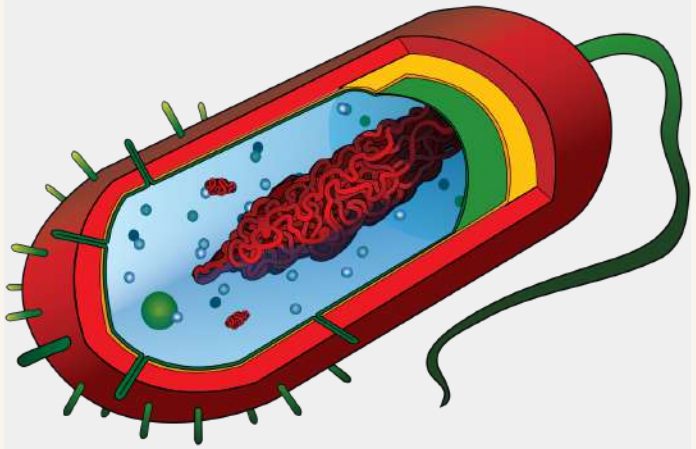
E. Cells may be **Prokaryotic**

   1. **Prokaryotes** include bacteria & lack a nucleus or membrane-bound structures called organelles.
   2. **Prokaryotes have:**
      c) **Nucleoid region** that contains the DNA
      b) **Cell membrane** & **cell wall**

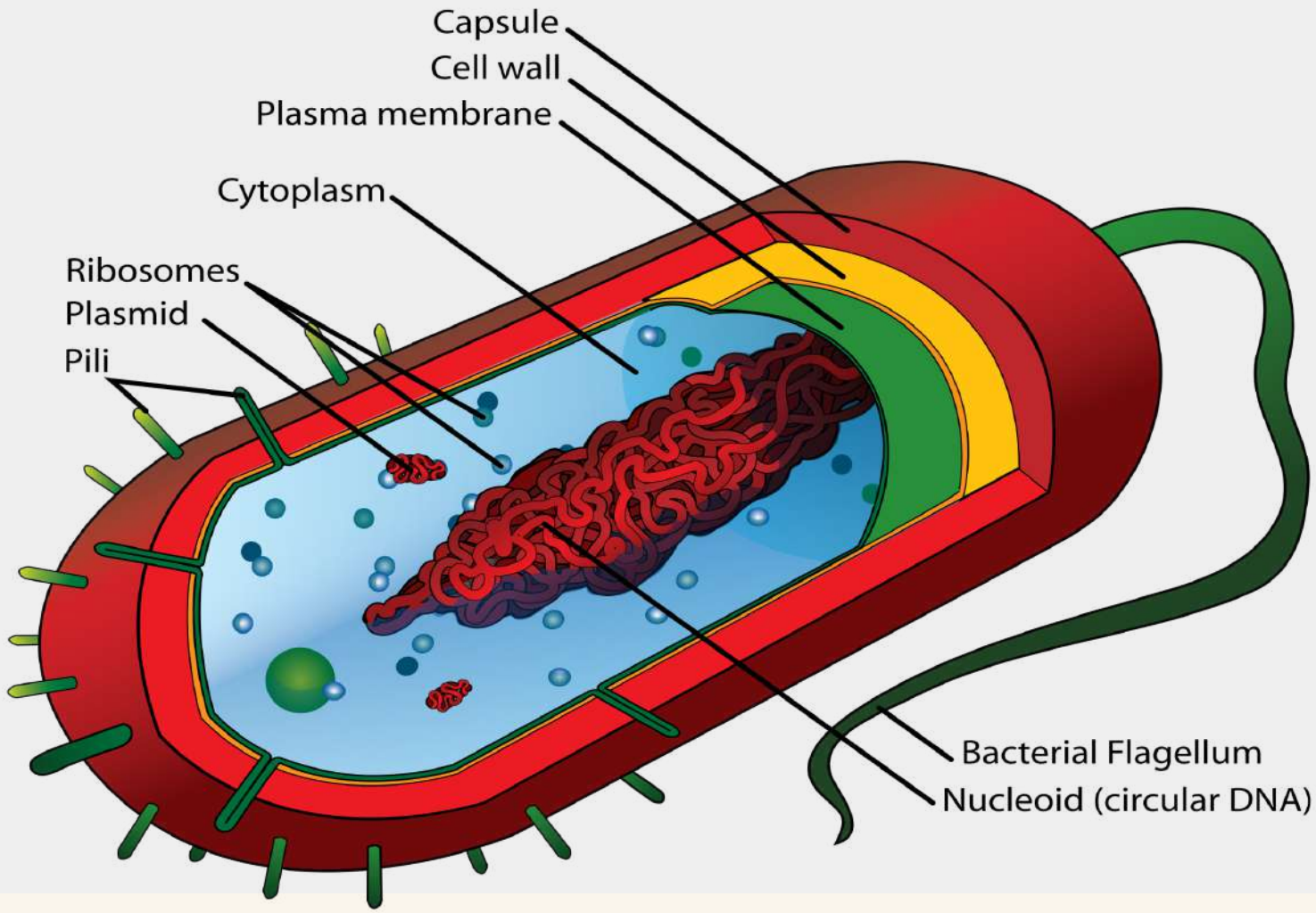
## 03

### Continued

c) Contain **ribosomes (no membrane)** to make proteins in their cytoplasm



# Prokaryote - Up Close



# Organelles

## 01

Organelles

**IV. Organelles**

A. Characteristics:

2. Very small (Microscopic)
3. Perform various functions for a cell
4. Found in the cytoplasm
5. May or may not be membrane-bound

## 02

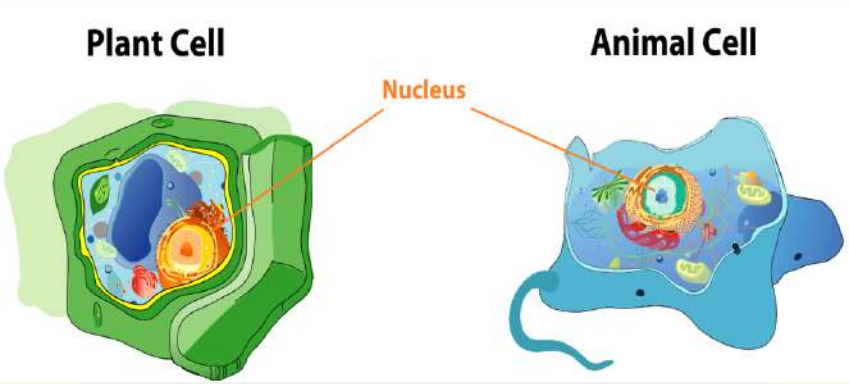
**Nucleus**

**B. The Nucleus - functions**

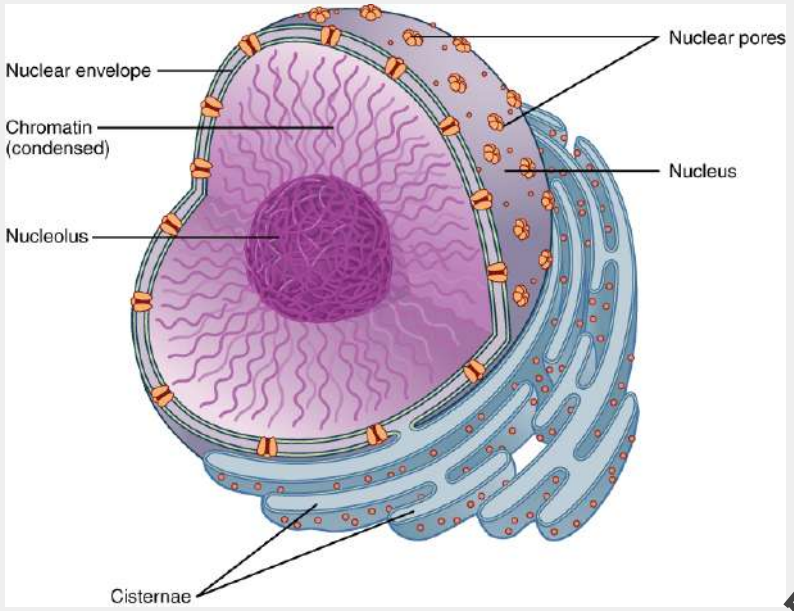
1. Controls the normal activities of the cell
2. Contains the DNA in chromosomes
3. Bounded by a nuclear envelope (membrane) with pores
4. Usually the largest organelle
5. Each cell has a fixed number of chromosomes that carry genes
6. Genes control cell characteristics
7. **DNA is located in the nucleus.**

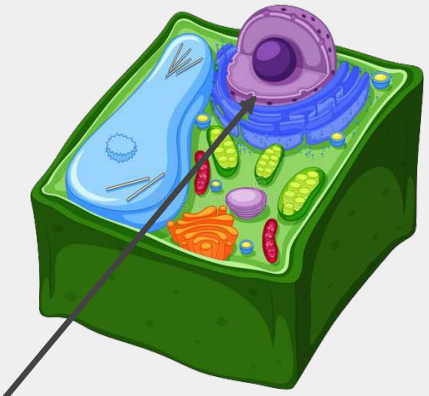
## 03

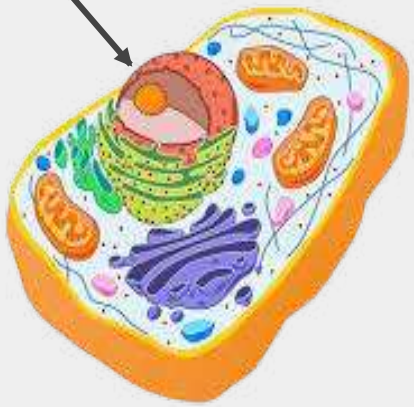
**Nucleus Cont'**



# The Nucleus - Parts





**a. The Nucleolus**

2) Inside nucleus

3) Cell may have 1 to 3 nucleoli

4) Disappears when cell divides

5) Makes ribosomes that make proteins

**b. The Nuclear Envelope:**

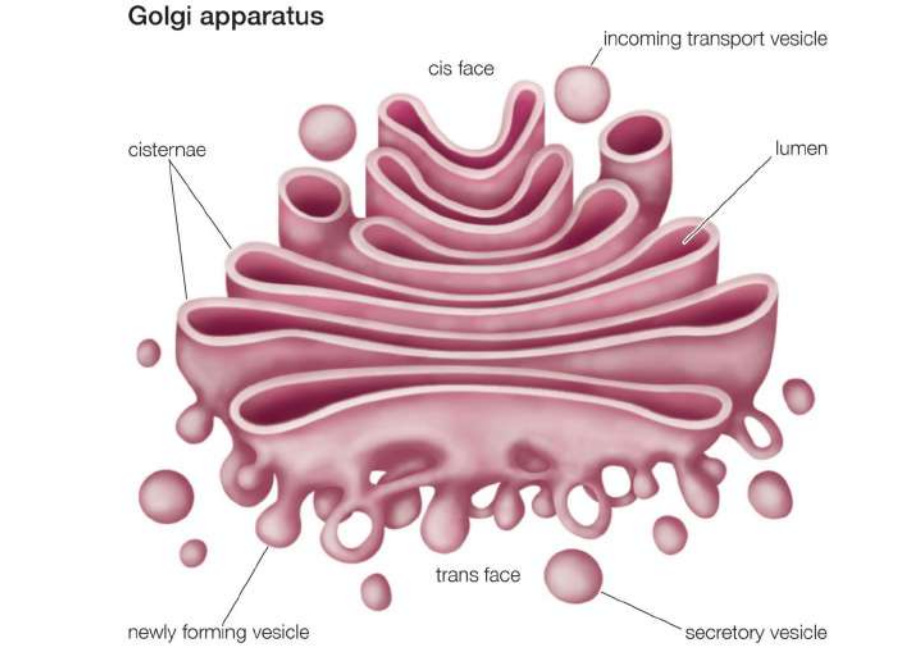
1) Double membrane surrounding nucleus

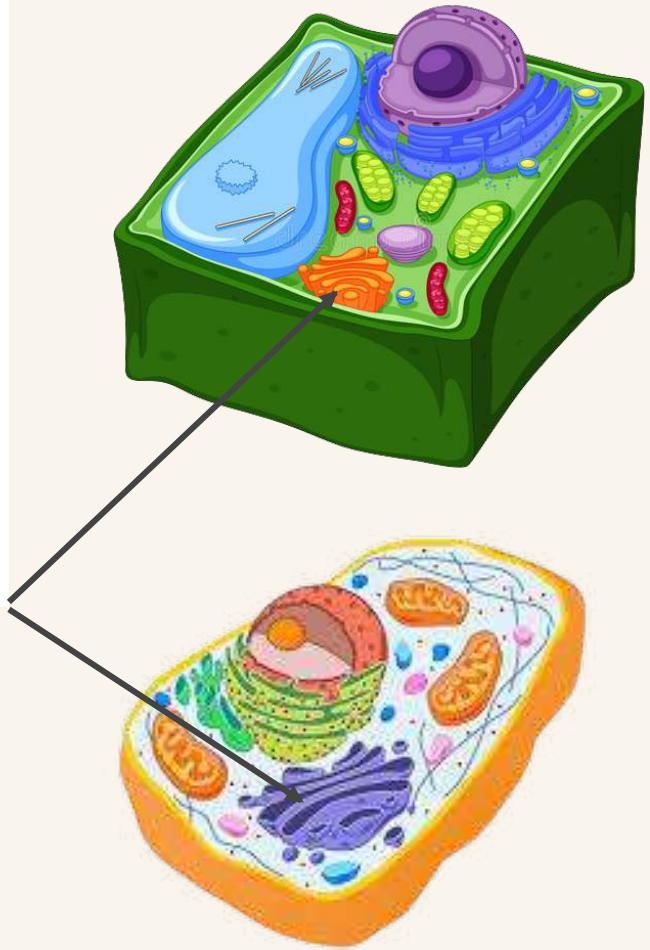
2) Also called nuclear membrane

3) Contains nuclear pores for materials to enter & leave nucleus

4) Connected to the rough ER

# Golgi Apparatus



## Golgi Bodies

### C. Golgi Bodies (Apparatus)

1. Stacks of flattened sacs.
2. Have a shipping side (trans face) and receiving side (cis face).
3. Receive proteins made by ER.
4. Transport vesicles with modified proteins pinch off the ends
5. Modify, sort, & package molecules from ER for storage or transport out of cell

# Endoplasmic Reticulum

## D. Endoplasmic Reticulum

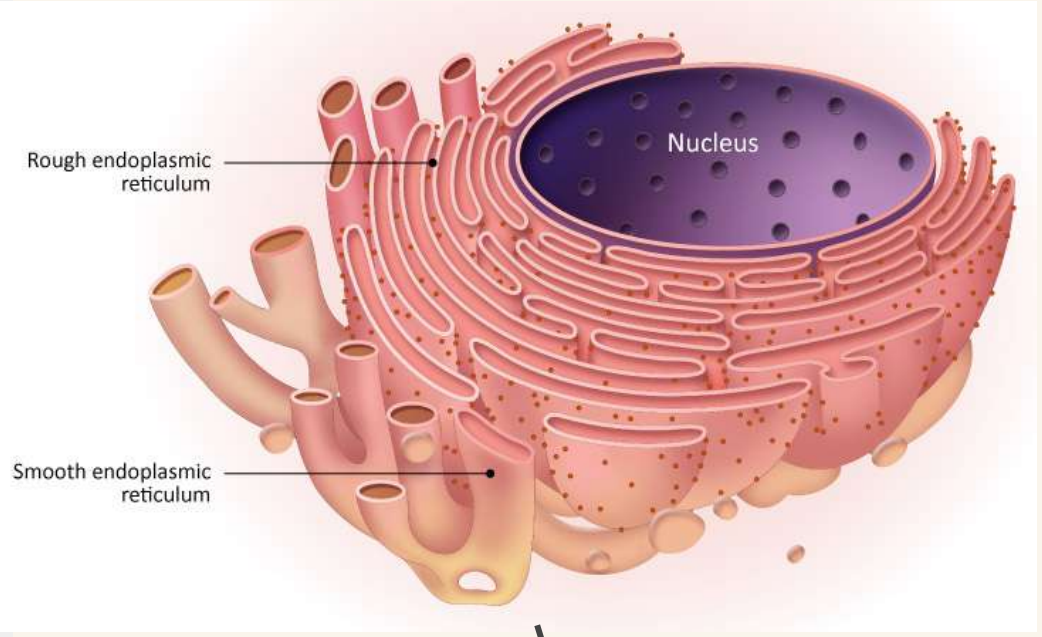
1. Network of hollow membrane tubules
2. Connects to nuclear envelope & cell membrane
3. Functions in Synthesis of cell products & Transport
4. Two kinds of ER **---ROUGH & SMOOTH**

**e. Rough ER**

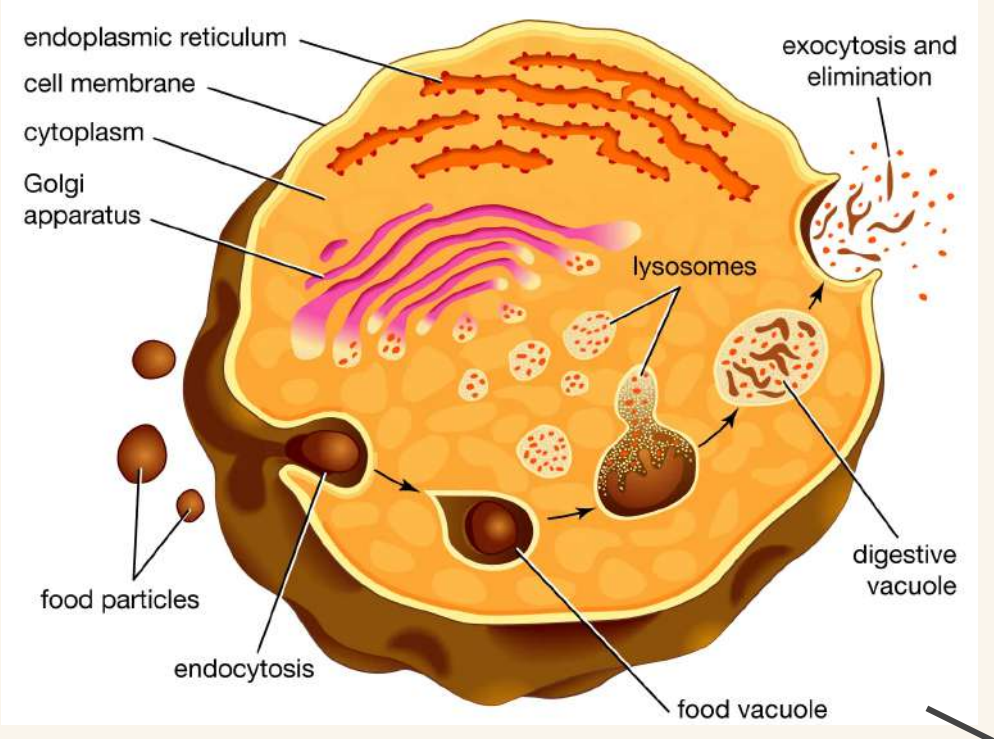
6. Have ribosomes on its surface.
7. Makes membrane proteins and proteins for export out of the cell.

**b. Smooth ER** lacks ribosomes on its surface.

1. Is attached to the ends of a rough ER.
2. Makes cell products that are used inside the cell.
3. Makes membrane lipids (steroids).
4. Regulates calcium (muscle cells).
5. Destroys toxic substances (Liver).




# Lysosomes




## Lysosomes

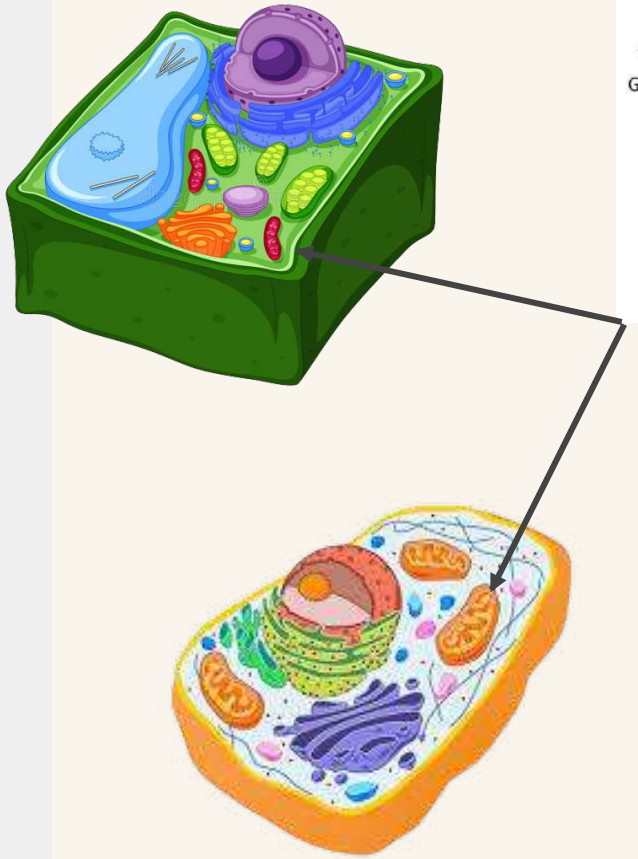
**E. Lysosomes:**

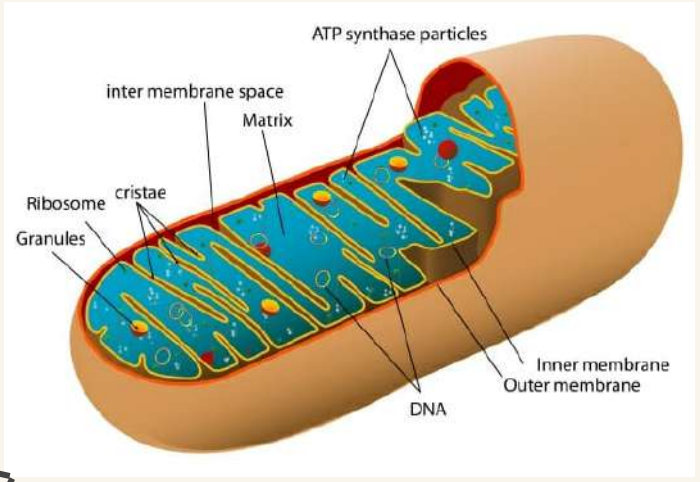
1. Contain digestive enzymes
2. Break down food, bacteria, and worn out cell parts for cells
   c. Cells take in food by phagocytosis
   d. Lysosomes digest the food & get rid of wastes
3. Programmed for cell death (**AUTOLYSIS**)
4. **Lyse** (break open) & release enzymes to break down & recycle cell parts)

# Mitochondria

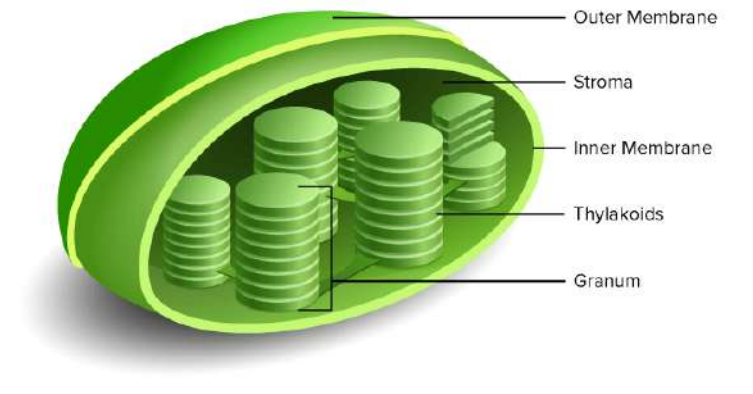
## F. Mitochondria

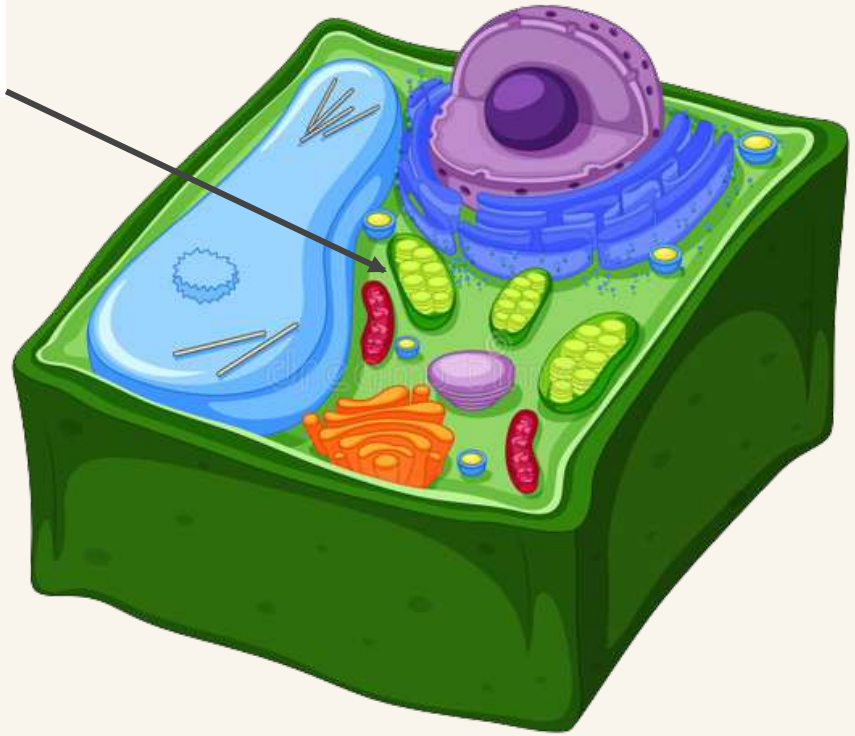
1. Powerhouse” of the cell.
2. Generate cellular energy (ATP) Surrounded by a double membrane.
3. Folded inner membrane called cristae (increases surface area for more chemical reactions).
4. Interior called matrix.
5. Breaks down glucose to
6. Release energy (ATP).
7. Active cells like muscle cells have more mitochondria.
8. Both plants & animal cells have mitochondria.
9. Site of cellular respiration
10. Has its own DNA.
11. Mitochondria come from cytoplasm in the egg cell during fertilization. You inherit your mitochondria from your mother!





# Chloroplasts



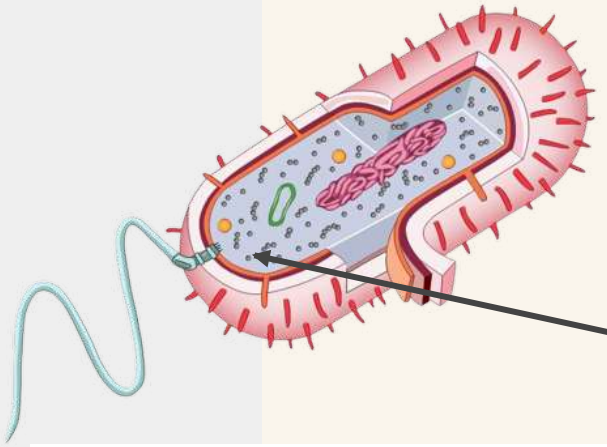
## G. Chloroplasts

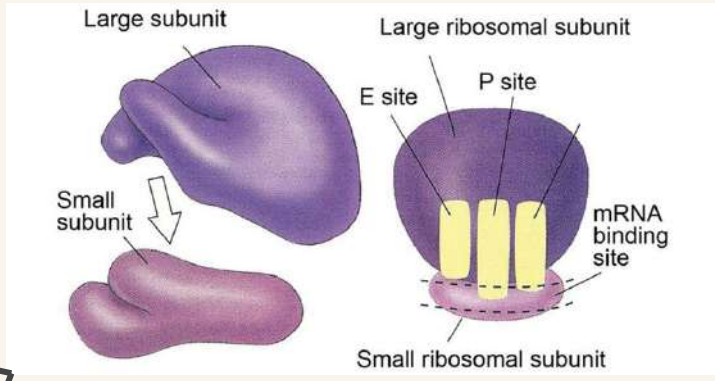
1. Found only in producers (organisms containing chlorophyll).
2. Contains its own DNA.
3. Contains enzymes & pigments for photosynthesis.
4. Never in animal or bacterial cells.
5. Surrounded by a double membrane.
6. Outer membrane smooth.
7. Inner membrane modified into sacs called **Thylakoids**.
    h. Thylakoids in stacks are called **Grana** and are interconnected.
    i. **Stroma** – gel like material surrounding thylakoids.

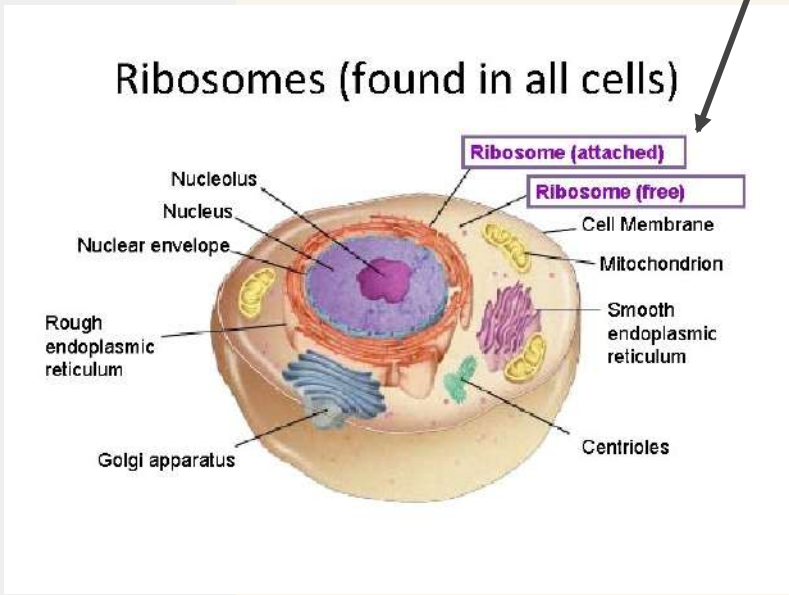
# Ribosomes

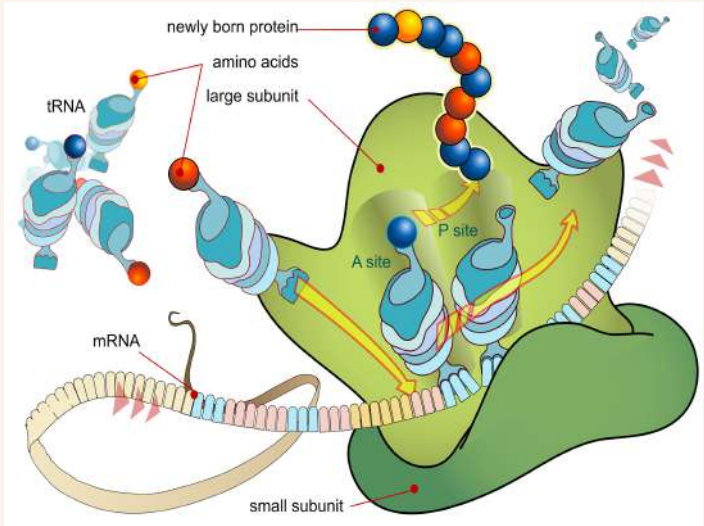
## H. Ribosomes

1. Made of proteins and rRNA.
2. “Protein factories” for cell.
3. Join amino acids together to make proteins.
4. Process is called protein synthesis.
5. Can be attached to Rough ER.
6. Can be free (unattached) in the cytoplasm.

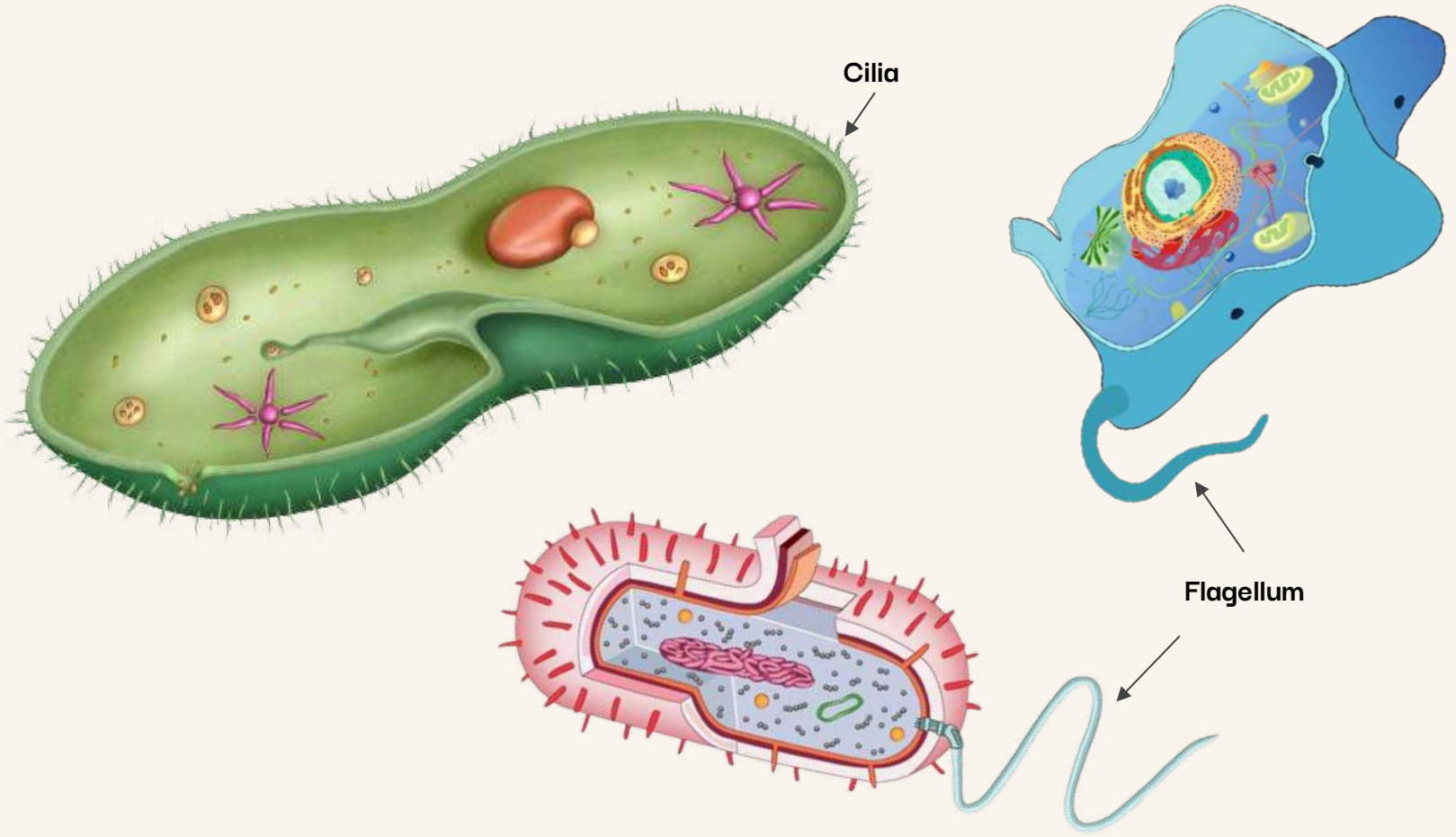




# Cilia & Flagella



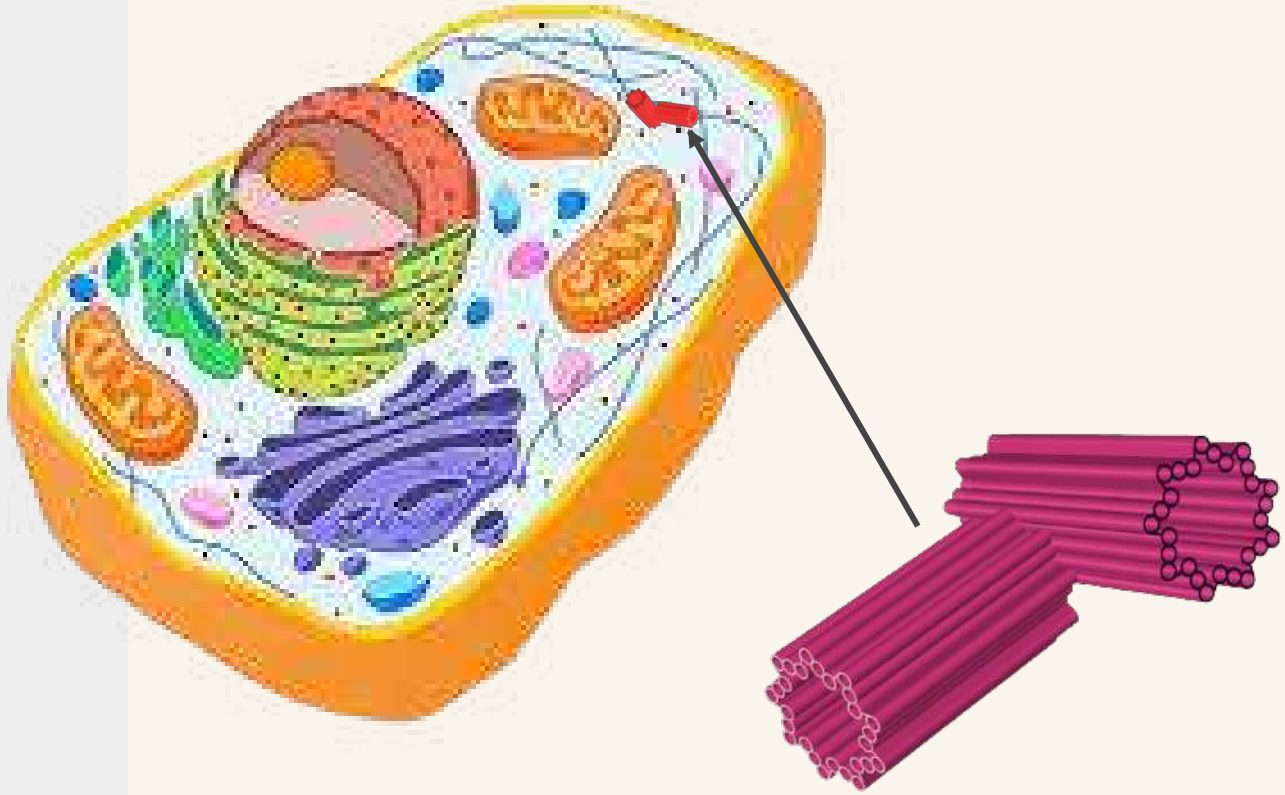

## I. Cilia & Flagella

1. Made of protein tubes called microtubules.
2. Microtubules arranged (9 + 2 arrangement).
3. Functions- moving cells, moving fluids, or small particles across the cell surface.
4. Cilia are shorter and more numerous on cells.
5. Flagella are longer and fewer (usually 1-3) on cells.

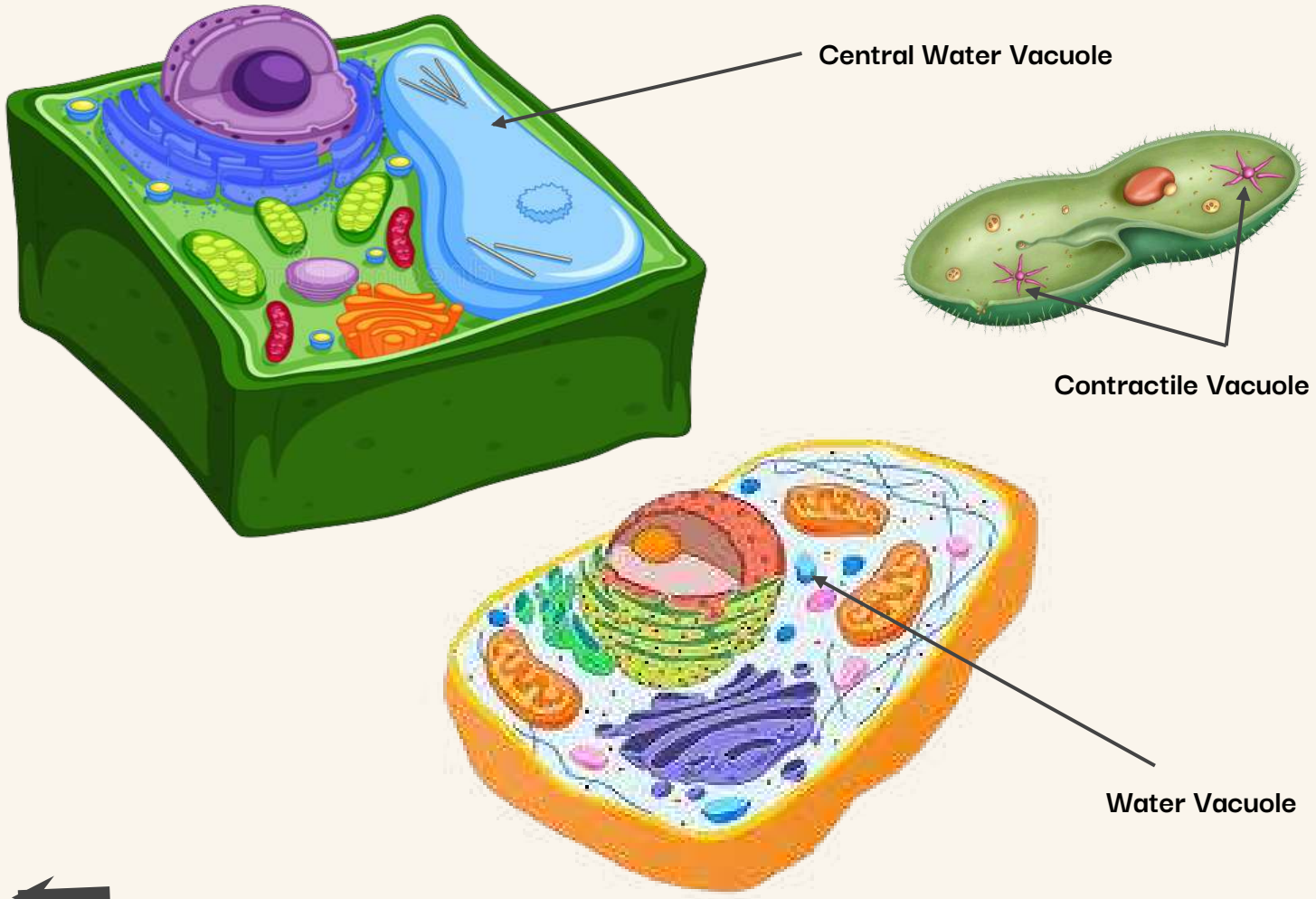
# Centrioles

**J. Centrioles**

1. Found only in animal cells.
2. Paired structures near the nucleus.
3. Made of a bundle of microtubules.
4. Appear during cell division forming a mitotic spindle.
5. Help to pull chromosome pairs apart to opposite ends of the cell.



# Vacuoles




## K. Vacuoles

1. Fluid filled sacs for storage.
2. Small or absent in animal cells.
3. Plant cells have a large Central Vacuole.
4. No vacuoles in bacterial cells.
5. Can store sugars, proteins, minerals, lipids,

   Water Vacuole

6. wastes, salts, water, and enzymes.
7. **Contractile Vacuole**
   h. Found in unicellular protists like paramecia.
   i. Regulate water intake by pumping out excess (homeostasis).
   j. Keeps the cell from lysing (bursting).

# Other Components of the Cell

## 01

Cytoplasm

### A. Cytoplasm

2. Jelly-like substance enclosed by cell membrane.
3. Provides a medium for chemical reactions to take place.
4. Contains organelles to carry out specific jobs
5. Found in ALL cells.

## 02

**Cytoskeleton**

### B. Cytoskeleton

1. Helps cells maintain cell shape.
2. Also help move organelles around.
3. Made of proteins.
4. Microfilaments are threadlike & made of **ACTIN**.
5. Microtubules are tube-like & made of **TUBULIN**.

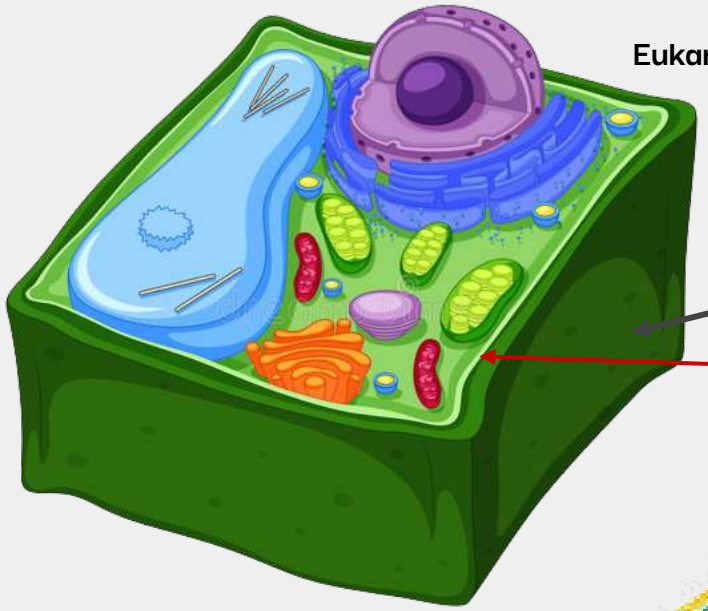
## 03

**Cell Wall**

### C. Cell Wall

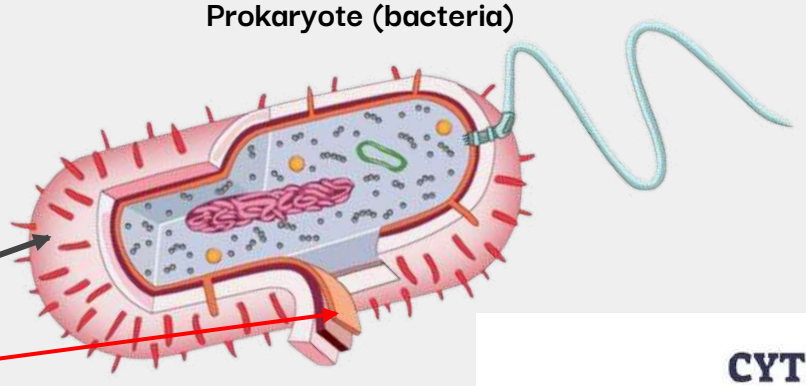
1. Non Living layer.
2. Found in plants, fungi, & bacteria.
3. Made of cellulose in plants.
4. Made of peptidoglycan in bacteria.
5. Made of chitin in Fungi.
6. Supports and protects the cell.
7. Found outside of the cell membrane.

# Other Components



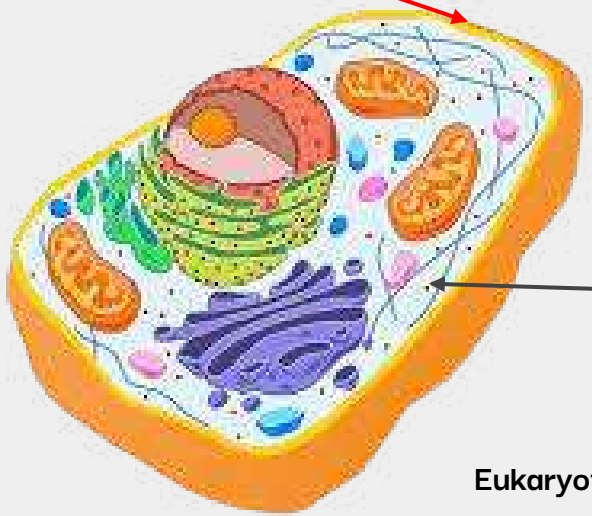
Eukaryote - Plant

Prokaryote (bacteria)

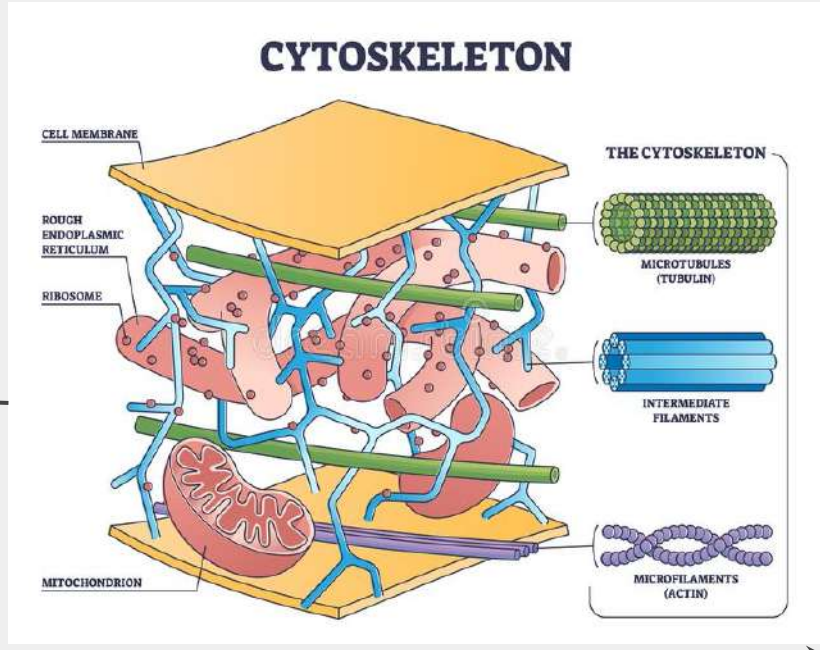


CELL WALL

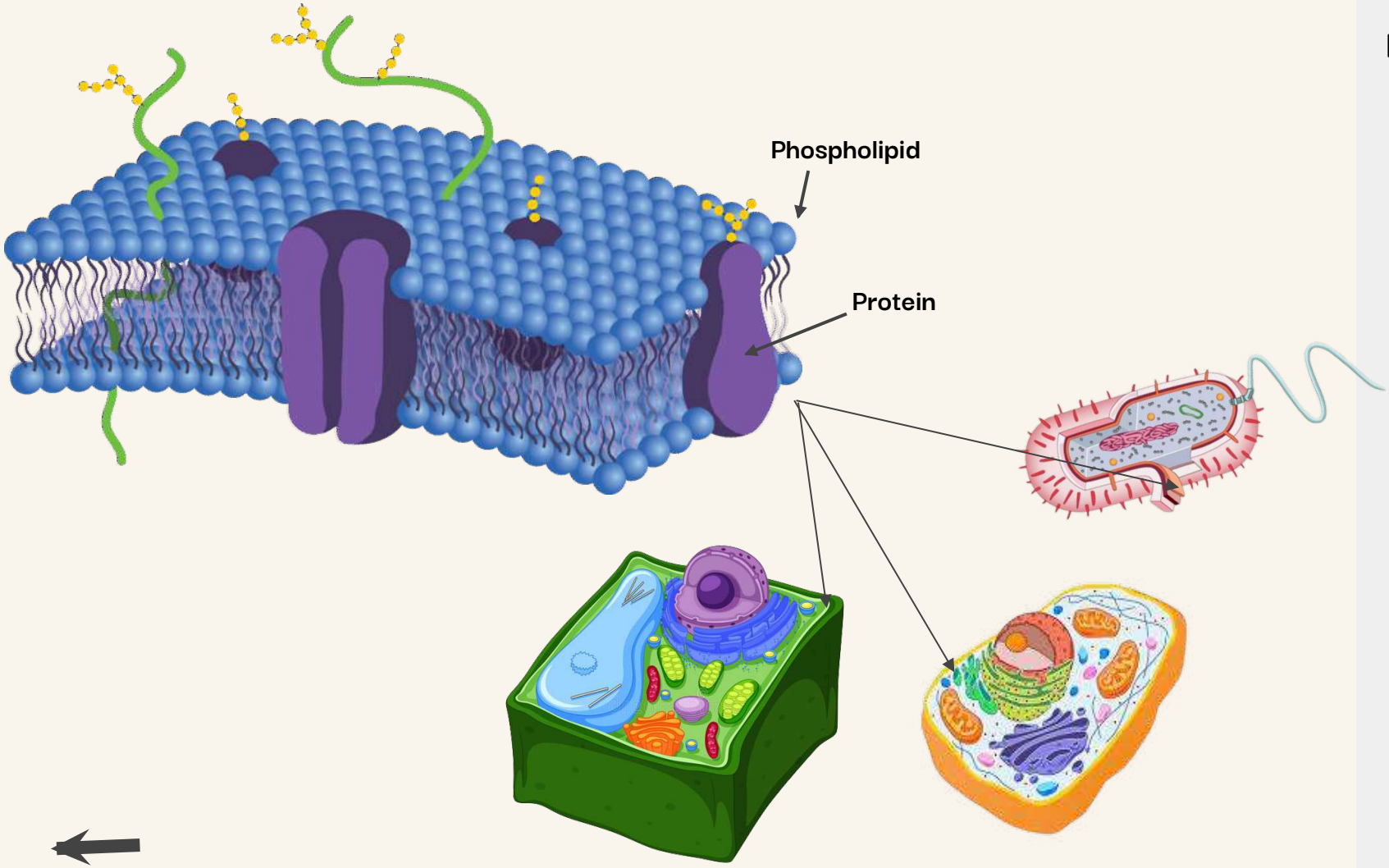
CELL Membrane



Eukaryote - Animal



# Cell Membrane




**D. Cell or Plasma Membrane**

1. Composed of a double layer of phospholipids and proteins.
2. Surrounds outside of ALL cells.
3. Controls what enters or leaves the cell.
4. Living layer.
5. The cell membrane is fluid.
6. Molecules in cell membranes are constantly moving and changing.


# Thank you!

Do you have any questions?

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xxx-xxx-xxxx