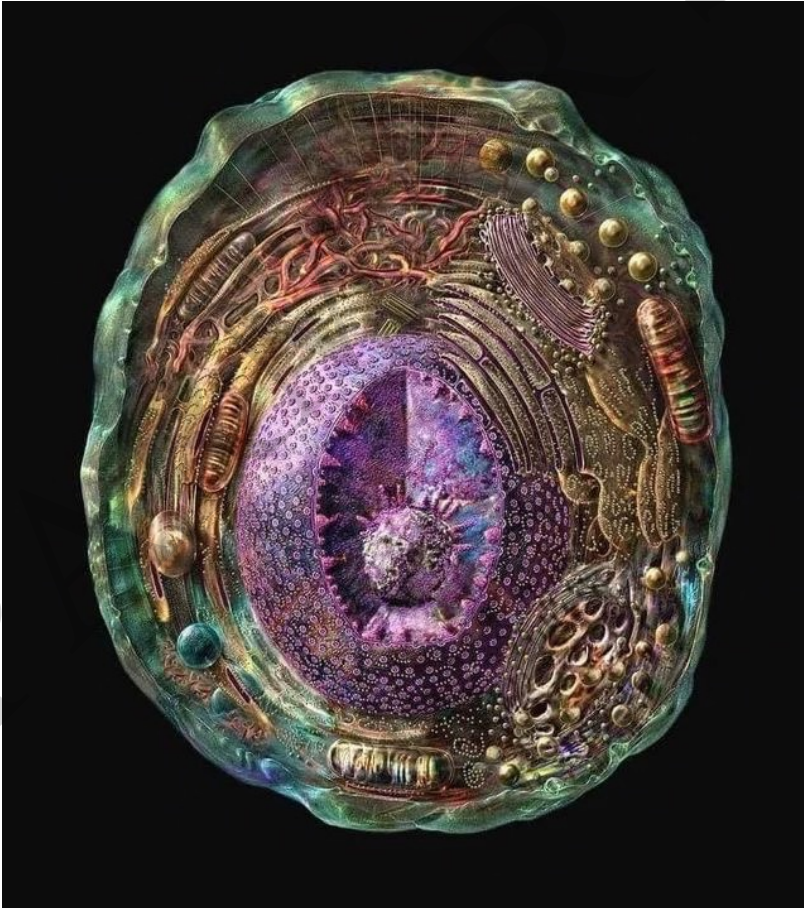


# The Cell



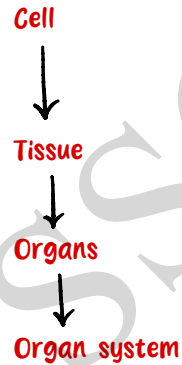
## Cell Definition

- building blocks of life
- fundamental unit of life
- structural or functional basis of life

Cell Study → is called cytology

**Cyto:** Cell

**Logy:** Study



## Cell Discovery

- First discovery by: Robert Hooke (1665)
- Observed in cork
- Cork is obtained from **bark of tree**

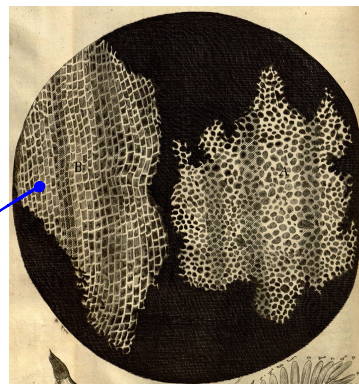


↓  
Dead cell



Cork Cell

↓  
Father of cytology



↓  
Honeycomb shape  
(with compartments)

### Some other discoveries

- Antonie van Leeuwenhoek (1674) — Free living cells in water
- Robert Brown (1831) — Nuclues
- Purkinje (1839) — named Protoplasm

in pond water



### Cell Theory

- "All the plants and animals are composed of cells"
- "Basic unit of life"

Given by: Schleiden and Schwan (1838)

Virchow further worked on it → New cells are formed from Pre-existing cells

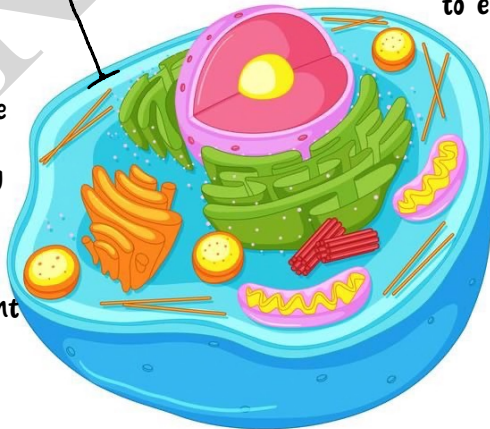
### Other characteristics:

- **Selectively permeable** (Only allows some materials)
- **Proteins+lipids** (composition)
- Flexibility enables the cell to engulf food

60-80%

### Parts of Cell

- Cell membrane
- **Protects the cell: bodyguard**
- Thin, elastic, flexible
- Living
- Outer most covering
- Provides definite shape and holds content of cell
- Present in both plant and animal



## Movements across Cell Membrane

### Diffusion

- Spontaneous movement of molecules from high to lower concentration

Rate of Diffusion

→ mixing

Gases > liquids > solids

ex: Agarbatti smell diffusion, ions/molecules -  $CO_2$ ,  $O_2$

- due to cellular activities,  $CO_2$  production takes place

Conc. of  $CO_2$  inside cell > Conc. of  $CO_2$  in external environment

CO leaves cell through diffusion

humesha concentration of water hi Lena hai

Osmosis: Movement from high to low but through a semipermeable membrane

Solution = Solute + Solvent

Hypertonic

Solute > Solvent

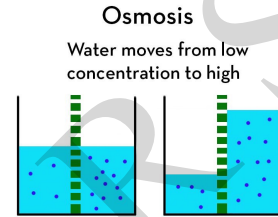
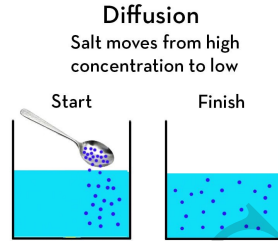
Hypotonic

Solute < Solvent

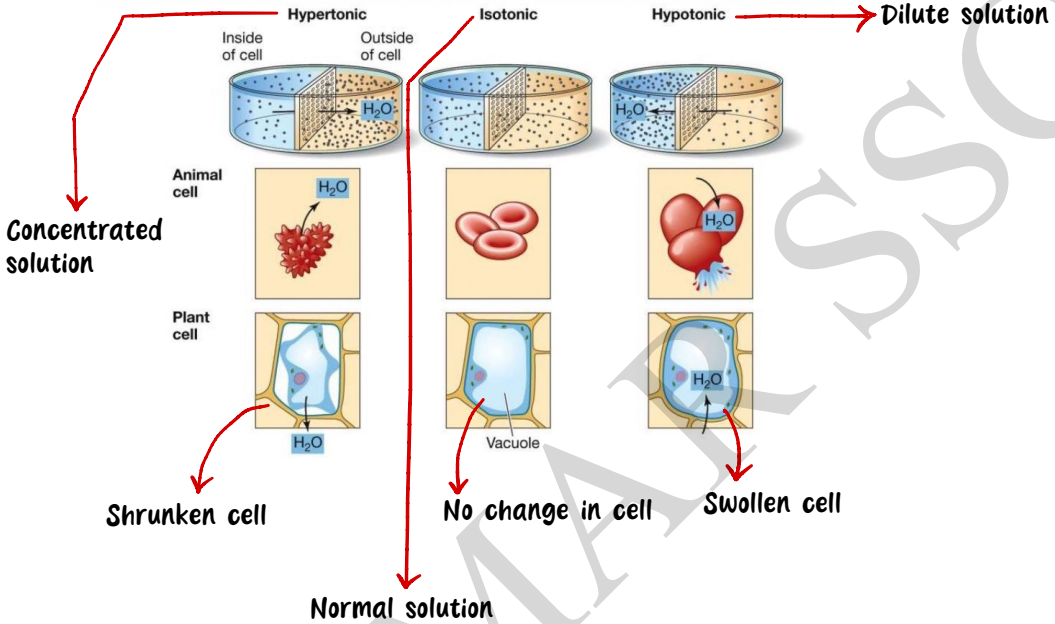
Isotonic

Solute = Solvent

cell absorbs water through osmosis, no energy is required and lasts upto equilibrium state

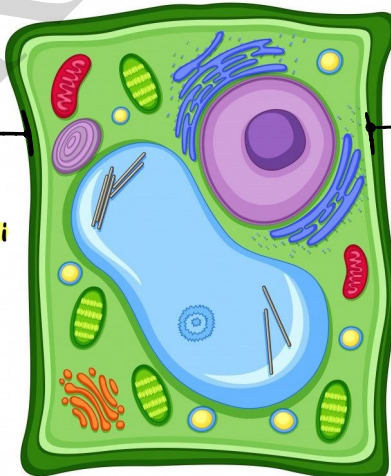


# Summary: What happens to cells when placed in a solution which is :



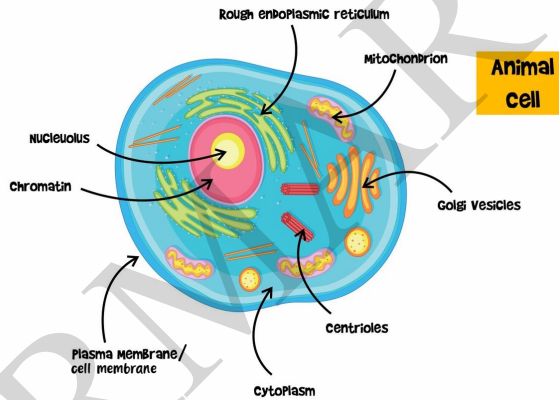
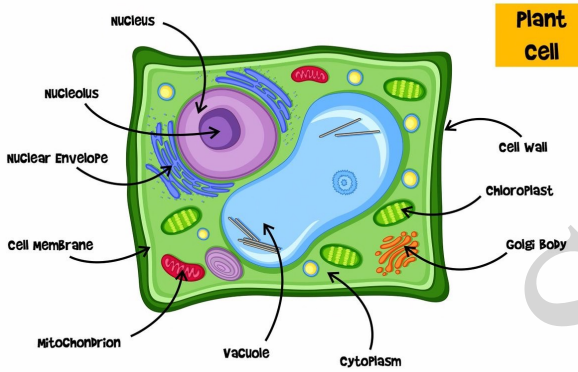
## • Cell wall

- Only present in plants and bacteria and fungi
- Non-living
- Freely permeable
- Determines shape
- Made up of cellulose
- Provides strength and turgidity to cells

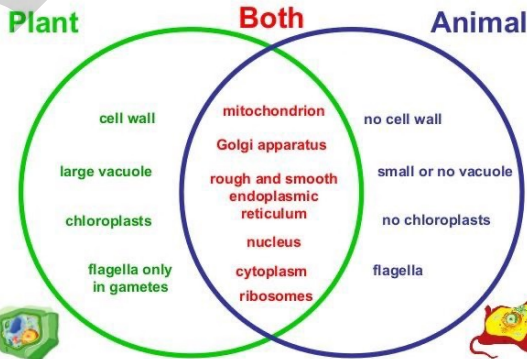


## Cell membrane

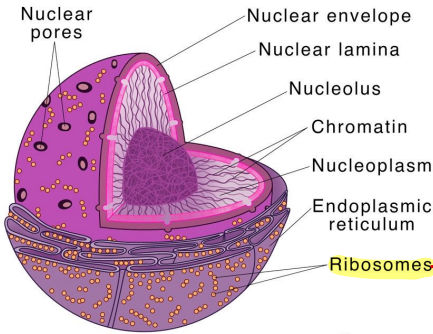
- Bacterial cell wall made of Peptidoglycan and outermost layer is called as Glycocalyx
- Fungi: Chitin



## Compare and Contrast



# Nucleus



- cellular component of cell
- Centrally located
- Large in size
- Largest cell structure
- "Brain of the cell"

**Ribosomes** — involved in formation of proteins

## Components of Nucleus

### Nuclear envelope

- Composed of membranes
- Covers Nucleus
- Separates nucleus from cytoplasm
- Permits materials between nucleoplasm and cytoplasm
- Pores are present called: nuclear pores

### Nucleoplasm

- Liquid ground substance of nuclear envelope

→ Covered by NE

#### Types:

**Nucleolus**

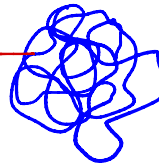
One or more in numbers

**Chromatin material**

Forms protein forming centres— Ribosomes

### Chromatin material

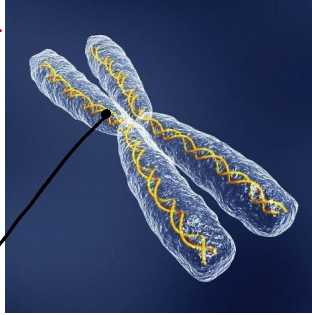
- Entangled mass of thread like structures
- During cell division they get organised into chromosomes



## Chromosomes

- Thread like structures
- Visible during cell division
- Components:

- DNA
- Proteins



chromosomes: 23 pairs

- 22 pairs (autosomal)
- 1 pair (sex pair)

**Total: 46 chromosomes**

XY: Male  
XX: Female

## DNA

- Consists of **genes**
- Genetic information transferred from one generation to another

Molecule discovery: Fredrick Mischer (1869)

Double-helical structure: Watson and Crick (1953)

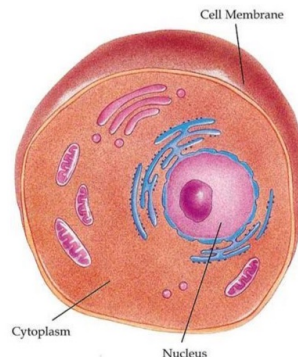
- The basic physical and functional unit of heredity  
Or
- Are functional unit of DNA

## Four bases of DNA

- Adenine (A)
- Cytosine (C)
- Guanine (G)
- Thymine (T)

## Cytoplasm

- Parts between plasma membrane and nuclear envelope
- Cell organelles present in cytoplasm
- Cytos: Aqueous ground substance of cytoplasm





## Types of cell

- Prokaryotic cell
- Eukaryotic cell

• Cell wall is absent in Tapeworm

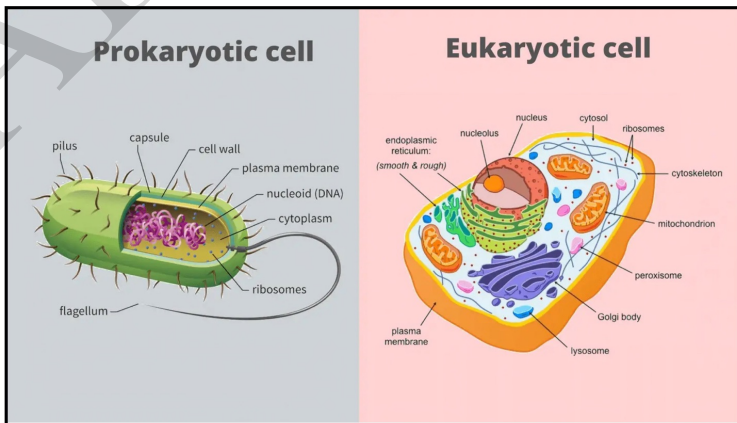
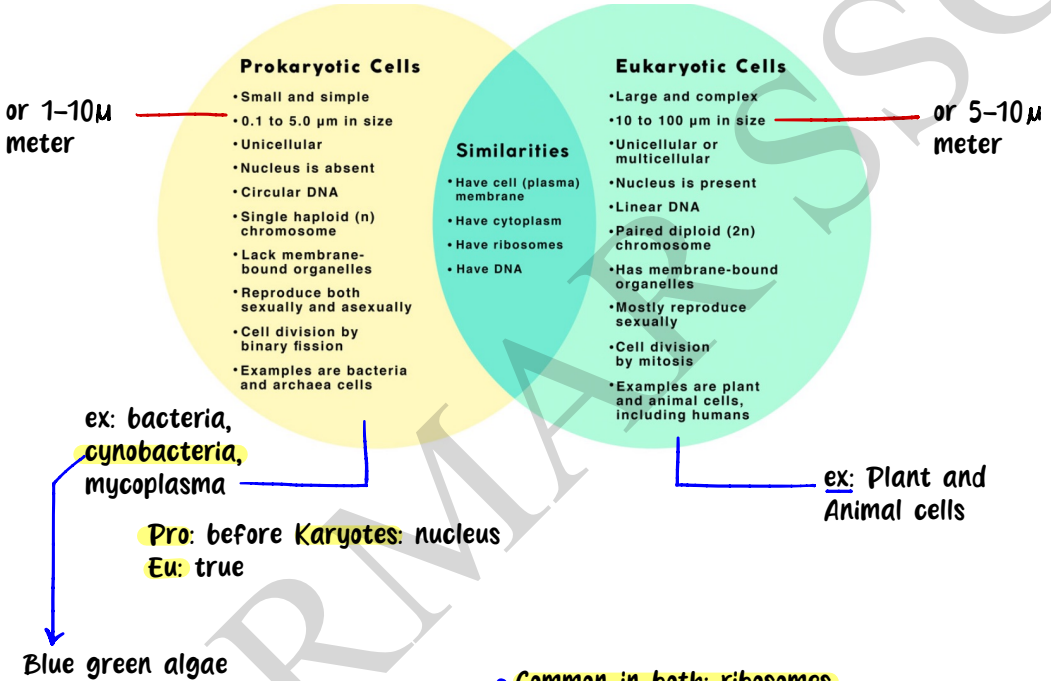
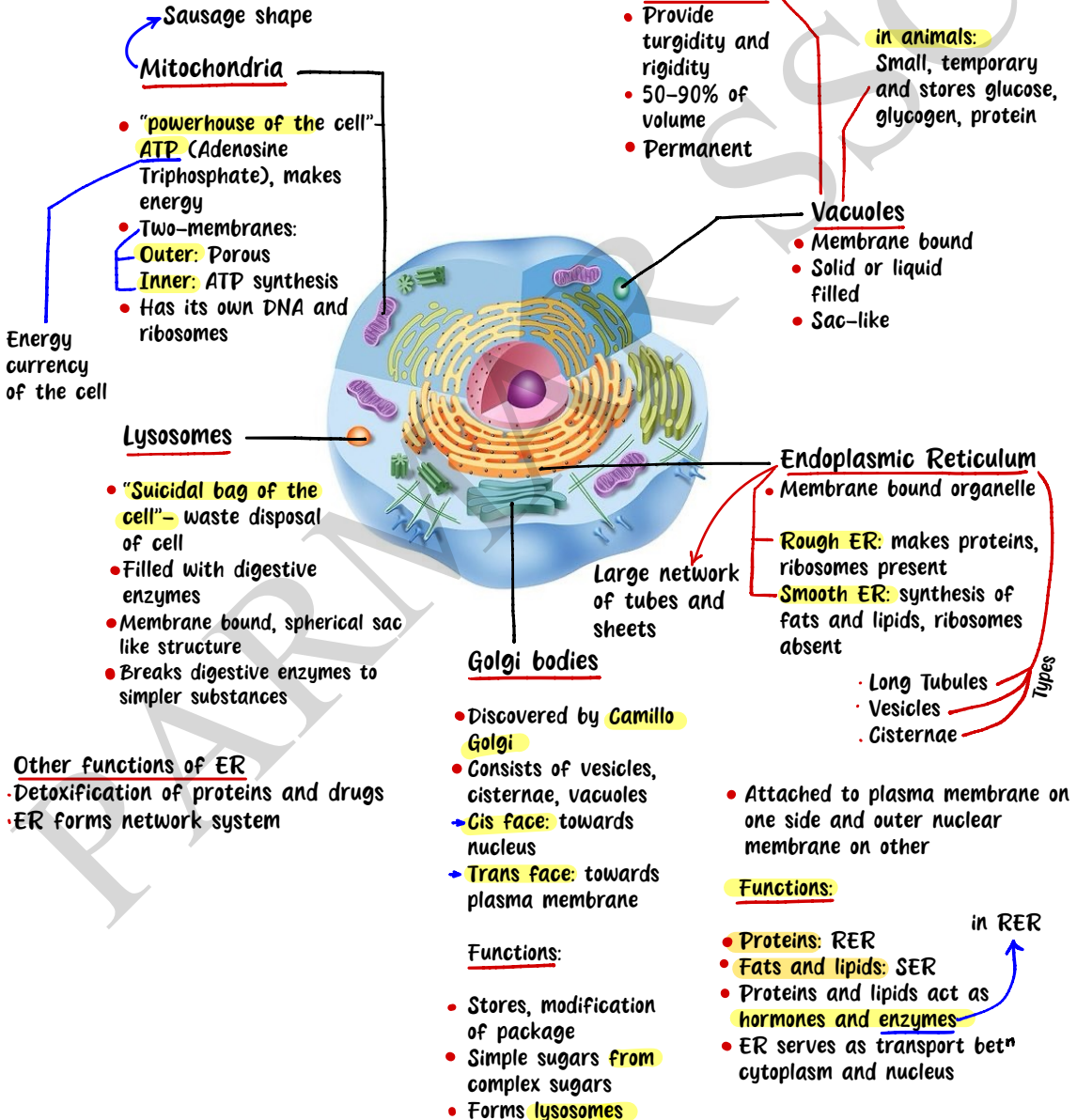
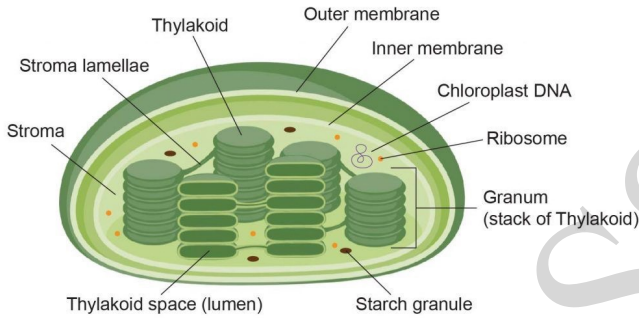


Figure: Prokaryotic Cell and Eukaryotic Cell

## Cell organelles





## Plastids

Only in plant cell, not in animal cell

- Has its own DNA and Ribosomes

### Types:

**Chloroplasts:** contains chlorophyll pigment  
Also contain yellow and orange pigments

**Chromoplasts:** contains different types of pigments which provides colour

**Leucoplasts:** colourless or white in colour  
Stores starch, oil and protein granules

contains Mg for food synthesis

imparts colour to flowers and fruits

## Cell Division

- Division of cells into new cells

Reason for division:

- growth of organism
- replace old, dead and injured cells
- for gamete formation

### Types:

- Mitosis
- Meiosis

## Phases of Cell Cycle



**G1** - Growth

**S** - DNA synthesis

**G2** - Growth and preparation for mitosis

**M** - Mitosis (cell division)

Mitosis	Meiosis
It occurs in <u>Somatic cells</u>	It occurs in <u>Germ cells</u>
Nucleus divides only once	Nucleus divides twice
It is divided into <u>prophase, metaphase, anaphase and telophase</u>	<del>Meiosis I and II divided into prophase I and II, metaphase I and II, anaphase I and II and telophase I and II</del>
Daughter cells are <u>diploid - 2</u>	Daughter cells are <u>haploid - 1</u>
No crossing over takes place	Crossing over takes place
Increase number of normal cells	Produces <u>egg and sperm cells</u>
Involved in healing and growth	Involved in genetic variations
2 daughter cells are produced	4 daughter cells are produced
Malfunction results in cancer	Malfunction results in <u>genetic disorder</u> such as <u>Down's syndrome, klinefelter's syndrome and Turner's syndrome.</u>

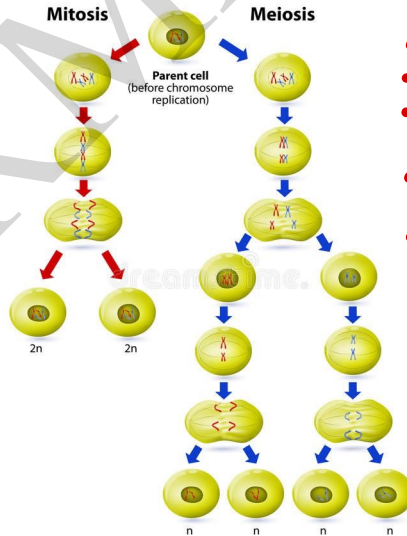
involved in reproduction

Largest cell in humans

Smallest cell in humans

\* Learn only marked ones

Uncontrolled cell division



- largest cell: Ostrich egg
- smallest cell: Mycoplasma
- Longest cell in human: Neurons
- Smallest cell in humans: Sperm cell
- Largest cell in humans: Ovum

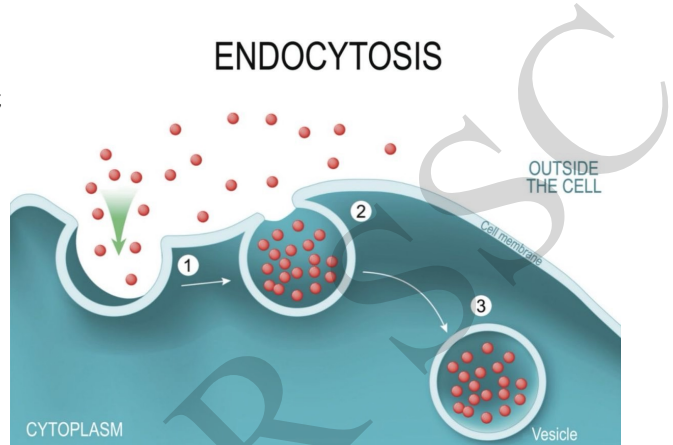
## Endocytosis

- Type of active transport
- Movement of particle into the cell from external environment

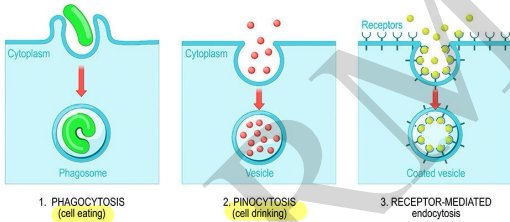
- **Endo:** andar
- **Exo:** bahar

### It is of two types

- Phagocytosis
- Pinocytosis



### Endocytosis



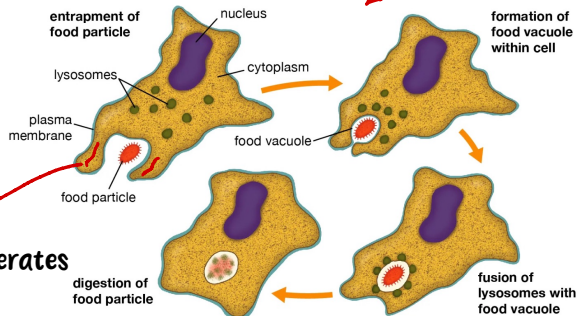
### Phagocytosis

- Cell's eating process
- Large particles taken into cell

### Process

- Plasma membrane invaginate
- Vacuole formation
- Merging of vacuole with Lysosomes
- Vacuole formation
- Release of contents outside the cell

### False feet generates

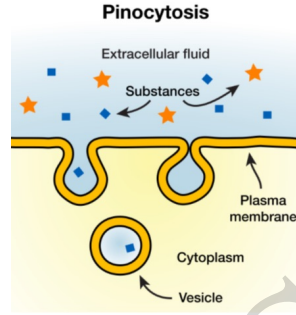


**Pseudopodia:** false feet of amoeba

### Pinocytosis

Cell's drinking process

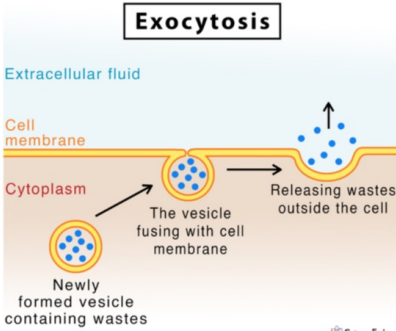
- Extracellular fluid is taken into cell



### Exocytosis

Movement of particles from cell to external environment

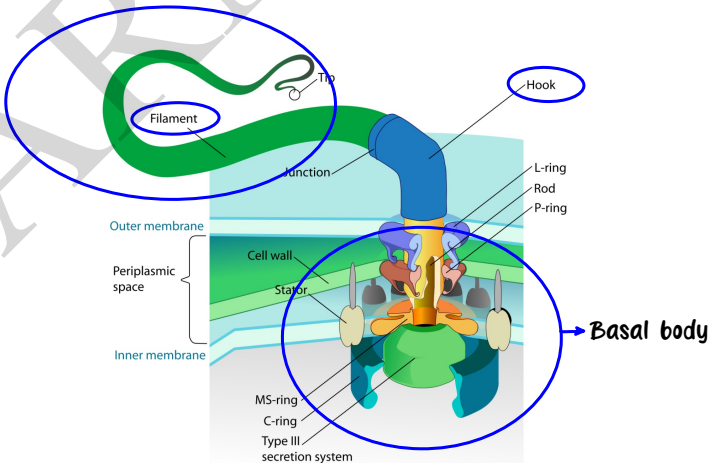
- Also called cell vomiting
- Vomited particles are:
- Undigested residues from endocytosis
- Enzymes and hormones



- **Bacteria Flagella** → Helps in mobility/movement in bacteria

### Three parts

- Filament
- Hook
- Basal body





- Biological stains used in histology and cytology to colour cell nuclei **red: Safranin**
- Most abundant molecule in cell: Water (70% or more of total cell mass)
- Phases of Golgi apparatus:  
Concave: maturing face  
Convex
- Group of ribosomes attached to mRNA: **Polysomes**
- Mitochondria without outer membrane is called **mitoplast**
- Active transport example: **Sodium and Potassium pumps**
- **Peptidoglycan:** Bacteria
- **Cellulose:** Plants
- **Chitin:** Insects
- **Pectin:** Fruits