The Cellular Level of Organization

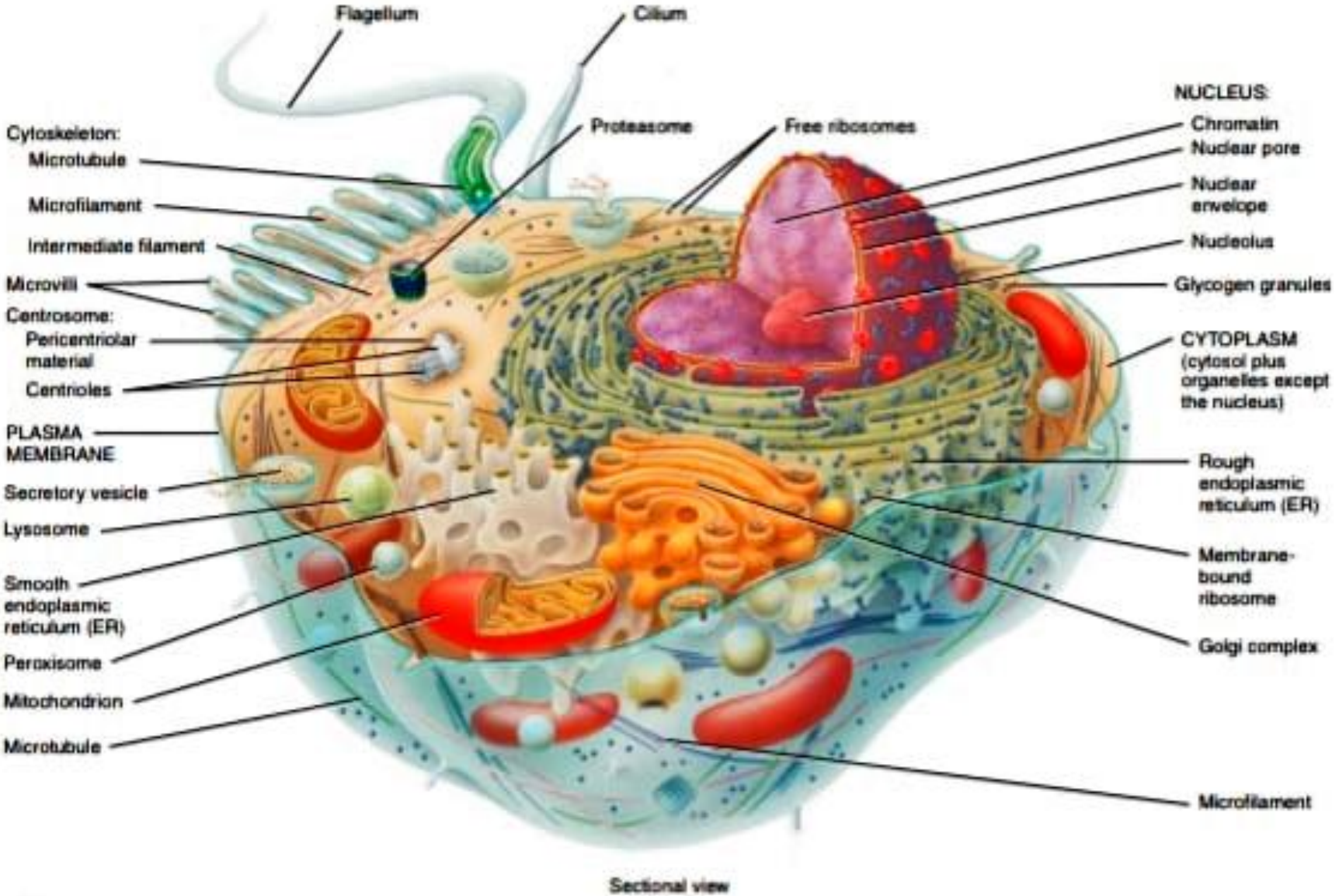
Cell :- Cell is a structural and functional unit of life.

→ Cell carry out multiple of functions that help each System contribute to the homeostasis of the entire Body.

→ All cell arise from Existing and mother cell by the process of cell Division.

Cell Biology :- Also known as cytology.

→ Cytology is the Study of Cellular Structure and function. Study the various cell parts and their Relationship to one another.



Sectional view

Function of Cell

Different Parts of Cell Perform different functions but interconnected to Each other

① Plasma Membrane :- The outer surface that Separate the Cell's Internal Environment from External Environment.

→ It is also called Cell Membrane

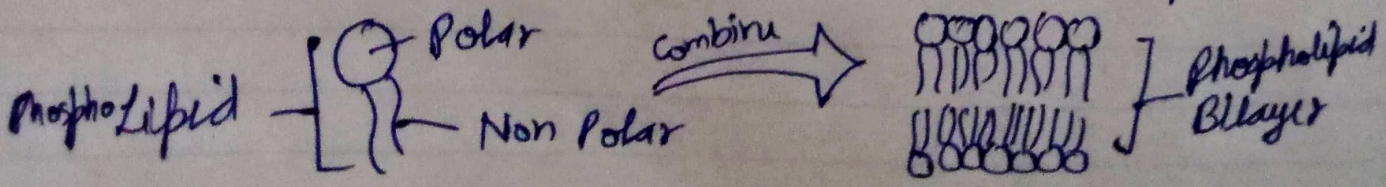
→ It is a Selective Barrier help in flow of materials into and out of cell.

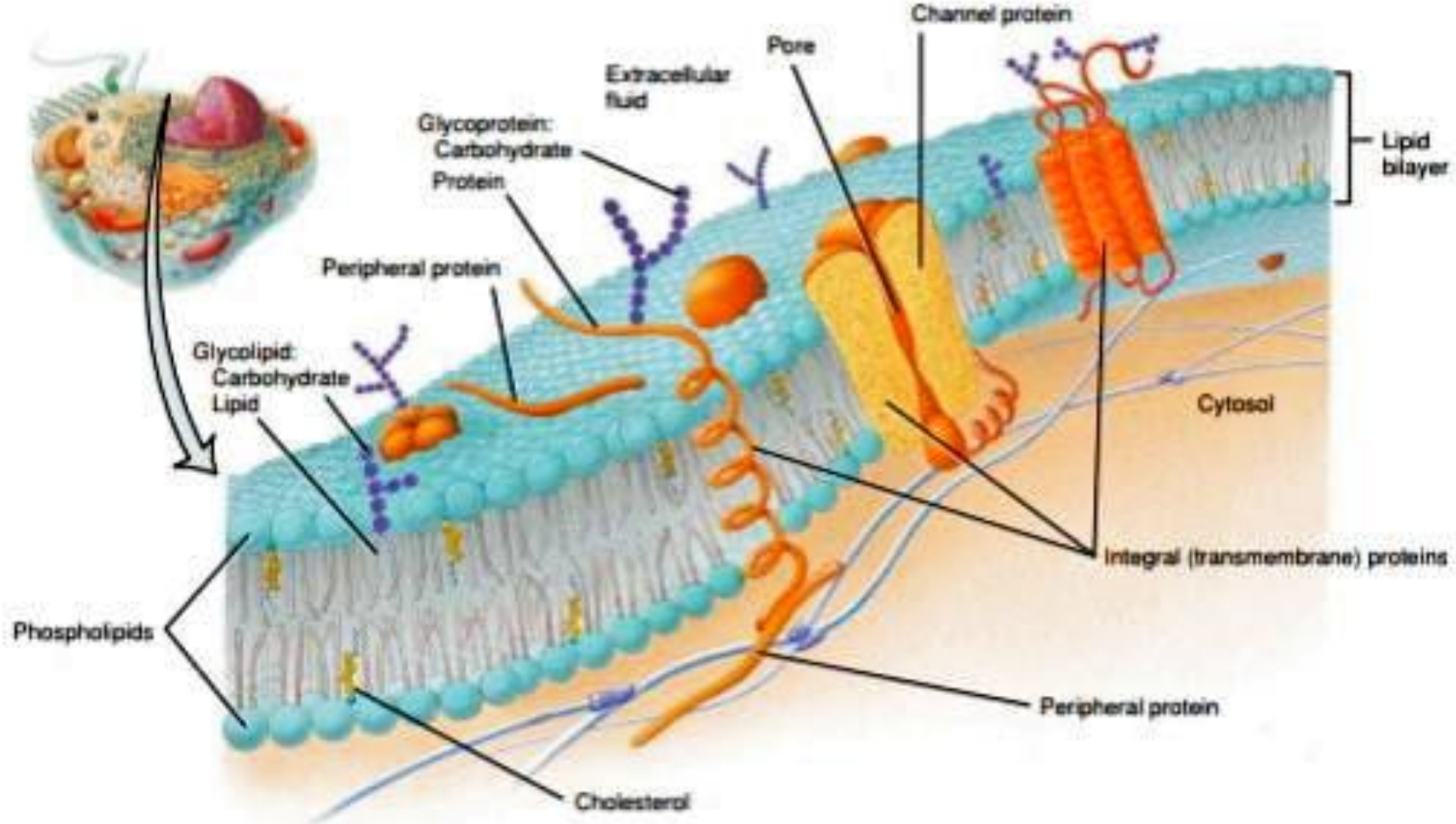
Structure

★ Membrane consist of lipid bilayer made up of 3 type of lipid (fat) molecules - Phospholipids Cholesterol and glycolipids.

→ 75% of membrane are Phospholipids, 20% of cholesterol, 5% glycolipids, etc.

→ Lipids contain Polar and Non-Polar parts.




Channel protein
Pore
Extracellular fluid
Glycoprotein:
Carbohydrate
Protein
Lipid bilayer
Peripheral protein
Glycolipid:
Carbohydrate
Lipid
Cytosol
Integral (transmembrane) proteins
Phospholipids
Peripheral protein
Cholesterol

→ Plasma of or cell membrane consist Protein channels, cholesterol molecules, carbohydrate etc other proteins and other atoms

✡ Functions :-

→ Some Protein makes ion channels or holes that allow only single type of ion to pass through.

→ Some Protein forms carriers, that selectively moving and carry any specific attached substance from outer to inner or inner to out by shape changing.

→ Some Protein form receptor on the surface, Drug or Other material attached to it and Activate a specific function.

→ Membrane glycoprotein and glycolipids help in
- Recognize other cells of same kind during tissue formation
- Support of Plasma membrane
- Gave Shape to the cell

(2) Cytoplasm :- Cytoplasm contain fluid (without organelle) called cytosol and other parts of the cell called organelles (combinely)

→ Cytoplasm = Cytosol(55%) + Organelles

→ cytosol consist of 75-90% of water and other Suspended components like ions, glucose, Amino Acids, fatty acids, ATP etc.

Functions- It is the main site of Chemical Reactions require for cell's Existence.

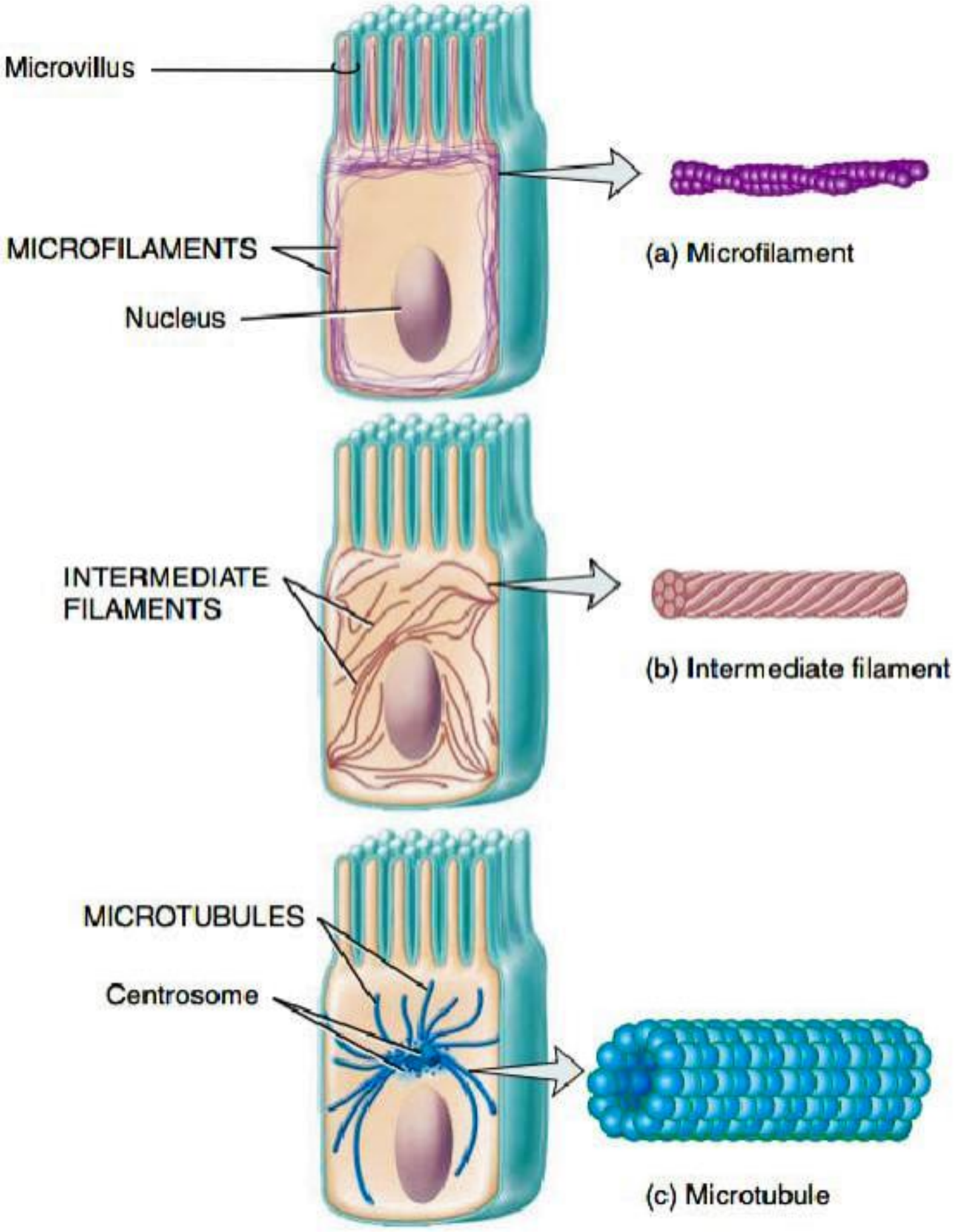
(3) Cytoskeleton :- Network of protein filaments that provide and maintain cell Structure.

* Cytoskeleton consist of mainly 3 filaments :-

↳ Microfilaments (Contain Actin and Myosin)
(Provide mechanical Support)
(help in muscle contraction, cell division, locomotion etc)

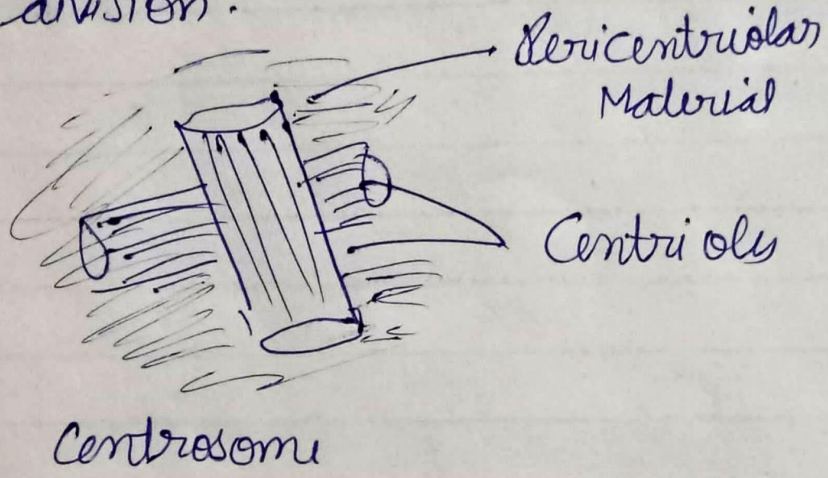
↳ Intermediate filament (thicker than Microfilament)
(Provide mechanical Support)
(help in Stabilize organelle Position)

↳ Microtubule :- (determine cell Shape and function in Movement of organelle in Some Cases)


Microvillus
MICROFILAMENTS
Nucleus
(a) Microfilament
INTERMEDIATE FILAMENTS
(b) Intermediate filament
MICROTUBULES
Centrosome
(c) Microtubule

④. Some Centromere :- It located Near the Nucleus contain Pair of centrioles and Pericentriolar Material.

Function - helps in growth of mitotic Spindle during cell division.

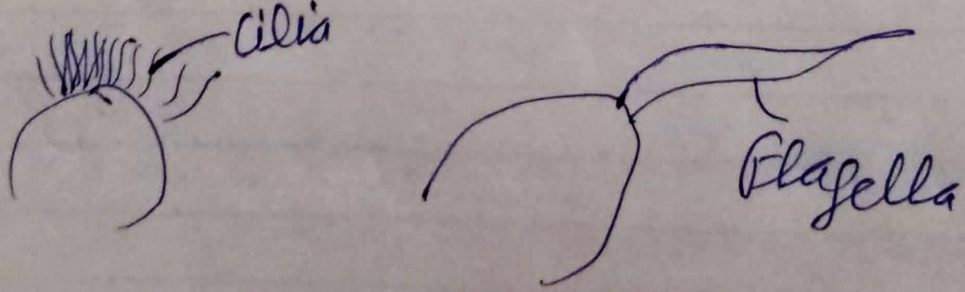


⑤ Cilia & flagella :- hair like Structure present on cell surface.

Cilia - more in Number, Small in length.

Flagella - 1 or 2 in Number, long.

Function :- helps in Movement of cells.



(7) Ribosomes :- Site of Protein Synthesis. contain high content of RNA or rRNA.

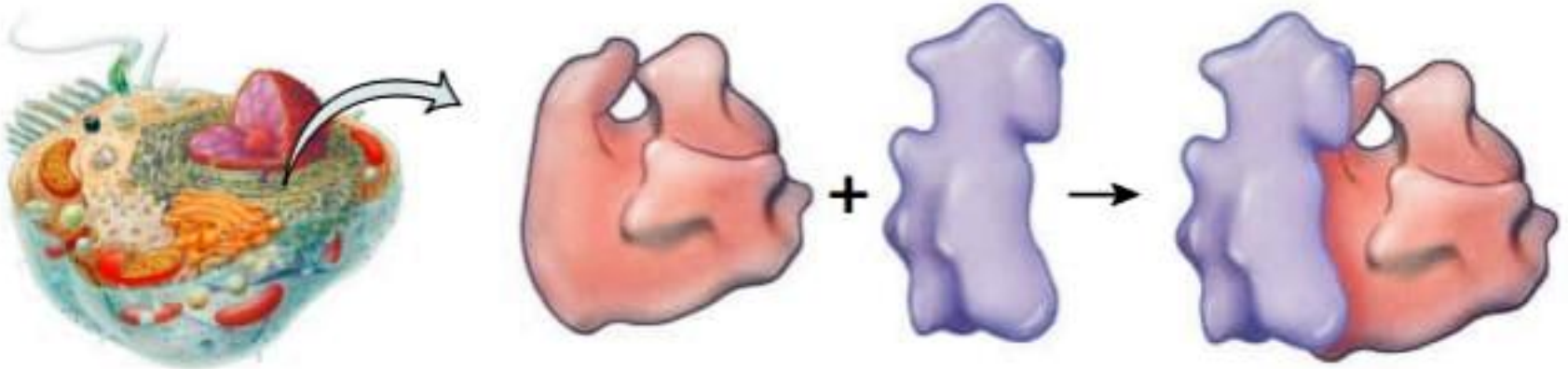
→ Structure of Ribosome divides into 2 Subunits

large small.

→ Small and large Subunits form separately in nucleolus and exit out to nucleus and attached to form Ribosomal Body

Functions :- → Protein Synthesis (formation)

→ Also locate in mitochondria and form mitochondrial Protein.



Details of ribosomal subunits

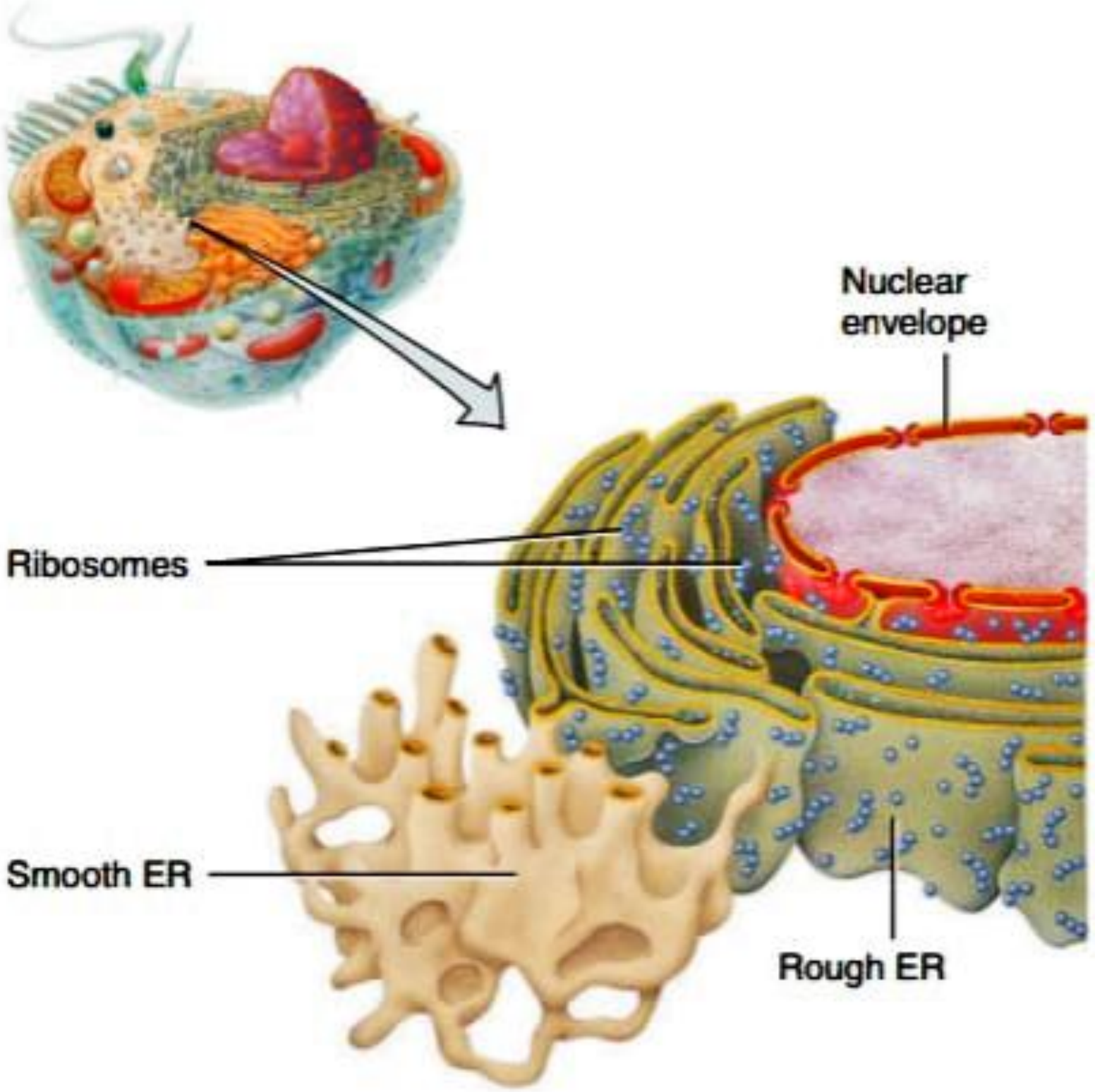
(7) Endoplasmic Reticulum: Tubular network of membranes extend / develop from the nuclear Envelope - connected and projected throughout the cytoplasm.

ER → SER (Smooth Endoplasmic Reticulum)
ER → RER (Rough Endoplasmic Reticulum)

Function:

SER – √No Ribosomes attached with them.
→ SER Synthesizes Fatty acids and Steroids such as Estrogen and Testesterone.

RER - Ribosomes attached to the ER.
→ helps to make glycoprotein and Phospholipids



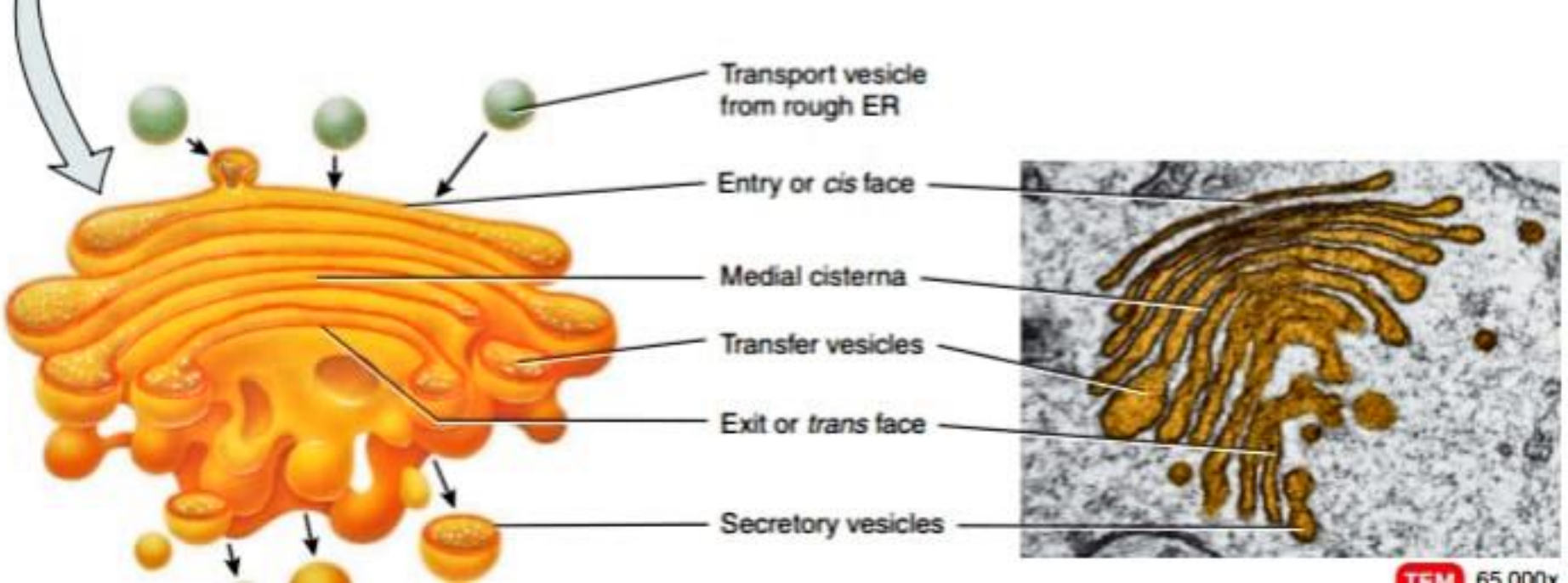
(a) Details

(8) Golgi Complex :- The way to transport protein from ER to other parts is golgi complex.

→ It is small, flattened membranous Sac Structured Body.

→ It consist of 3 to 20 Cisternae.
↓
giving cup like shape.

→ Entry, medial and Exit Cisternae of the golgi complex helps to modify, sort and Package Protein in Vesicles for Transport


Transport vesicle from rough ER
Entry or *cis* face
Medial cisterna
Transfer vesicles
Exit or *trans* face
Secretory vesicles
TEM
65,000×

(9) Lysosomes :- Membrane enclosed Vesicles formed by the golgi Complex.

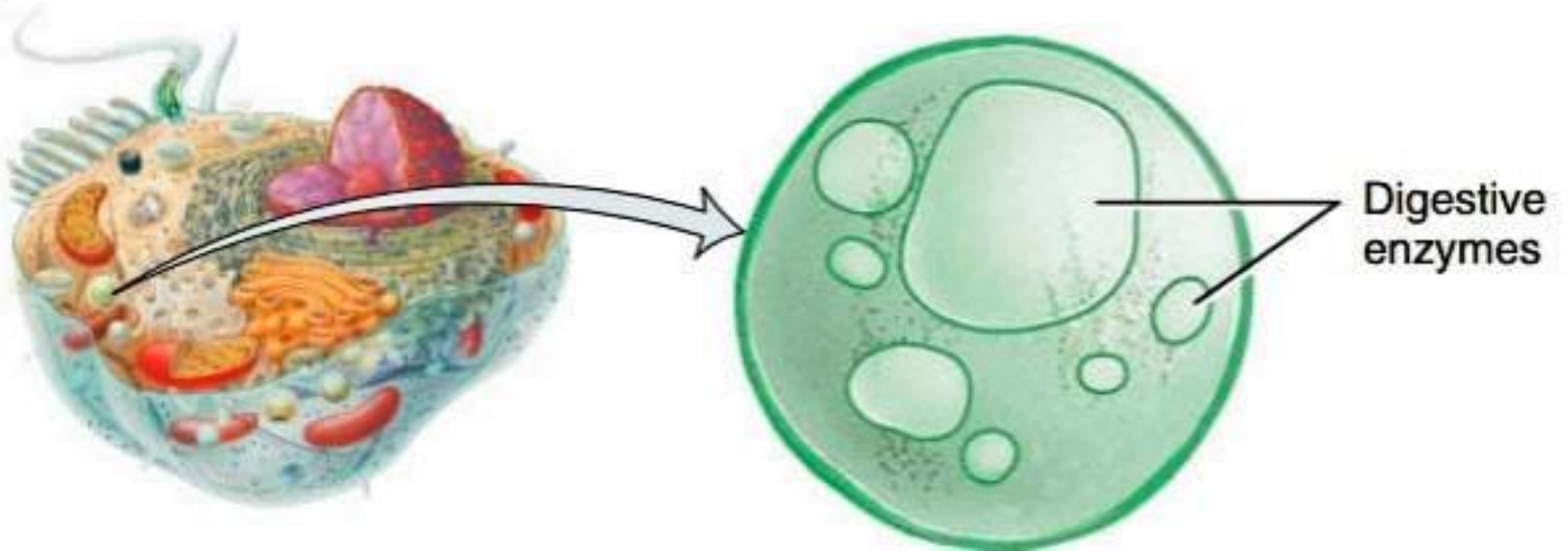
→ Contain 60 Kinds of Enzymes that are digestive and hydrolytic.

→ It works best at an acidic PH. (5)

→ Also Called Suicidal Bags of cell.

Functions - They can recycle the cell structures by engulf, digest and return digested component to cell's Cytosol for reuse.

Lysosomes contain several types of powerful digestive enzymes.



(10) Peroxisomes :- Similar to lysomes, but smaller. also called microbodies.

→ Contain oxidases enzyme that oxidize various organic substance.

exam- Amino Acids and Fatty acids are oxidized by Peroxisomes.

Function :-

→ Reduces Toxic substances also like Alcohol etc.

(11) Mitochondria :- Also called Power house of the cell that generate ATP by aerobic respiration.

→ A cell may have few hundred mitochondria.

Functions :-

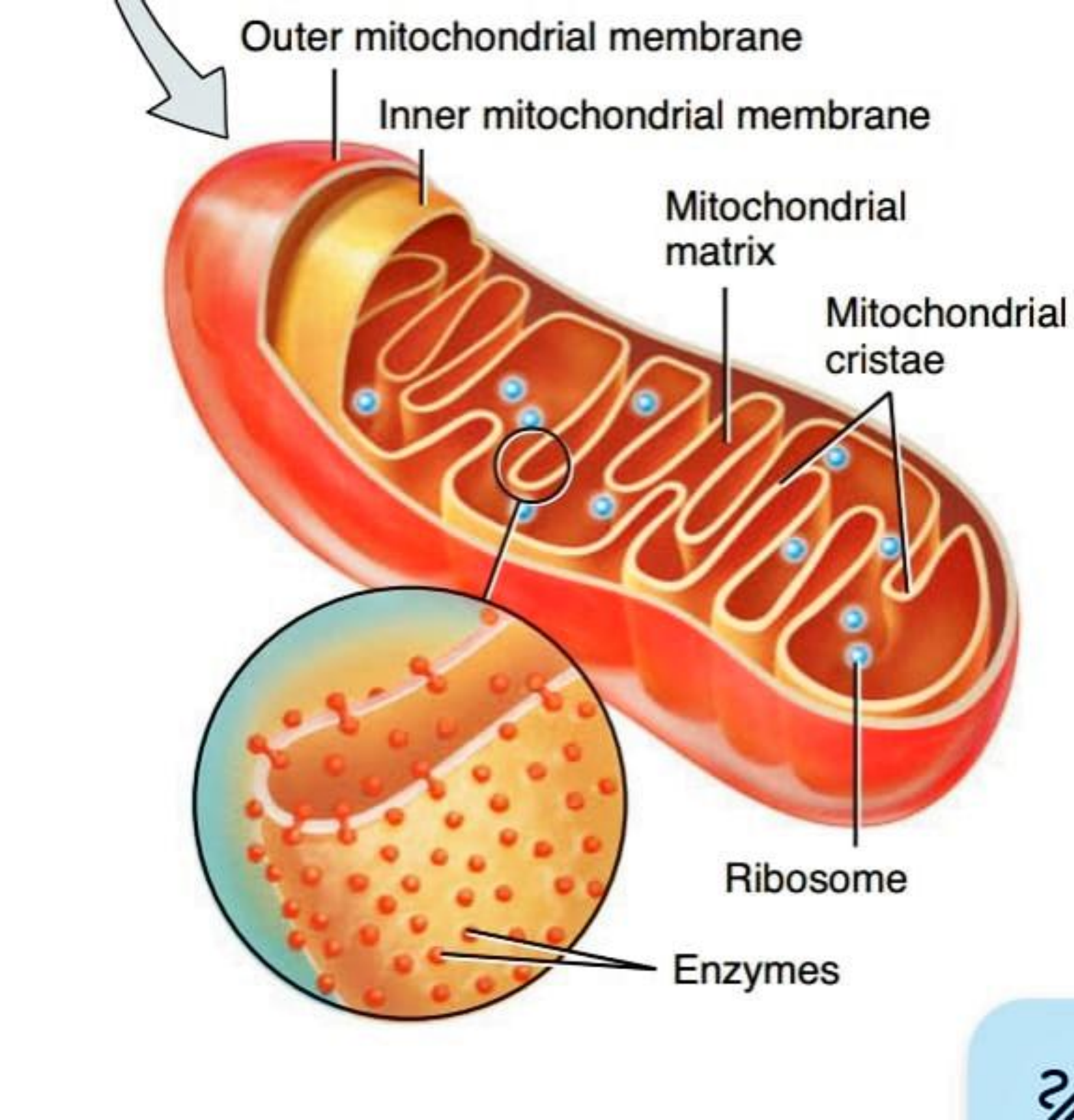
→ Self relicate property at time of increase Energy Demand.

→ Provide Energy Energy to the Different Parts.

(12) Nucleus :- Spherical or oval shaped structure, most important part of cell.

→ Outer membrane called nuclear envelope or membrane

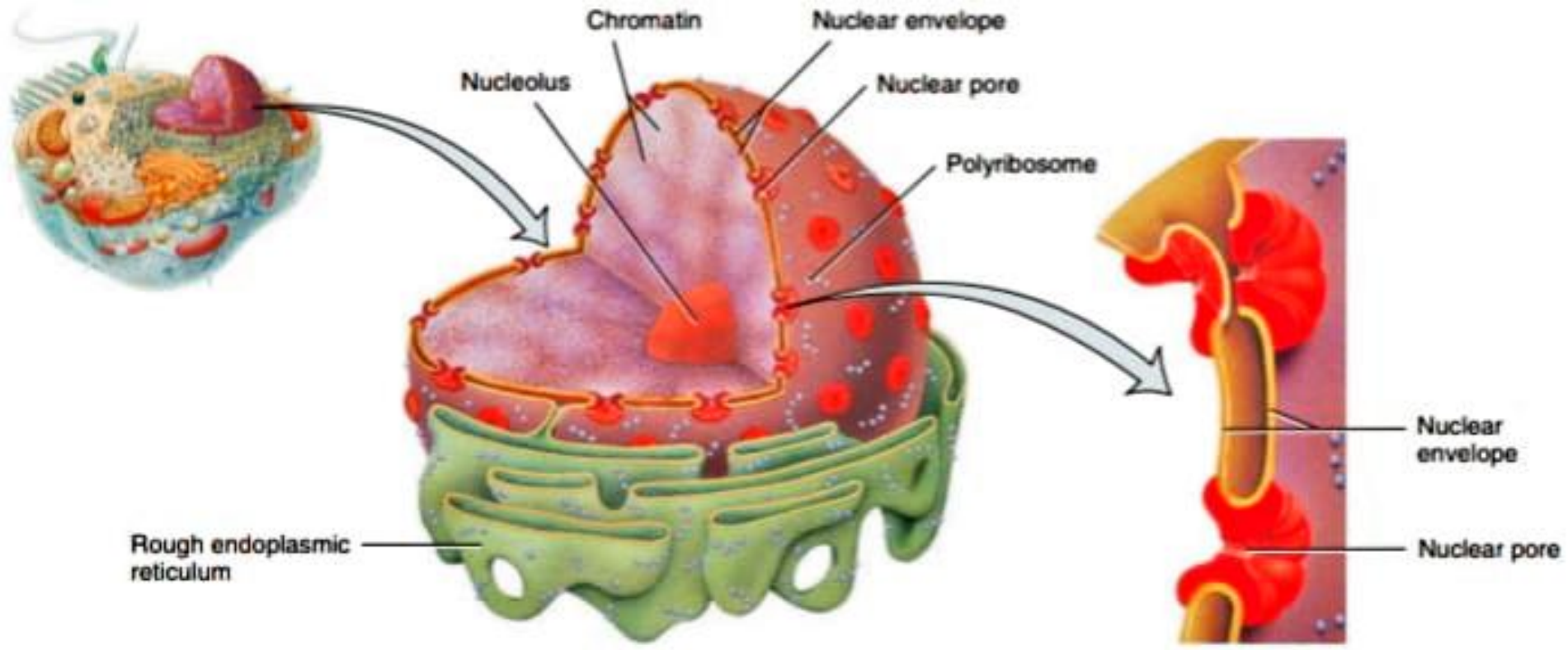
→ Openings in nuclear membrane are called Pores.


Outer mitochondrial membrane
Inner mitochondrial membrane
Mitochondrial matrix
Mitochondrial cristae
Ribosome
Enzymes

→ Nucleoli in nucleus helps to produce Ribosomes
(Nucleolus - Singular)
→ Nucleolus contain protein, DNA and RNA in cluster. (FISH)
→ Nucleus contain hereditary units called genes.
→ genes attached to chromosomes.
→ Each chromosome is long DNA molecule that coiled with proteins.
→ Cell carry genetic information called genome.

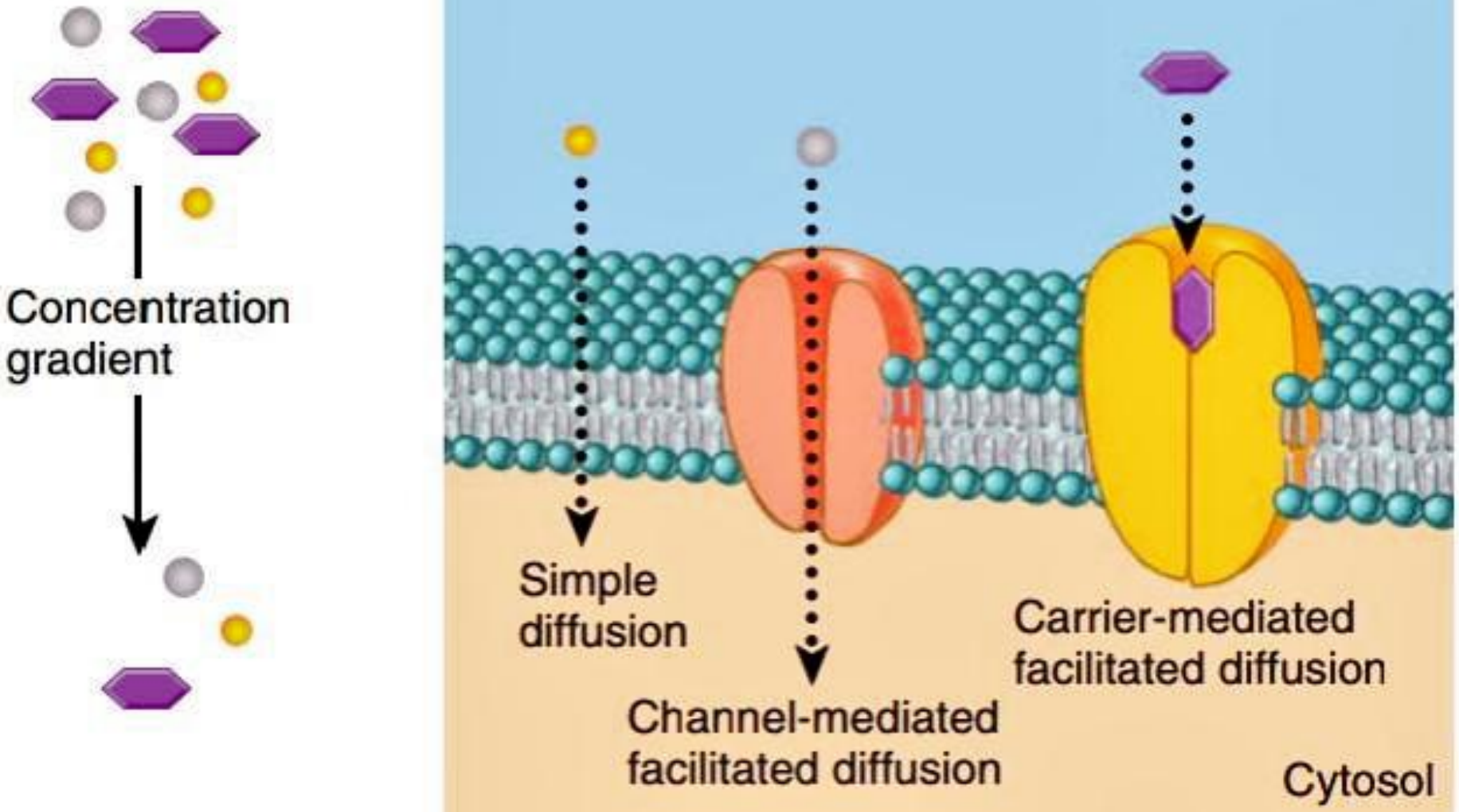
Functions :-

→ Carry genetic information from generation to generation
→ Functional unit of a cell.
→ Initial Site of protein Synthesis.



(a) Details of the nucleus

(b) Details of the nuclear envelope


Concentration gradient
Extracellular fluid
Simple diffusion
Channel-mediated facilitated diffusion
Carrier-mediated facilitated diffusion
Cytosol

PASSIVE TRANSPORT

Introduction :-

☆ Passive Transport working on the principle of Diffusion

→ Transport from high concentration to the lower concentration is commonly known as Passive Transport.

→ Diffusion :- A passive process in which the random mixing of particles in a solution occurs because of the particle "Kinetic Energy".

example - Of a particulate Solute present in high concentration in one area of a Solution and in low concentration in other area, the Solute particles diffuse (moves) towards the area of lower conantration.

→ The greater the differnce in concentrations of 2 Sides, higher the rate of Diffusion.

Types

diffusion → Simple diffusion
diffusion → Facilitative Diffusion → Channel Mediated
Facilitative Diffusion → carrier Mediated

(1) Simple Diffusion – Passive Process in which Substances move freely through the lipid Bilayer of Plasma membrane without the help of any transporter.

→ Non Polar molecules move through the Passive diffusion Process.
Like:- oxygen, CO_2 and nitrogen gases.
→ Polar molecules also pass through simple diffusion.
Like:- water, urea, Alcohols etc. (Small molecules)
Location - Exam- Exchange of O_2 and CO_2 within lungs during Breathing. etc

② Facilitated Diffusion:- In this process, specific substance across the membrane can move through the simple Passive diffusion by protein channels. in the membrane. or carrier protein

Facilitated Diffusion → Channel Mediated
Facilitated Diffusion → Carrier Mediated

Channel Mediated:- Ions or substances moves across the proteneous channels in the cell membrane.
→ Numerous ions are selective for K^+ or Cl^- ion channels, fewer (less) channels are available for Sodium (Na^+) ions or Calcium Ions (Ca^{2+})
→ It is very fast process. more than one million K^+ ions flow through Potassium channel in 1 second.

Carrier Mediated :- The substance or solute bount to a specific carrier on on side and is release to the other side by change in shape of carrier.

→ glucose, Fructose, galactose etc enters many cells by carrier mediated facilitated diffusion.

→ glucose binds to specific carrier type called glucose Transported (Glu T)

(3) Osmosis :- A type of diffusion in which, Solvent/H_2O moves from ~~lower~~ area of higher concentration to the area of lower concentration by selective permeable Membrane

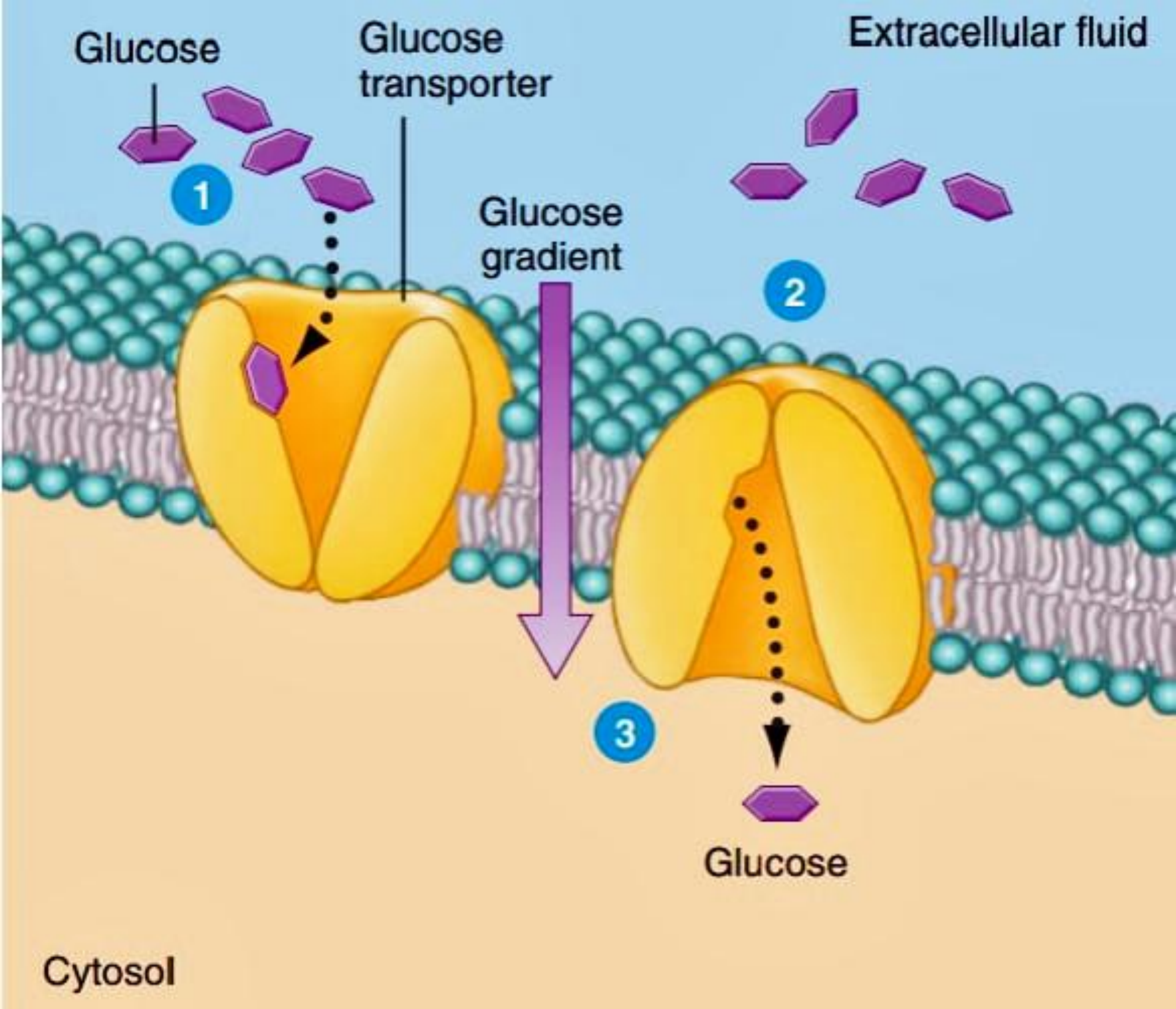
☆ Permeable Membrane :- The membrane, that allow some/ certain substances to move or cross from it.

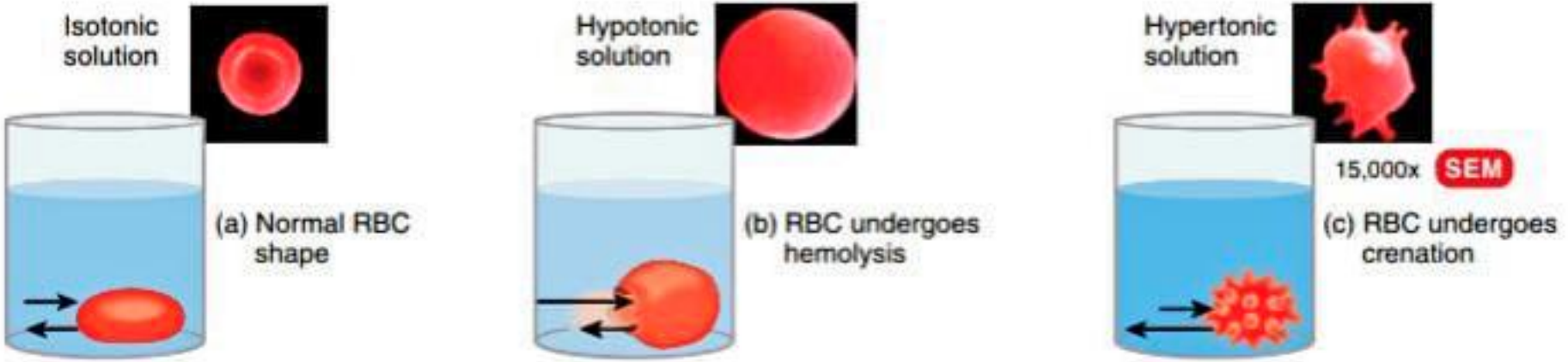
→ Osmosis occur only when membrane is permeable to water but not to certain solutes.

Example :- (Types)

→ Any Solution in which RBC (Red Blood cell) maintain their original shape and volume is called Isotonic soln. because the concentration of Solute at both sides are equal.

→ In hypotonic Solution (low Solute concentration), RBC swell up by movement of Solution from lower concentration


Glucose
Glucose transporter
Extracellular fluid
1
Glucose gradient
2
3
Glucose
Cytosol


Isotonic solution
(a) Normal RBC shape
Hypotonic solution
(b) RBC undergoes hemolysis
Hypertonic solution
15,000x
SEM
(c) RBC undergoes crenation

to higher.

→ In hypertonic solution (More concentration of Solute) RBC shrink due to movement of RBC Solutions to the Solution.

ACTIVE TRANSPORT

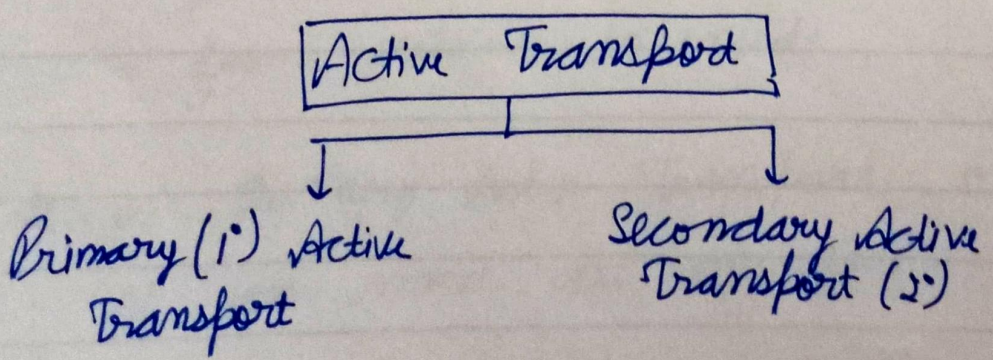
The movement of solute particles moves from ~~passive~~ concentration of low/less no. of particles to the high concentration with the help of Energy.

Low concentration —Active Transport→ High concentration

→ The process is against the concentration gradient.

→ The process require energy for movement.

→ Energy obtained by various reactions in Body like ① hydrolysis of ATP (Adenosine Triphosphate).



☆ Primary Active Transport :-

In this process, Energy derived from hydrolysis of ATP changes shape of carrier protein.

↓

change in shape of carrier protein help in transport of substances from lower to higher concentration (against concentration gradient)

→ Carrier protein can undergo Primary Active Transport called Pumps.

Example - Sodium-Potassium ATPase Pump (Na^+-K^+ ATPase)

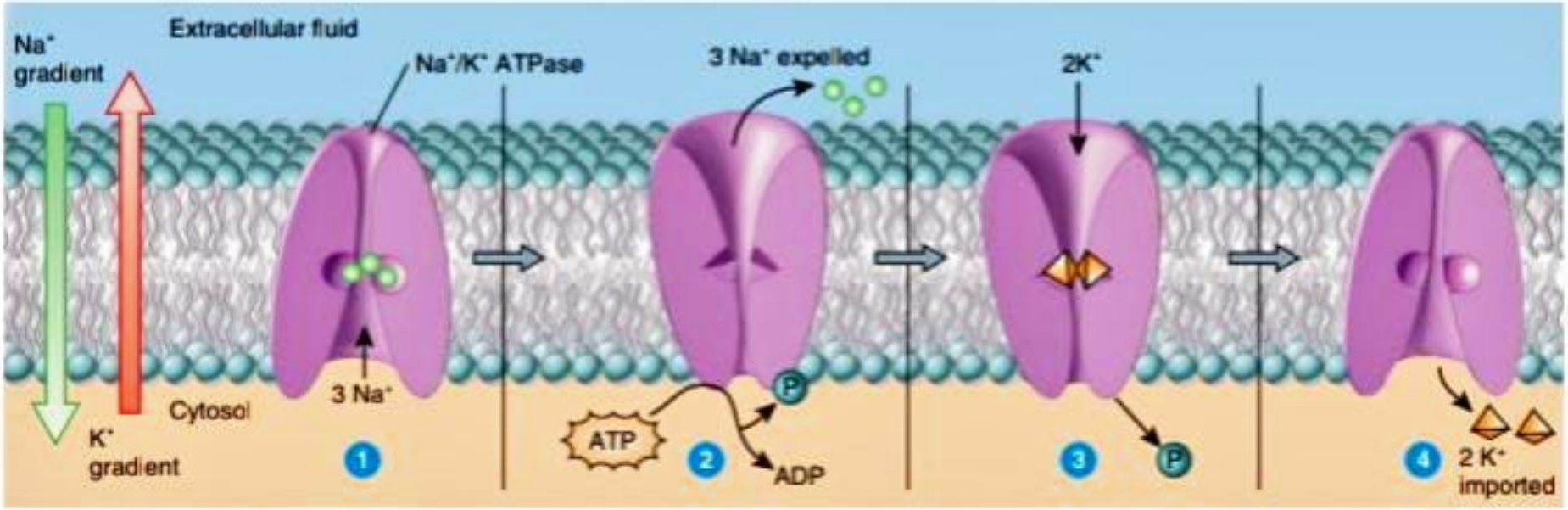
↓

When 3 Sodium atom/ions can move out and ATP used and changes in ADP

↓

From outside 2 Potassium ions can move from outside to inside.

☆ in Primary Active Transport, only one Type of ion move at one time.



3 sodium ions (Na^+) from the cytosol bind to the inside surface of the sodium–potassium pump.

Na^+ binding triggers ATP to bind to the pump and be split into ADP and P (phosphate). The energy from ATP splitting causes the protein to change shape, which moves the Na^+ to the outside.

2 potassium ions (K^+) land to the outside surface of the pump and cause the P to be released.

The release of the P causes the pump to return to its original shape, which moves the K^+ into the cell.

☆ Secondary Active Transport :-

In Secondary Active Transport, the carrier protein simultaneously binds (with Both ions) to sodium and other substance and change its shape to transport both substances at same time

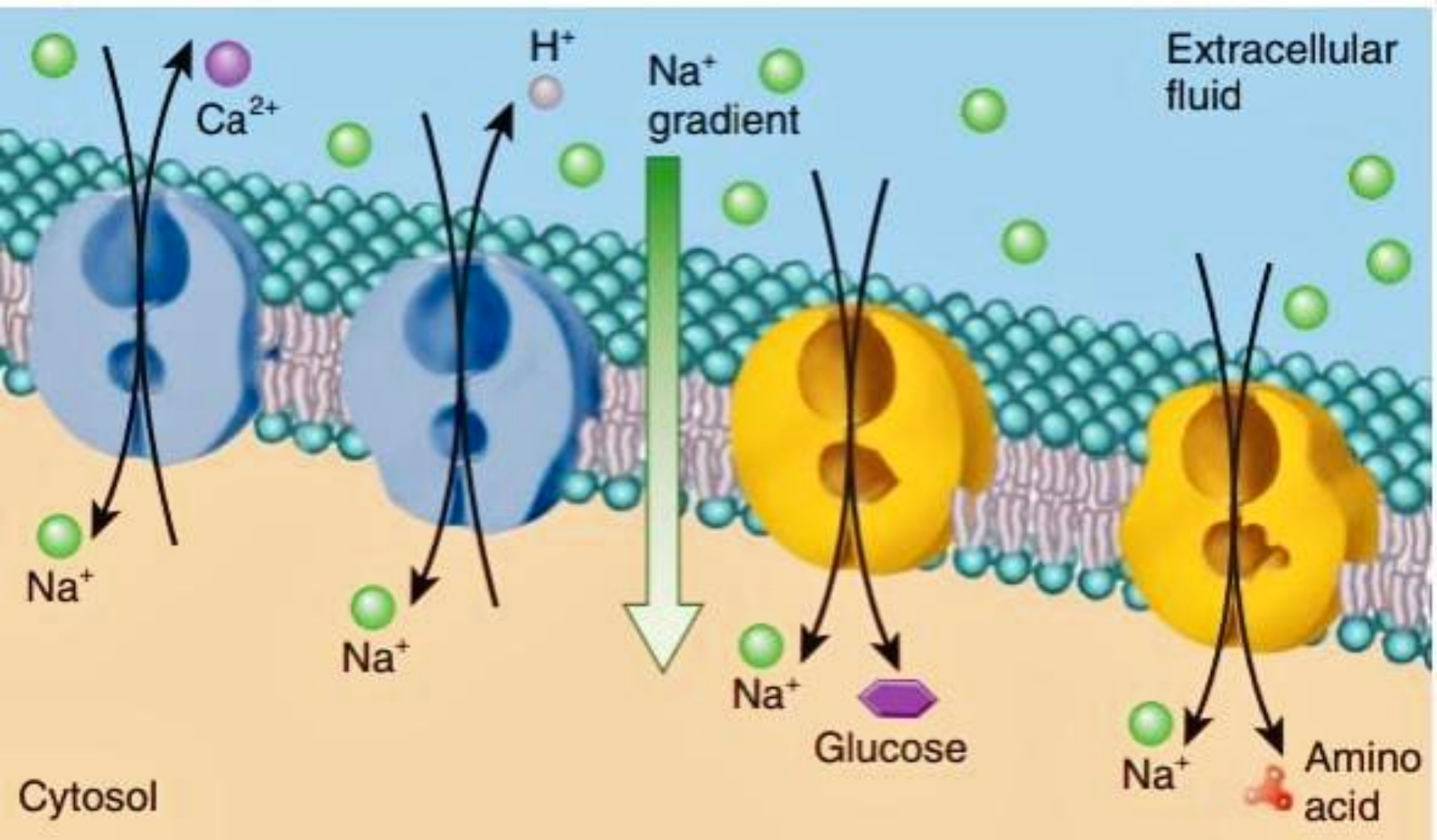
Secondary Transport

Symporters Antiporters

☆ **Symporters** :- Transport of 2 different substances in same direction. (Substance called Symporter) Process called Symport

☆ **Antiporters** :- Transport of 2 different substances in opposite direction by same carrier at same Time.

→ The substance called Antiporters and Process called Antiport.


Extracellular fluid
Ca^{2+}
H^+
Na^+ gradient
Na^+
Na^+
Na^+
Glucose
Na^+
Amino acid
Cytosol

3. TRANSPORT IN VESICLES

Some substances can transport or move in the Body through some Spherical Sac like Structures.

→ Substance also Transport inside cell from one Structure to another.

Type of Vesicle Transport

- Endocytosis
- Exocytosis
- Pinocytosis
- Phagocytosis
- Transcytosis

Endocytosis – The transport of material from Extracellular fluid to the Intracellular fluid.

→ Transport of material from outside to Inside the cell.

Exocytosis :- The transport of inside (Intracellular fluid) to the outside (Extracellular fluid) of cell.

exam – Secretion of digestive Enzymes, hormones, mucus etc from cells.

Phagocytosis : Type of Endocytosis, the process in which the cell engulf (eat) large Solid particles.

Example – Whole Bacterial cell, Virus etc.

Figure 3.13 Phagocytosis. Pseudopods surround a particle, and the membranes fuse to form a phagosome.

Phagocytosis is a vital defense mechanism that helps protect the body from disease.

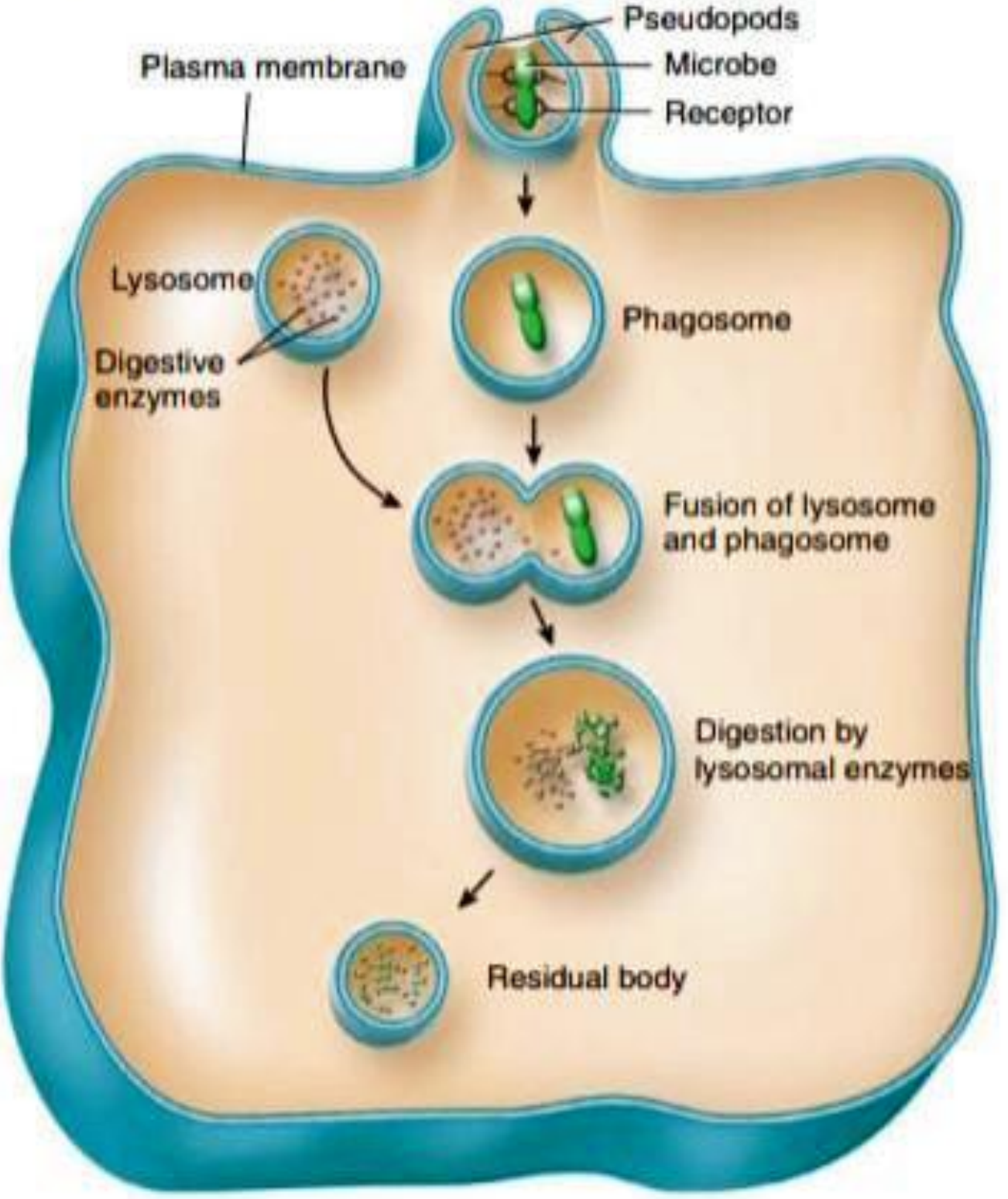
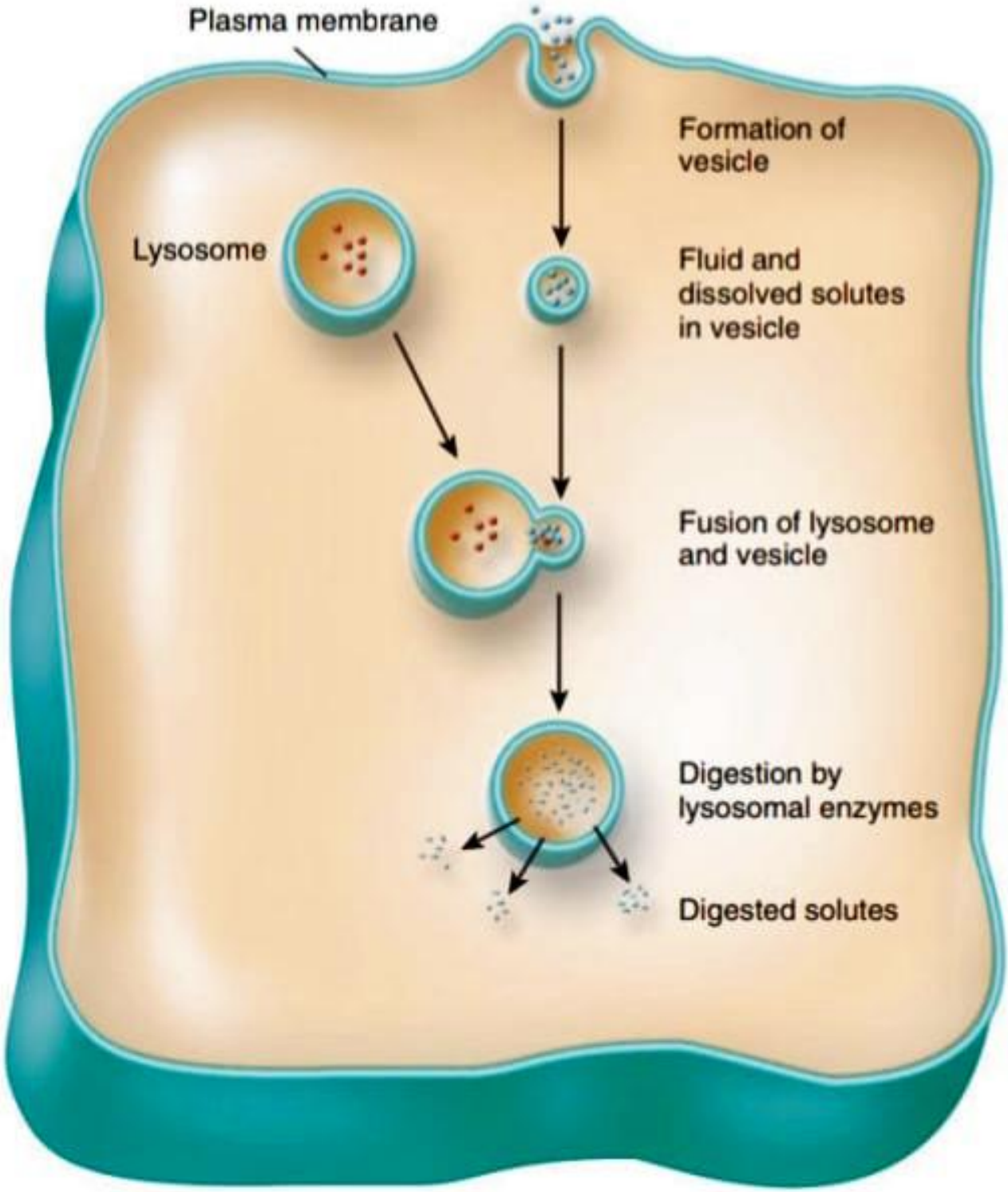


Figure 3.14 Bulk-phase endocytosis. The plasma membrane folds inward, forming a vesicle.

Most body cells carry out bulk-phase endocytosis, the nonselective uptake of tiny droplets of extracellular fluid.



* Two Phagocytes mainly works in Body.
  - Neutrophill (In Human Blood) (WBC)
  - Macrophage (In Body Tissue)

Pinocytosis :- A Type of Endocytosis, in which Small or Tiny droplets of Extracellular fluid Taken up.
→ Solute dissolve into Extracellular fluid (ECF) and brought into cell.

Transcytosis :- The Process in which Vesicle undergo Endocytosis on one side and Exocytosis on the opposite side.
→ Occur in Endothelial cells lie / locate in Blood Vessels.

☆ Cell cycle contain Major Periods → Interphase
→ Mitotic

Interphase :- Cell Replicates its DNA by a process.
→ Also produces additional organelles and cytosolic components
→ Interphase is stage of high metabolic activity.

Interphase Phases.
- → G_1 - Cell Doupliates material
- → S - Synthesis of DNA
- → G_2 - growth Phase

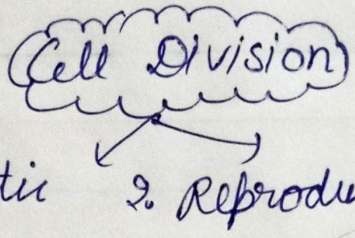
↳ G_1 - Interval B/w mitotic phase and S Phase.
→ Cell Replicates organelles and cytosolic components but not its DNA.
→ G_1 cycle Time last to 8 to 10 hours.
→ It is very short in many cells like cancer cells so, It can said to be G_0 Phase.

↳ S :- Interval Between G_1 and G_2 Phase last about 8 hours.
→ DNA Replication occurs result formation of 2 identical cells during cell division.

↳ G_2 :- Interval B/w S and mitotic Phase.
→ It last for 4 to 6 hours.
→ Continue cell growth, enzymes and Proteins are formed in Preparation of cell division.

Cell Division

Cells Reproduce and produce new cells with the process of cell Division.



→ Somatic Cell Division undergo division (Mitotic) in normal cells or other than Germ (Reproductive) cells.

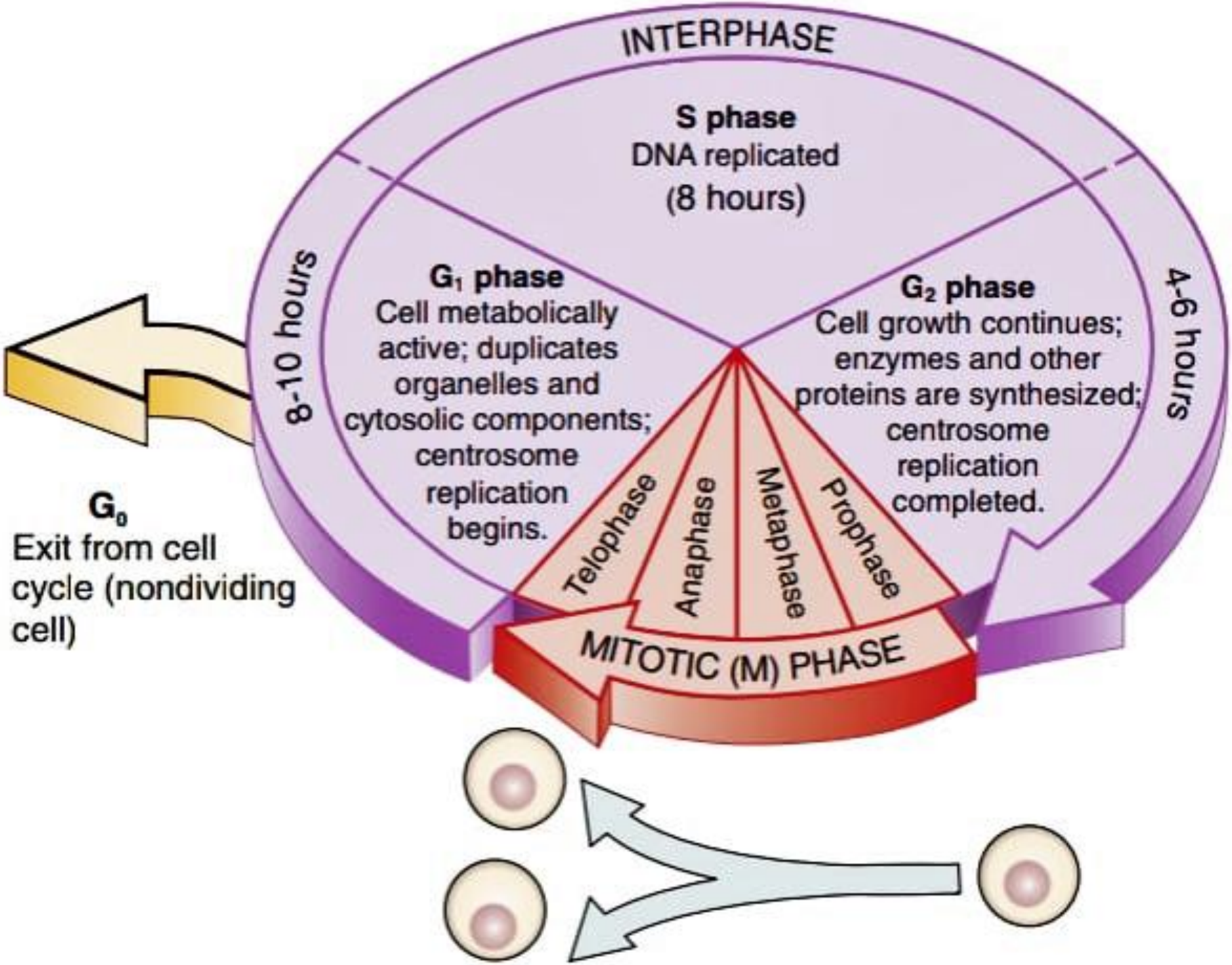
→ Reproductive Cell Division undergo division that produces gametes help in Sexually reproducing organisms.

1. Somatic Cell Division

The Cell cycle is an Orderly Sequence in which Somatic Cell Duplicates its content and Divides into 2.

→ Cells contain 23 Pair of chromosomes. 2 chromosomes make up each pair called homologous chromosome, contain similar genes.

→ 1 pair is Exceptionaly is Sex chromosomes designed X and Y. → Female contain XX Pair
→ Male contain XY Pair


INTERPHASE
S phase
DNA replicated
(8 hours)
G1 phase
Cell metabolically active; duplicates organelles and cytosolic components; centrosome replication begins.
G2 phase
Cell growth continues; enzymes and other proteins are synthesized; centrosome replication completed.
8-10 hours
4-6 hours
Telophase
Anaphase
Metaphase
Prophase
MITOTIC (M) PHASE
G0
Exit from cell cycle (nondividing cell)

Mitotic Phase :- A Phase of cell cycle, result of formation of 2 identical cells form from 1 cell consist of nuclear division and cytoplasmic division.

Karyokinesis — cytokinesis

→ Nuclear division Phases
- Prophase
- Metaphase
- Anaphase
- Telophase

→ Cytoplasmic Division → cytokinesis

↳ Nuclear Division Phases

① Prophase :- Chromatin fibre condense and shortened into chromosomes visible under light microscope.
→ Each chromosomes consists a pair of identical (same) strands called chromatids.
→ Centromere hold the chromatids together.
→ Later, pericentriolar material start form the mitotic spindle and push the two centrosomes at Poles (ends) of cell.

② Metaphase :- Microtubules of mitotic spindle align the chromatids pairs at exact centre of mitotic spindle.
→ Midrib region is called metaphase plate.

③ Anaphase :- The pair of chromatid separates and move towards poles of cell. Separated chromatids called chromosomes.

④ Telophase :- Final stage of mitosis.

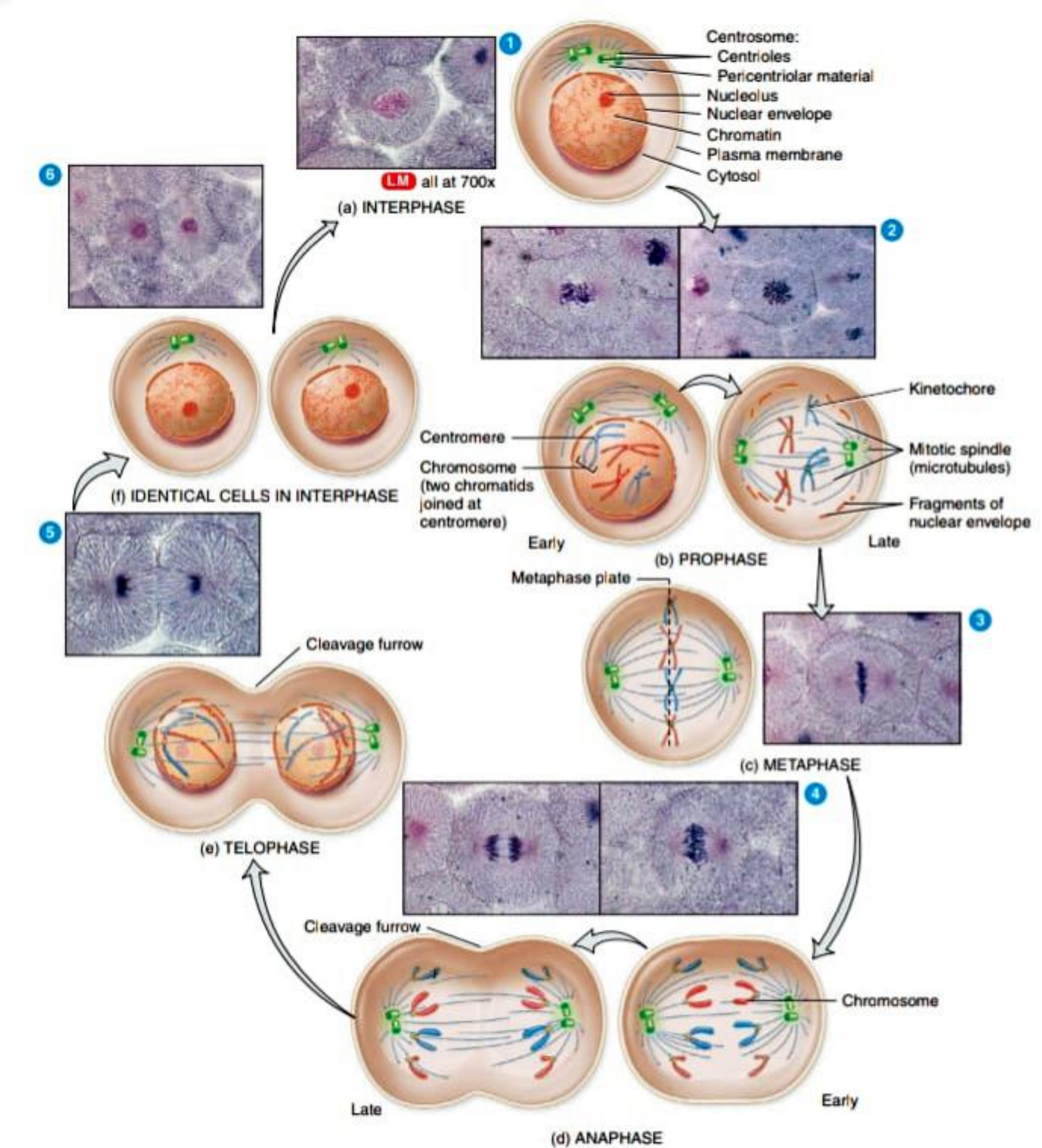
→ The identical Chromosomes uncoiled and revert to thread like chromatin form.

→ A nuclear envelop (layer) forms around each chromatin mass, nucleoli reappear in nuclei & mitotic Spindle ~~of~~ Breaks up.

↳ Cytoplasmic Division :-

Cytokinesis - Division of cell's cytoplasm and organelles into 2 identical (same) cells.

G_1 ⟶ S Phase ⟶ G_2 Phase ⟶ mitosis → Cytokinesis.


1
Centrosome:
Centrioles
Pericentriolar material
Nucleolus
Nuclear envelope
Chromatin
Plasma membrane
Cytosol
LM all at 700x
(a) INTERPHASE
2
Kinetochore
Centromere
Chromosome (two chromatids joined at centromere)
Mitotic spindle (microtubules)
Fragments of nuclear envelope
Early
Late
(b) PROPHASE
3
Metaphase plate
(c) METAPHASE
4
Cleavage furrow
Chromosome
Late
Early
(d) ANAPHASE
Cleavage furrow
(e) TELOPHASE
5
(f) IDENTICAL CELLS IN INTERPHASE
6

2. Reproductive Cell Division

This type of Division occurs in Sexual Reproduction.

→ New organism is result of union/fusion of 2 differed gametes.

→ Meiosis - Reproductive cell division occurs in ovaries and testes, number of chromosomes reduced to half (46 → 23) thus cell formed called haploid cells

2. Reproductive Cell Division

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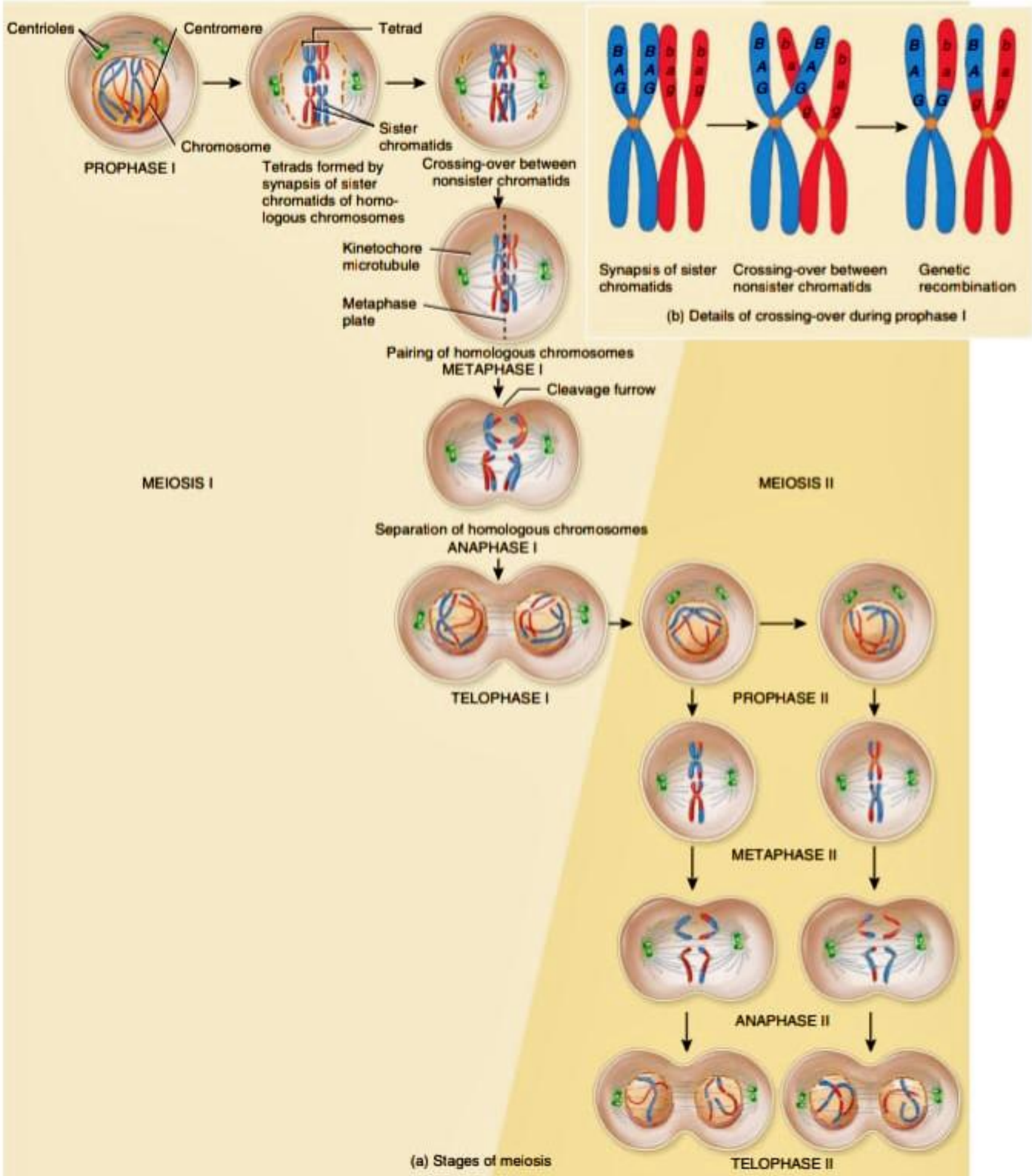
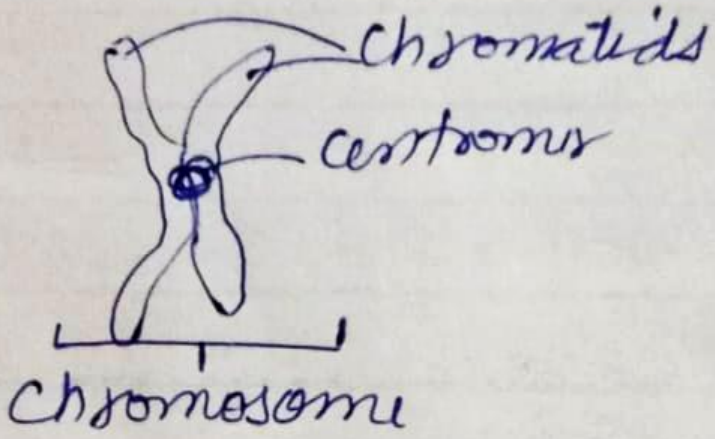
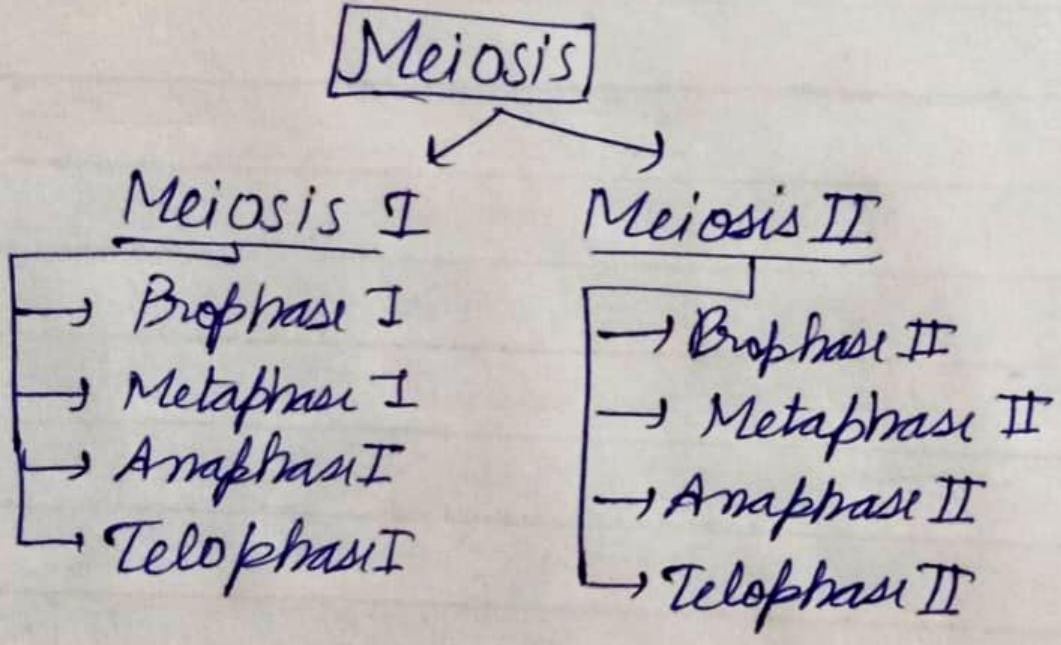

Centrioles
Centromere
Tetrad
Chromosome
Sister chromatids
PROPHASE I
Tetrads formed by synapsis of sister chromatids of homologous chromosomes
Crossing-over between nonsister chromatids
Kinetochore microtubule
Metaphase plate
Pairing of homologous chromosomes
METAPHASE I
Cleavage furrow
MEIOSIS I
MEIOSIS II
Separation of homologous chromosomes
ANAPHASE I
TELOPHASE I
PROPHASE II
METAPHASE II
ANAPHASE II
TELOPHASE II
(a) Stages of meiosis
Synapsis of sister chromatids
Crossing-over between nonsister chromatids
Genetic recombination
(b) Details of crossing-over during prophase I

Meiosis - During Interphase, Chromosomes of the Diploid cell (46 chromosomes → 23 Pairs) start replicate, Each chromosome contain 2 Sister Chromatids, attached to centrome





Transport Across The Cell Membrane

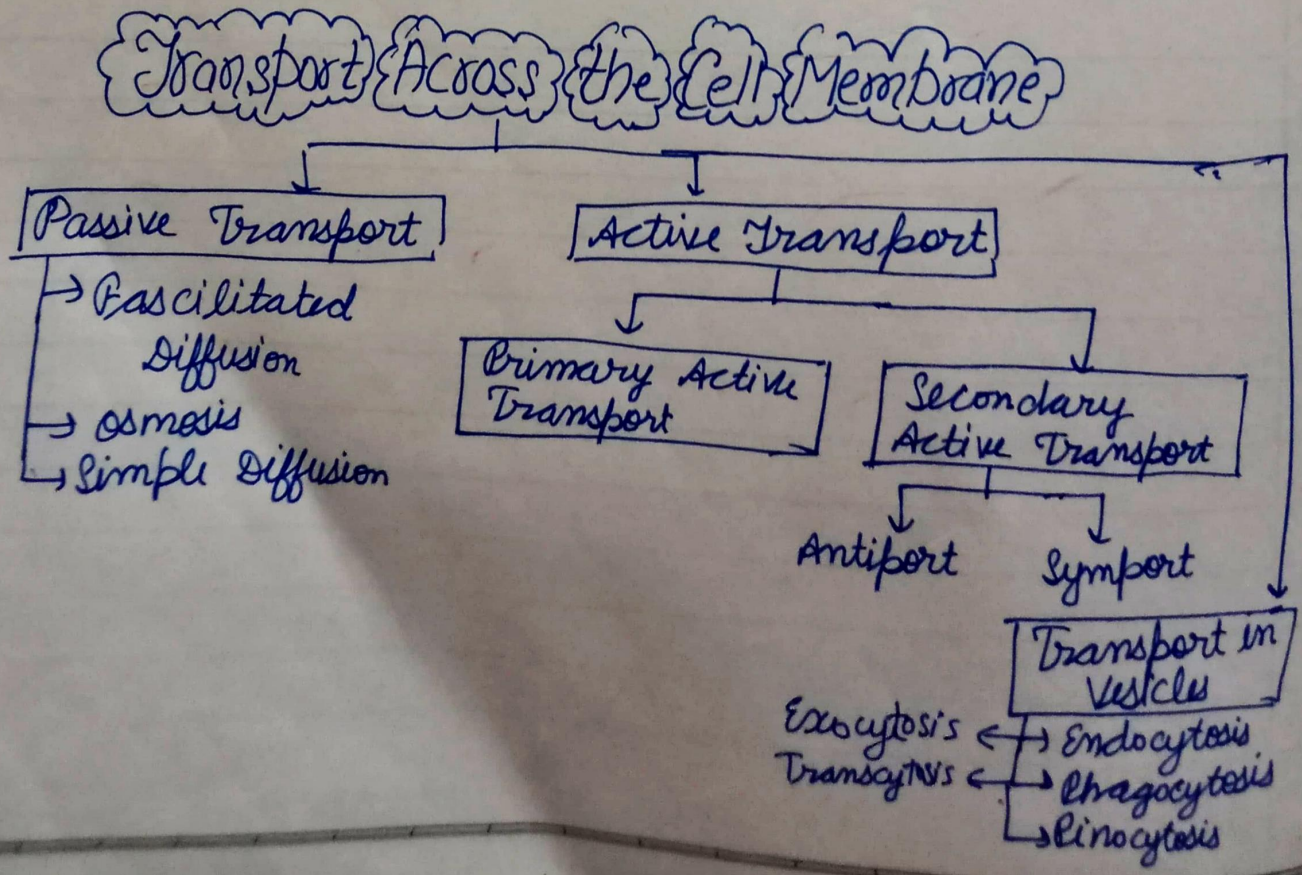
☆ Cell Membrane is also known as Plasma Membrane.

→ Transport of materials across the cell membrane is essential to the life of a cell.

→ Some substances must move into the cell to support metabolic Reactions.

→ Some substances also produce by cell membrane for export or as cellular waste product must move out of cell.

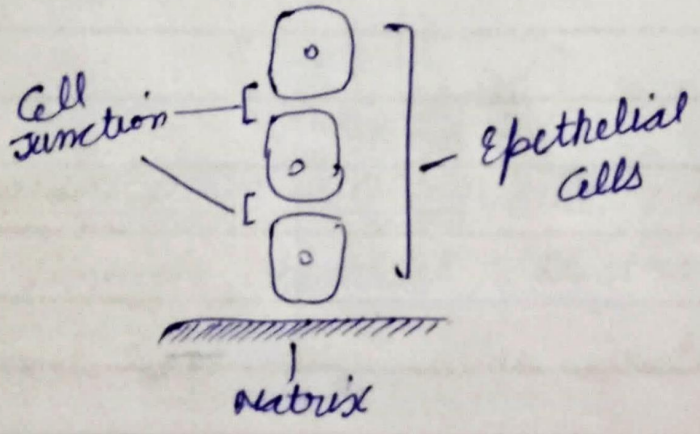
→ Substances transport across cellular membrane via transport processes



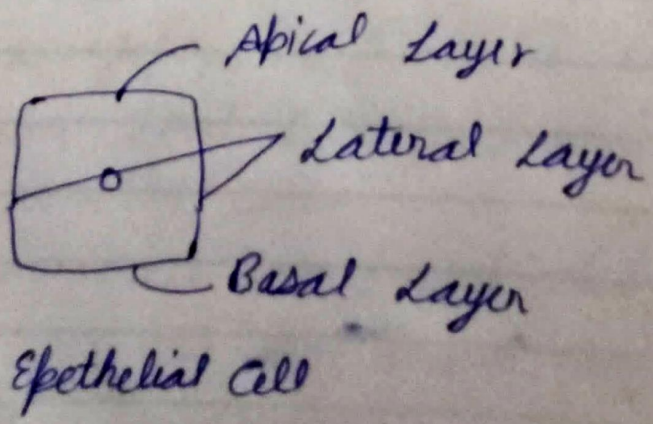
Cell Junction

The small ~~small~~ pores or space in between the cells (Epithelial cells) are known as cell Junction.

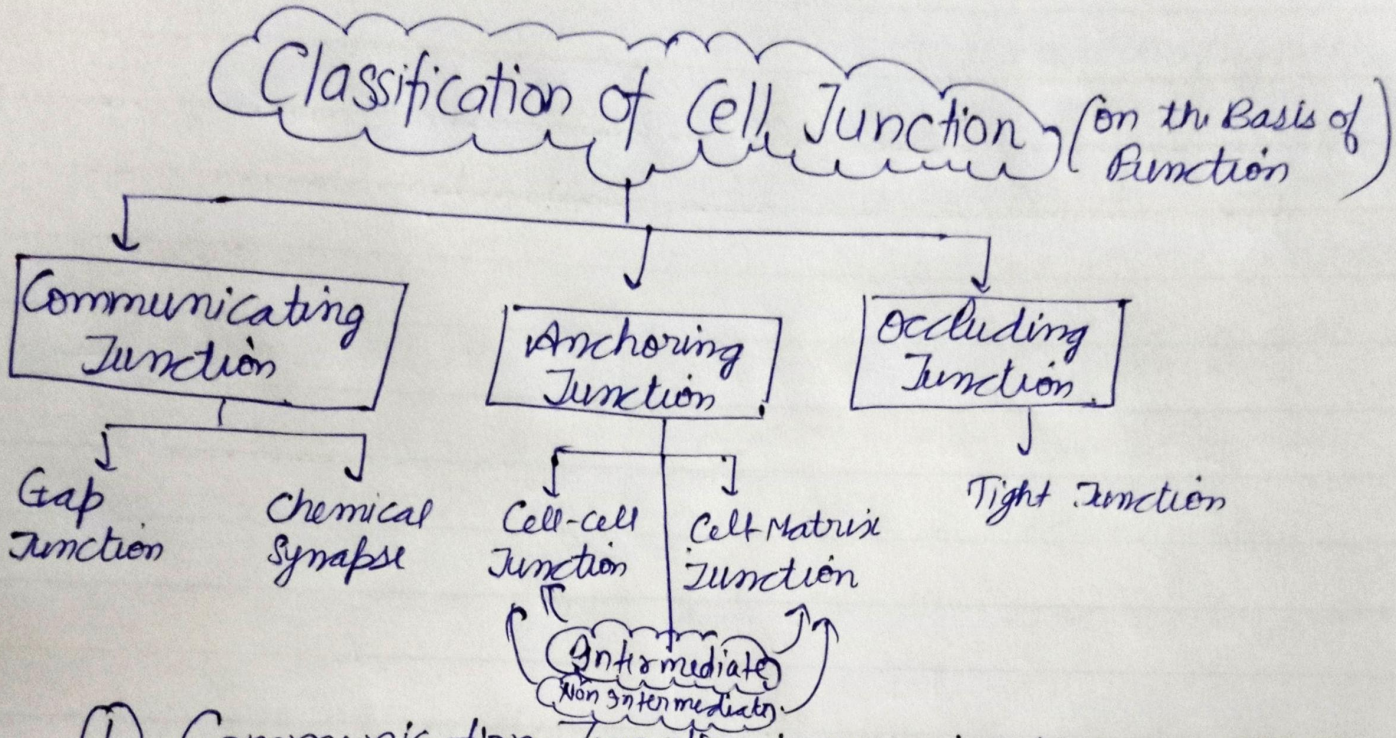
→ Para cellular Transportation occur through Cell Junction by transfer smaller particles from one to another side



→ An Epithelial cells having 4 sides, upper side is known as Apical layer, Base layer is known as Basal Layer and sides are known as Lateral layer.



→ Different sides / layers join and form cell Junction.



① Communication Junction :- There is passage of a signal through chemical, Electronotive signal etc.

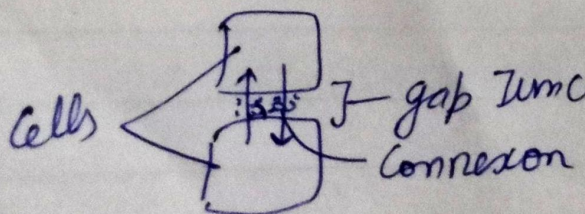
→ There is no any other material Tranport

Types

↳ Gap Junction :- There is some nox gap than other Junction between cells.

⇒ Between the gaps, some particles are present called Connexon that help to transfer signal from one to another cell.

⇒ 1000 dalton about can passed also.



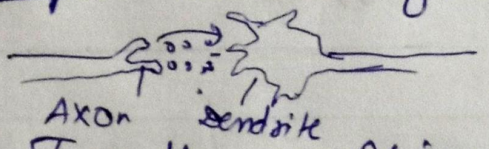
⇒ It is two way Signal Transfer means one to 2 and 2 to 1 Transfer in cells

↳ Chemical Synapse :- Attachment of Axon to dendrites (In Neuron)

⇒ It is one way Junction, Information/Signal Can transfer in only one direction.

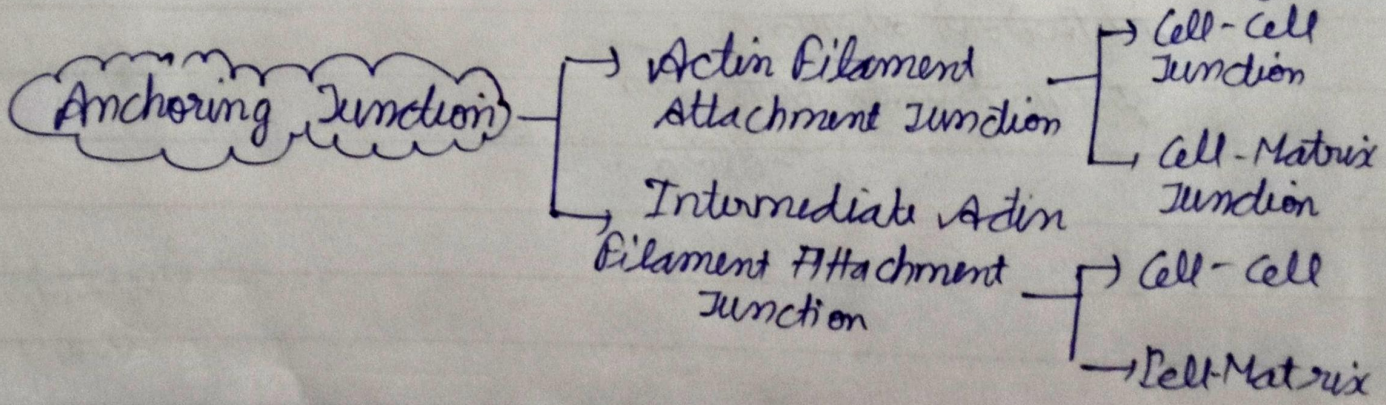
⇒ Axon release chemical massenges that binds to dendrites and transfer signal to next neuron.

⇒ Chemical Synapse can be found in Brain and Spinal Cord



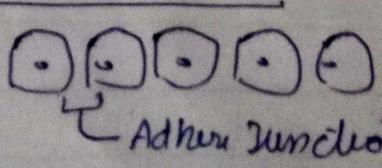
② Anchoring Junction :- It is a mechanically Attached Junction from cells to cells and cells with matrix.

→ Provide Strengthen to attachments of the organs.



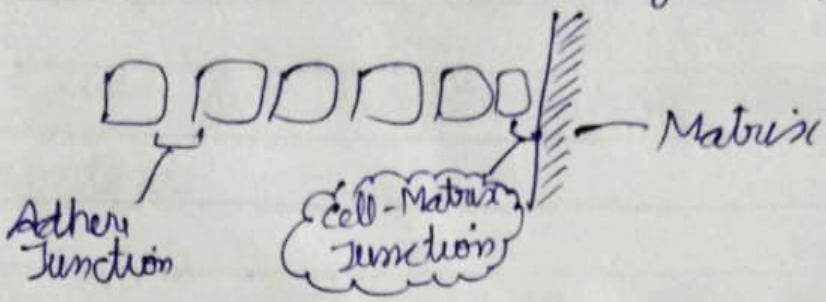
★ Actin-Filament Attachment Junction :-

↳ Cell-Cell Junction: Also known as adhere Junction



→ Cell-Cell Junction Attached with Protein.

↳ Cell-Matrix Junction : Cell-Attached to the Matrix (and) of the organs of Body



→ Also known as Focal Junction.
→ Cell and Matrix sticks or attached with the Integerins.

☆ Intermediate Actin-filament Attachment Junction :-

↳ Cell-Cell Junction - Also called Desmosome
→ Cells attached with Cadherin Protein

↳ Cell-Matrix Junction - Also called Hemi-Desmosome
→ Cell-Matrix attached with common Actin Protein.

(3) Occluding Junction :- Also known as Tight Junction.
→ Space between the cells is very small and Allow only few substances to transport.

Cell Signaling Pathway

Formation / Synthesis of the Signaling Molecule (when Stimli Achieved)

↓

Release of Signaling molecule from Synthesis Site to the Action Site.

↓

Detection (checking) and Binding of the Signaling molecule to the Specific Receptor

↓

Formation of Receptor - Signaling molecule Complex

↓

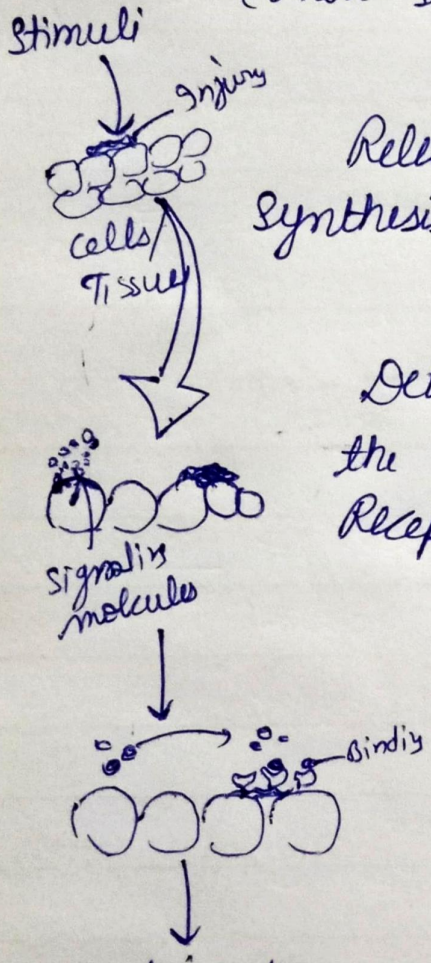
Action on Site

↓

Removal of molecule from Receptor after gain required Action.

↓

Response Termination



Action to destroy any Antigen like Virus, Bacteria etc at injury Site.

Cell Communication

Page No.
Date

Cell Signaling :- Also called Signal Transduction.

⇒ It is the ability for cells to respond to Stimuli from their Environment.

Example : Wound healing after injury.
Immune system response to Pathogens.

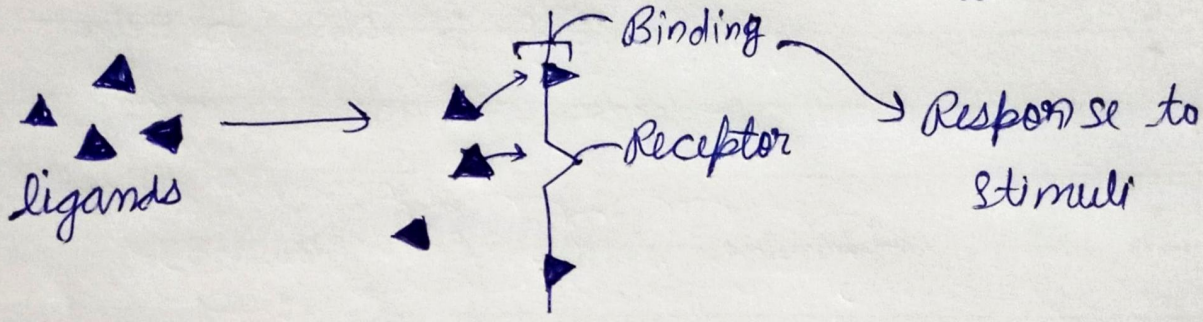
- **Intercellular Signalling** : communication between 2 cells.
- **Intracellular Signalling** : communication with in the cell.

★ Cell signaling is initiated by Signaling molecules called ligands.
Example - Insulin, human growth hormone, Lipids, amino acid etc.

★ These ligands can interact or attached with proteins or on target cells and produce response.
→ target cells or proteins are known as Receptors

→ Signaling molecule have unique charge, shape, size etc that help them to bind to specific regions on receptors-, having lock-Key like Interaction

Stimuli → ligands (Chemicals etc) Binds to → Receptors → Action to Stimuli



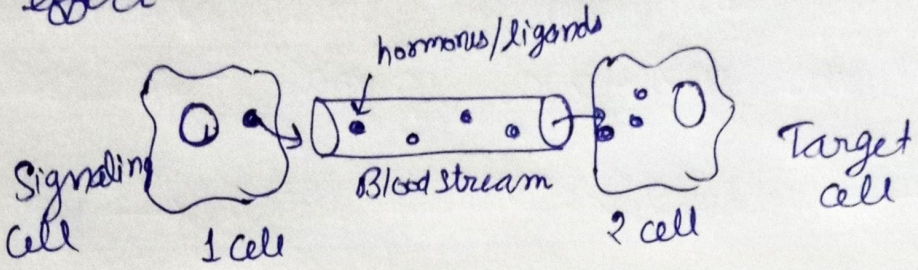
Types of Cell Signaling

- Endocrine → Long range Signaling
- Paracrine → Short range Signaling
- Autocrine → Self Activation
- Contact-Dependent → Direct Activation or Juxtacrine

Endocrine Signaling :- hormones or ligands travels long distances between Endocrine cells and dilute in the Blood Stream, then Binds to the Receptors.

Example :- Thyroid cells located in Thyroid gland.

→ Signal produces slower response but long lasting effect.



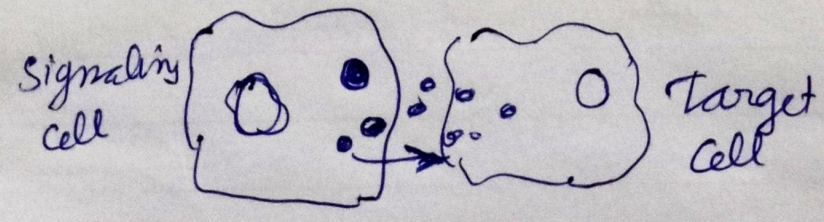
Endocrine Signaling

Paracrine Signaling:- The quick signal response having close locations of the 2 sites.

→ Paracrine signals move from Extracellular matrix/ out region or to the outer region for response.

Example:- An Inflammatory (सूजन) Response on the site of Injury or insect bite etc. through release of the hormones (ligands) have Inflammatory Action.

→ Process is quick and last for a short time.
→ The release hormones or Enzyme degraded/deactivate by neighboring all hormones.



* A cell targets a nearby cell

Paracrine Signaling

Autocrine Signaling :- In this, the cell targets itself

Signaling cell release the ligands and also Binds to itself.

→ Signaling and target cell are same, often occur during development of an organism (Early) to Ensure that the cells develop into the correct tissue.

→ It also regulates Pain Sensation and Inflammation response.

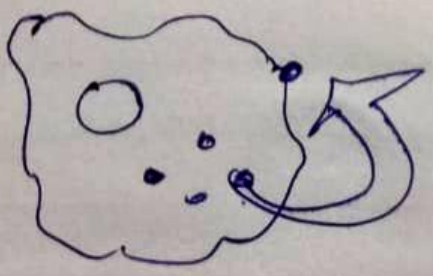
Exam- When any Virus attached to cell

↓

The Cell own and also neighbour cells release toxic hormones (ligands) and target on killing the Virus.

↓

Program cell death



Autocrine Signaling.

Contact-Dependent Signaling :- Also known as Juxtacrine Signaling.

⇒ Cells can Physically Interact or attached and Starts cell Signaling through gap Junctions or Transmembrane proteins.

⇒ The ligands generally bound to membrane of a cell and keep direct contact with Receptor of targd cell to deliver Signal.

Exam- Delta-Notch Pathway used in Embryonic Development.

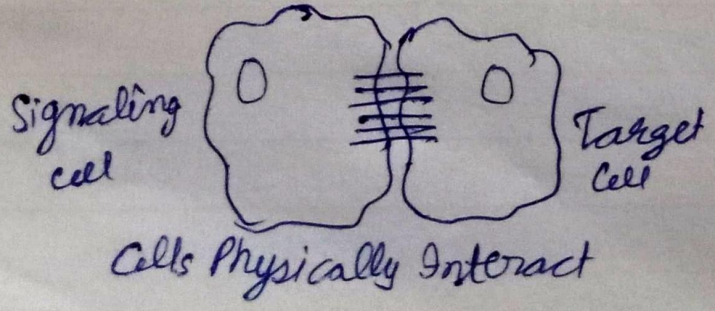
Delta is a transmembrane Protein (Ligand)

↓

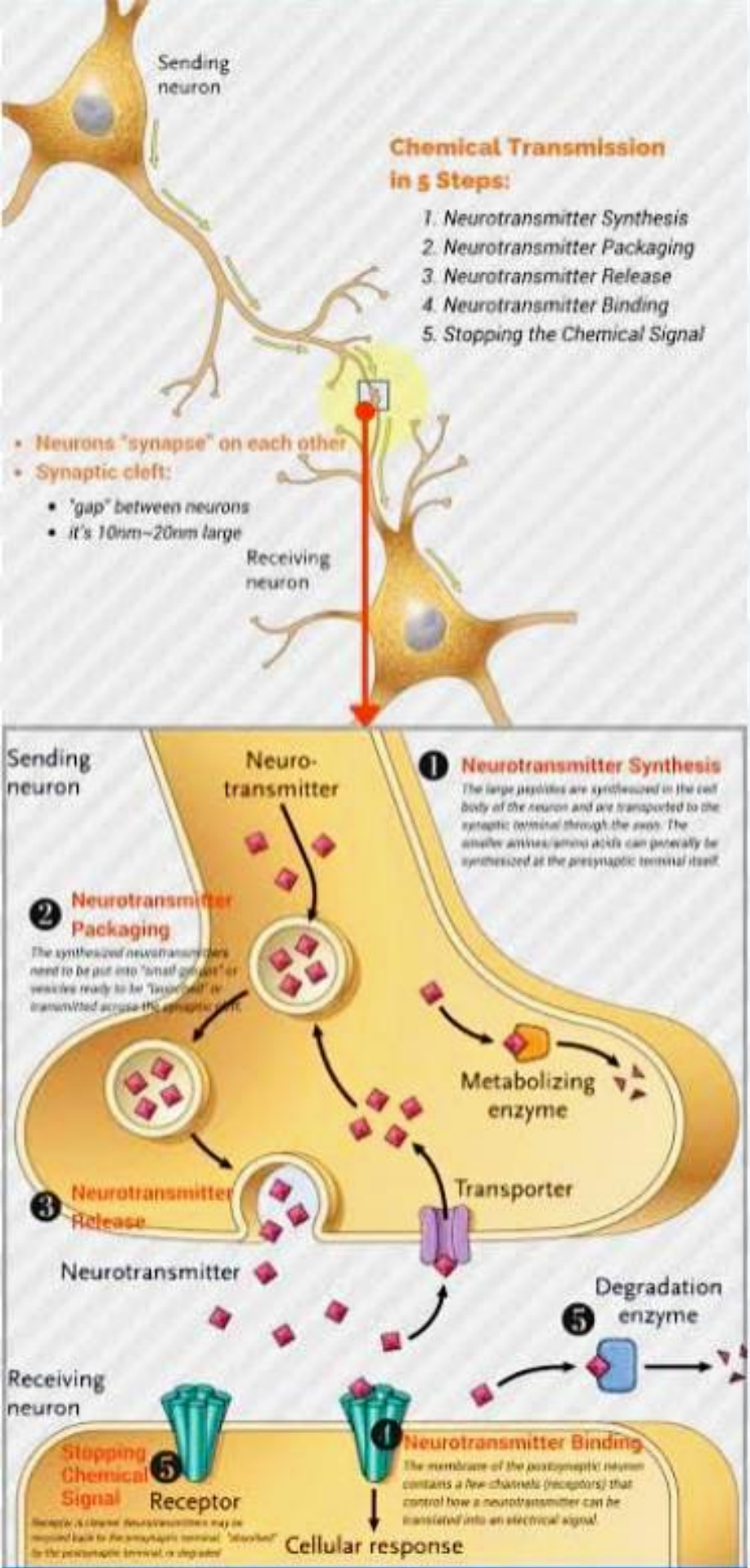
Binds to Notch, on receiving/Target cell

↓

Activation of transcription factor to upregulate the expression of genes needed in next developmental stage.



Contact-Dependent Signalling.


Sending neuron
Chemical Transmission in 5 Steps:
1. Neurotransmitter Synthesis
2. Neurotransmitter Packaging
3. Neurotransmitter Release
4. Neurotransmitter Binding
5. Stopping the Chemical Signal
• Neurons "synapse" on each other
• Synaptic cleft:
• "gap" between neurons
• it's 10nm~20nm large
Receiving neuron
Sending neuron
Neuro-transmitter
1 Neurotransmitter Synthesis
The large peptides are synthesized in the cell body of the neuron and are transported to the synaptic terminal through the axon. The smaller amines/amino acids can generally be synthesized at the presynaptic terminal itself.
2 Neurotransmitter Packaging
Metabolizing enzyme
Transporter
3 Neurotransmitter Release
Neurotransmitter
Degradation enzyme
5
Receiving neuron
4 Neurotransmitter Binding
The membrane of the postsynaptic neuron contains ion channels (receptors) that control how a neurotransmitter can be translated into an electrical signal.
Stopping Chemical Signal
5
Receptor
Cellular response