TOPICS
Discovery, Cell theory
Basic details of cell, cell membrane
cell wall, Endomembrane System
ER
Golgi bodies
Lysosome
vacuole
Mitochondria
Plastids
ribosome
cytoskeletal Elements
Nucleus
Chromosome
Microbodies

What is cell ?

↓

chamber / compartment

Liquid - H_2O
chemical reaction
compartment
Inner environment

cell is a compartment which separate inner environment (chemical reaction) with outer environment (water)

what is required to make cell

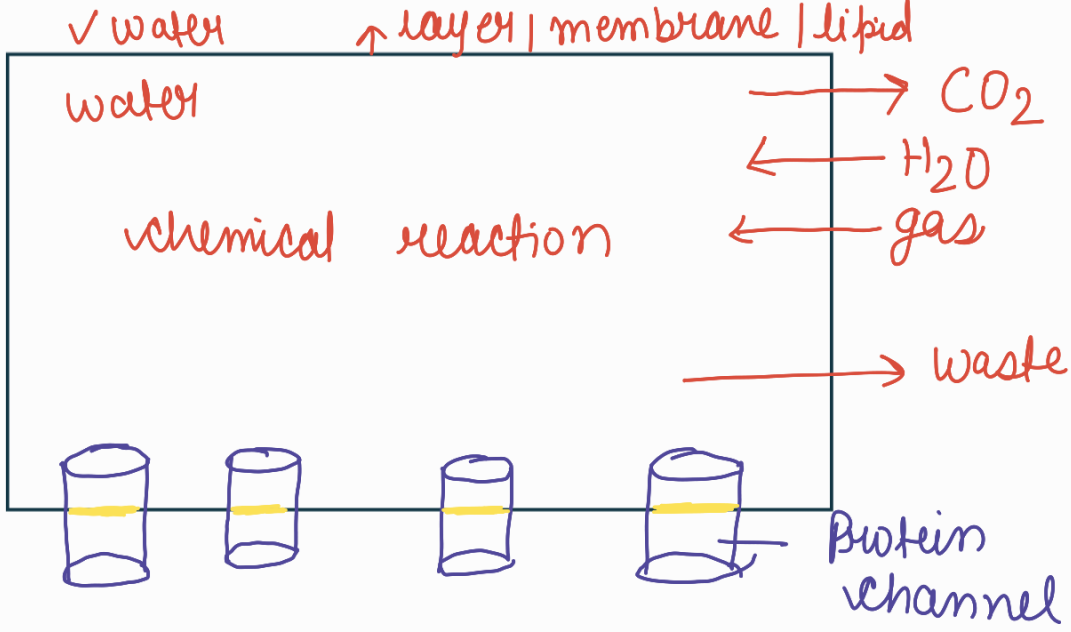
↓

1. Separation from outer environment (with the help of lipid layer)

2. Exchange from outer environment / - Exchange directly

(H_2O, gas) ↳ water soluble move by channel.

3. Genetic material - DNA Double stranded require Information store for all reaction inside cell



so in all cells basic requirement is

1. Membrane
2. Transport protein on - Exchange membrane
3. Genetic material - In all cells ds DNA

Definition of cell

Fundamental structural and functional unit of living organisms.

why cell is smallest unit of life → because presence of unicellular organism.

(a) unicellular organism independent existence

(b) Single cell can perform all function

Mitochondria - not have independent existence so that's why it is sub cell.

unicellular organisms are capable of
1. Independent Existence
2. Performing the essential functions of life

Note: - anything less than a complete structure of a cell does not ensure independent living

Discovery of cell

Robert Hooke - dead cells → 1st cell observe by Robert Hooke → Bark of stem → cork cells (dead)

Anton von Leeuwenhoek first saw and described a live cell - (protozoa, Bacteria, spermatozoa, RBC)

↳ with the help of microscope.

Robert Brown → nucleus

Note :- 1950s → Electron microscope available than detail structure of organelle and cell observe

cell theory

Matthias Schledien (German Botany) → observe many plants → all plants are made up of plant cells which form tissue..

Schwann (1839) British zoologist

(a) Animal cell observe → Presence of plasma membrane

(b) Observe many plant cell → cell wall present

(c) proposed → all living organism is made up of cell and its product

Scheilden and Schwann formulated cell theory.

Scheilden and Schwann — drawback
(not able to tell, how new cells arise)

Rudolf virchow → 1955 → cells divided and new cells are formed from pre-existing cells

(Omnis cellula - e- cellula)

Modify cell theory

① all organism is made up of cell & its products.

② all cells arise from pre-existing cell

Exception of cell theory ⟶ Virus

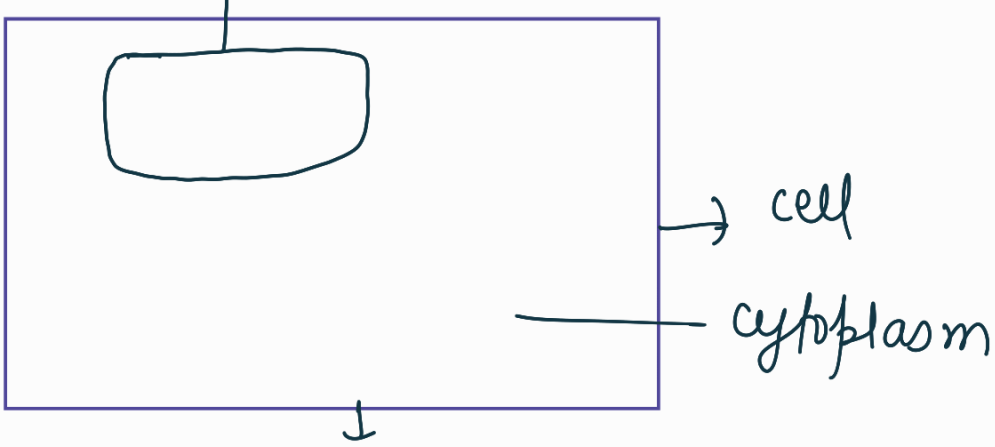
some detail about cell

Type of cell → Prokaryotic cell (always unicellular)
Example → Bacteria
→ Eukaryotic cell

Feature of all Eukaryotic cell

① Membrane bound organelle → ER, Golgi bodies, mitochondria, vacuole (membrane - lipid)

② compartmentalization →
↳ chamber organelle



Prokaryotic cell

A → B B → C
C → D
P → Q

Eukaryotic cell

P → Q

K → U
P → N

A → B B → C

Organelle / compartmentalization

Nucleus (DNA)

Eukaryotic cell

unicellular organism

Example → Protista

Multicellular

Plant cell
↳ Plastids present
↳ Sap vacuole present
↳ centriole absent
↳ cell wall present

Animal cell
↳ Plastids absent
↳ Sap vacuole present
↳ centriole present
↳ cell wall absent

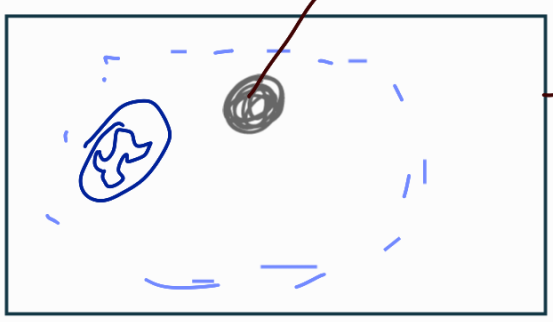
(1) cytosol (liquid)

(2) cytosol + organelle = cytoplasm

nucleus

(3) cytosol + organelle + nucleus = protoplasm

4)



organelle + cytosol + nucleus + membrane

→ Protoplast + cell wall → Plant cell

Protoplast = Protoplasm + membrane

Protoplasm = nucleus + cytoplasm

cytoplasm = Organelle + cytosol

cytosol = liquid - (chemical reaction occur)

Q - Glycolysis occur in

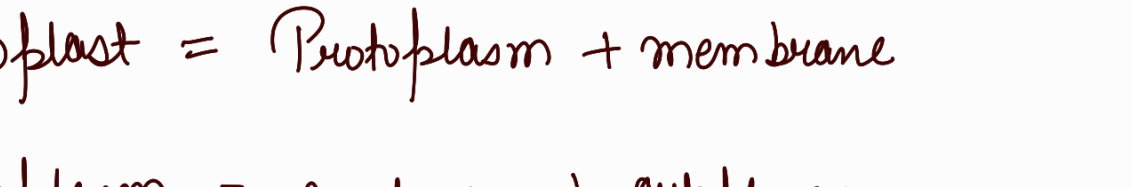
✓a cytosol (b) organelle (c) protoplasm

(d) cytoplasm

Q Kreb cycle occur in

(a) cytosol ~~(b)~~ cytoplasm (c) Nucleus (d) cellwall

membrane presence or absence in Eukaryotes



Without membrane

- Ribosome (plant cell, Animal cell, Bacteria cell)
- centriole (animal)
- Nucleolus (plant & animal cell)

Single membrane

- Vacuole / lysosome
- Peroxisome
- ER
- Golgi body
- Eukaryotic flagella & cilia

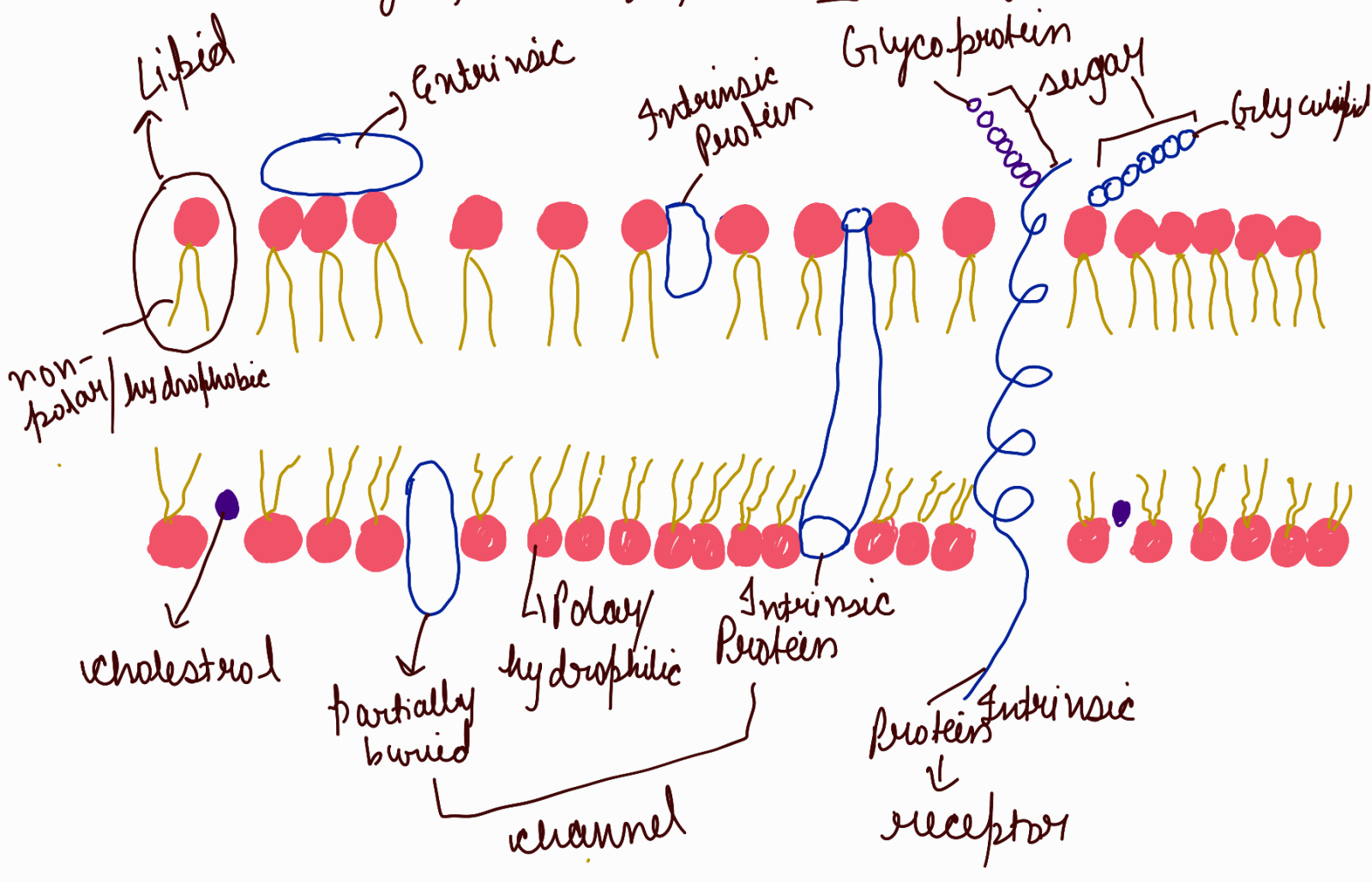
Double membrane

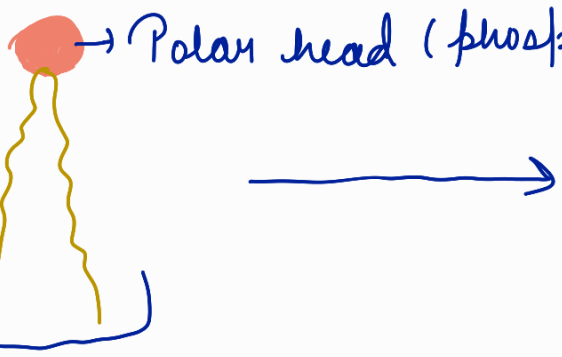
- Nucleus
- Mitochondria
- Plastids (chloroplast)

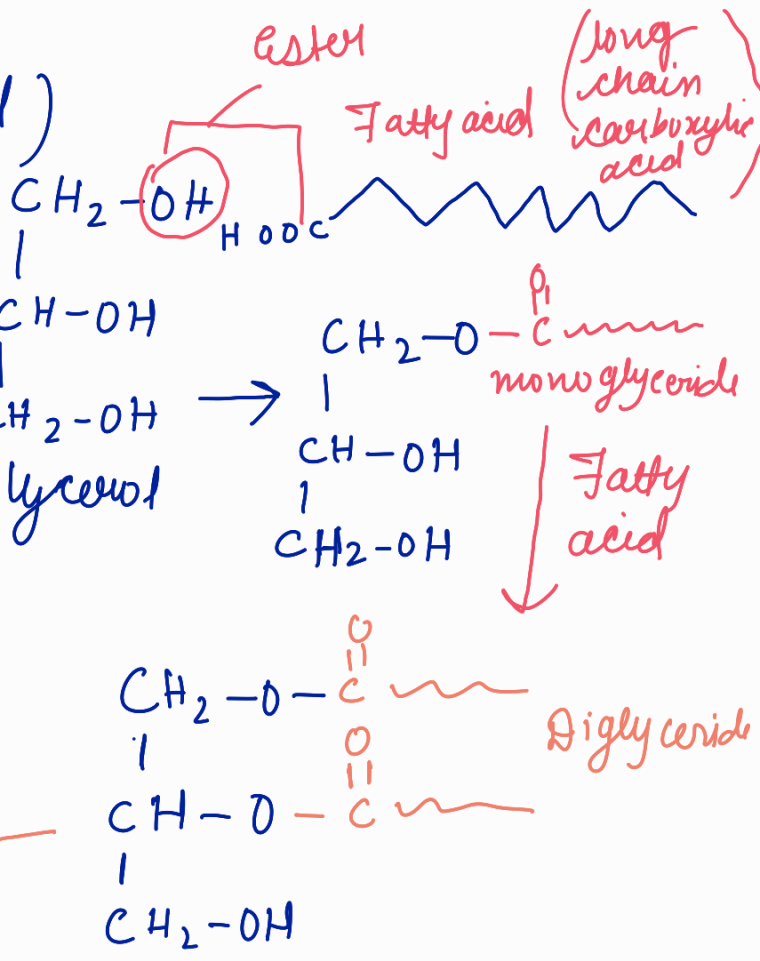
Plasma membrane

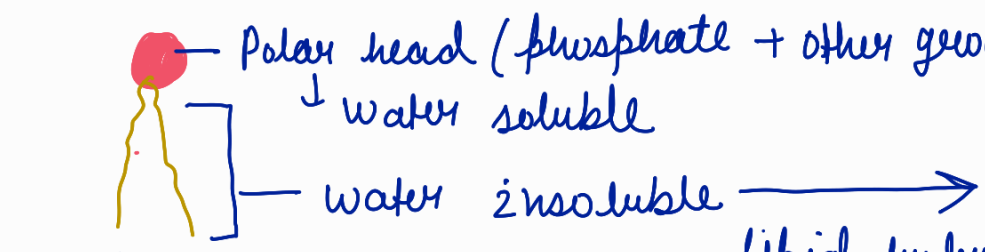
- Present in all type of cells
- living structure → consider (active role in transport)
  (cell wall = non-living)
- Structure → chemical structure
  analyse - similarity in different cell.
- chemically - phospholipid (Bilayer) + ~~proteins~~ + oligosaccharide
  + cholesterol Glycolipid, Glycoprotein

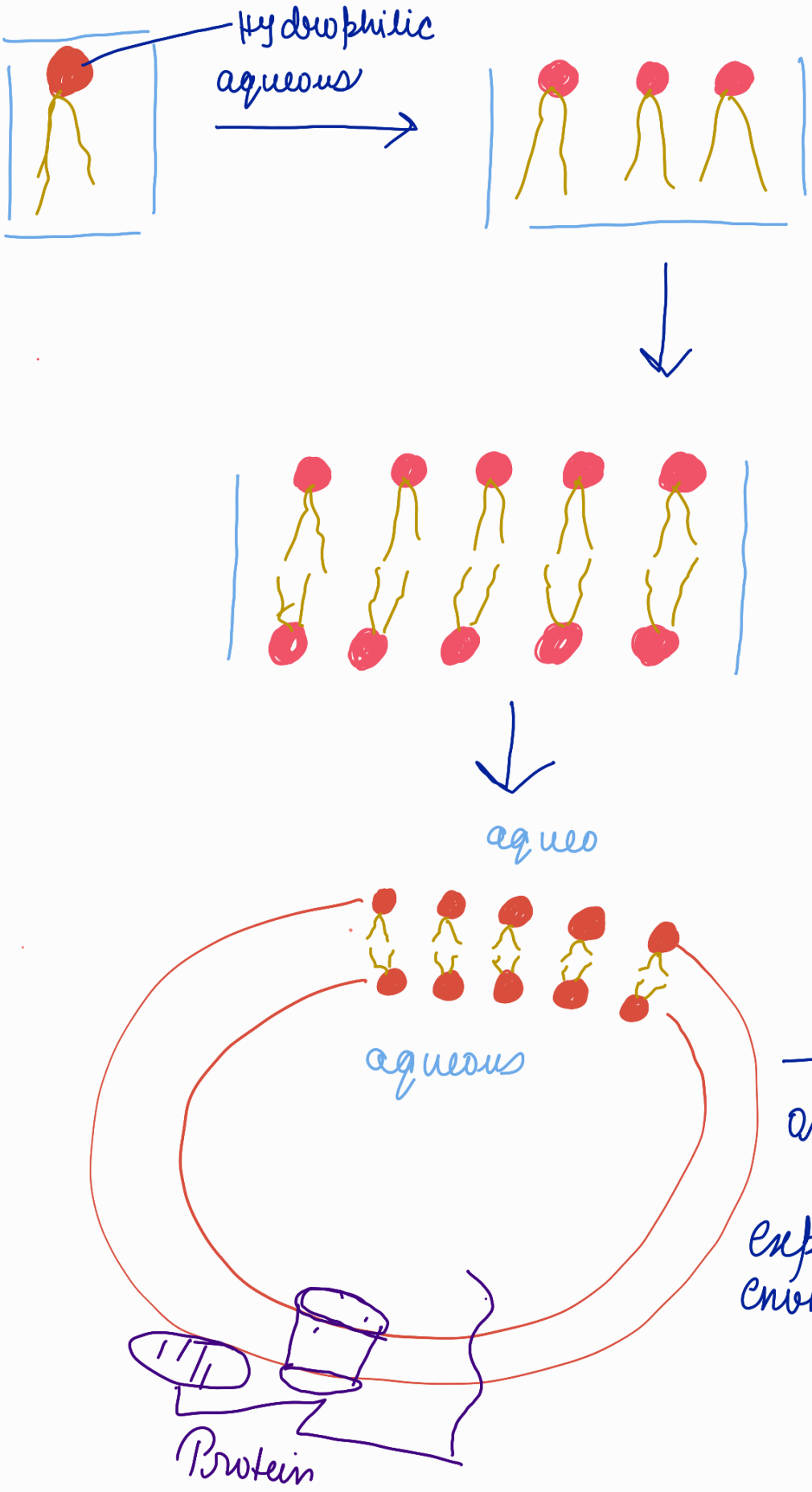
Structure → Lipid = phospholipid (Polar + non-polar part)
Bilayer
Protein
Glycolipid + Glycoprotein] antigen











→ In this structure only polar part is expose to aqueous environment

Structure of membrane

1) Lipid present → phospholipid → hydrophobic tail (Fatty acid) present inside & polar head expose to aqueous environment.

2. Proteins → On the basis of ease of extraction →

Two types of protein

(a) Extrinsic (less amount) – on both surface (Extracellular cytoplasmic)

(b) Intrinsic → difficult to remove → partially buried, completely buried

completely buried → channel, pump, receptors

(c) Glycolipid → oligosaccharide attach on surface of lipid

(d) Glycoprotein → oligosaccharide attach on surface of protein

(e) cholesterol (amino cell)

Discovery of structure

↳ Detail structure – study only after discovery of electron microscope (1950s)

↳ To study plasma membrane, you need to isolate plasma membrane

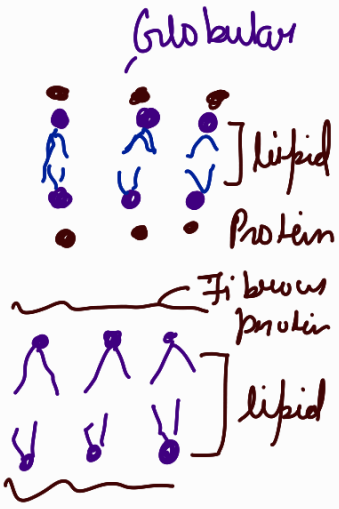
(1) chemical analysis of RBC → ER X
mitochondria X
Nucleus X
(no other membrane)

Membrane analysis
↳ 40% lipid
↳ 52% Protein
↳ 8% other carbohydrate

Note:- amount of lipid & protein vary according to cell & organelles

Membrane model → Explain how lipid & protein are arrange

1. Daniel Davison → Sandwich model - Protein - lipid - protein



2. Robertson → unit membrane → P-L-P

3. Fluid mosaic model → 1972 Singer & Nicholson

Fluid mosaic model

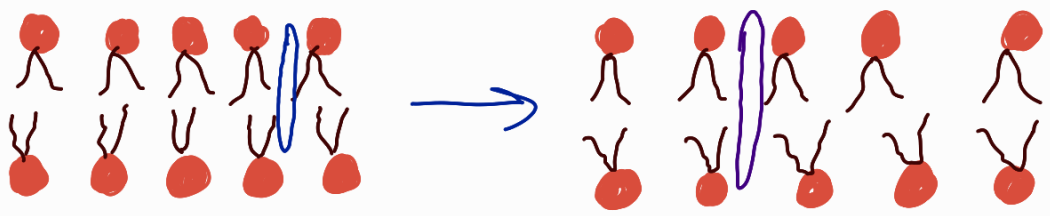
arrangement of lipid & protein

↳ Lipid bilayer + proteins are in form of ice bergs in form present oceans of lipid

↳ Nature of lipid is → Quasi fluid (not solid)

↳ This quasifluid nature able to explain many functions (secretions, Endocytosis, Growth & cell division)

Protein lateral movement ← Protein can show lateral movement which is measure Fluidity



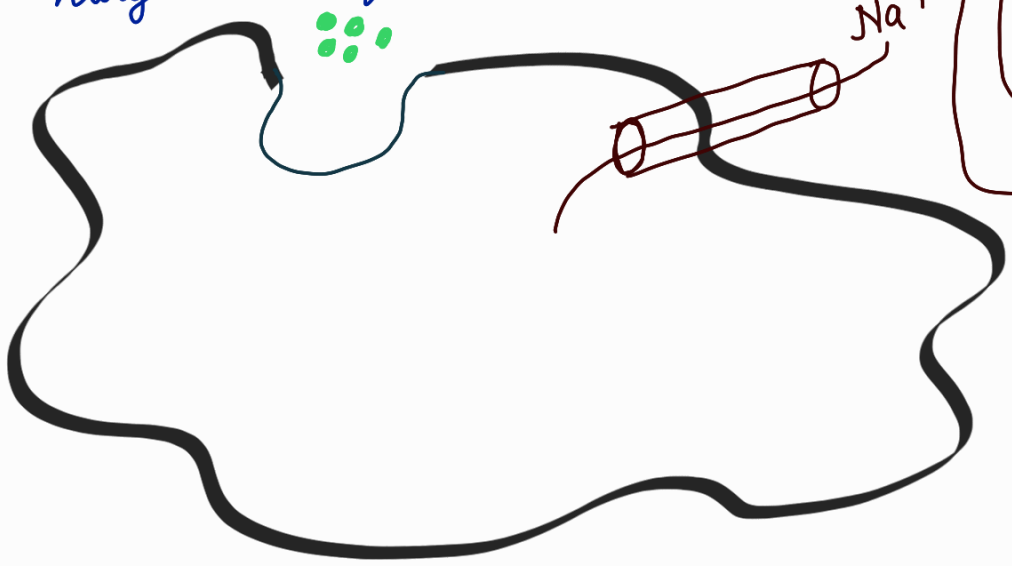
(Lipid can also show flip flop)

Note:- For best fluidity unsaturated fat is perfect.

Function of membrane → Explain with the help of Quasi fluid model
Secretion, Endocytosis, Growth, cell division, Interaction

Transport across membrane

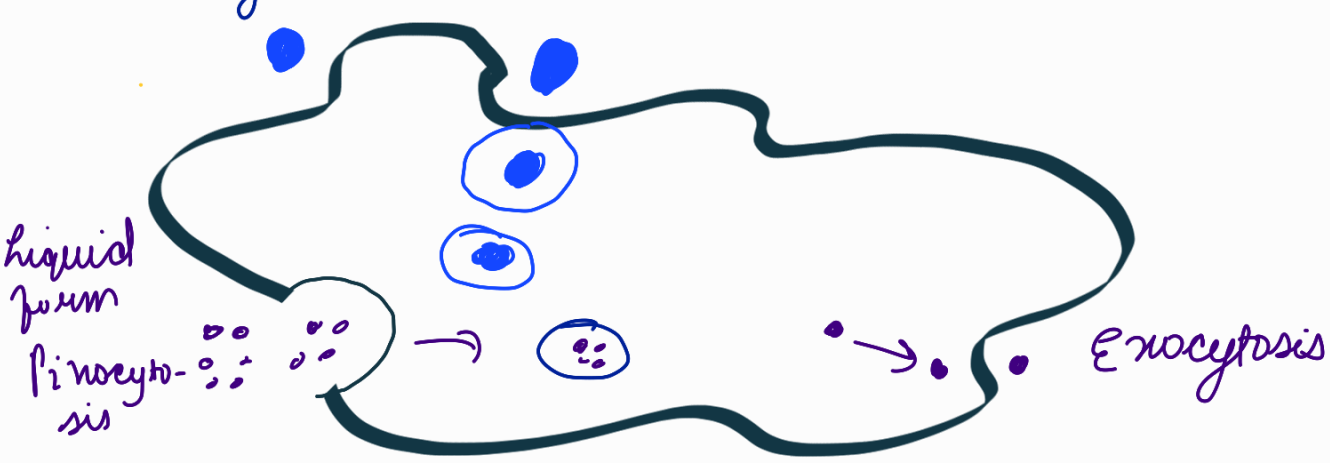
- Bulk Transport (large amount food)
- Specific transport
  - Gas
  - water
  - non-polar
  - Polar molecule



Bulk transport

- Endocytosis
  - Phago - Solid form endocytosis
  - Pino - liquid form endocytosis
- Exocytosis → thrown out from cell

Phagocytosis – cell eating
Endocytosis



Specific Transport → Direct move (Gas, water, non-polar)

(Partial pressure)
Diffusion
Gas (O_2, CO_2)

H_2O (osmosis)

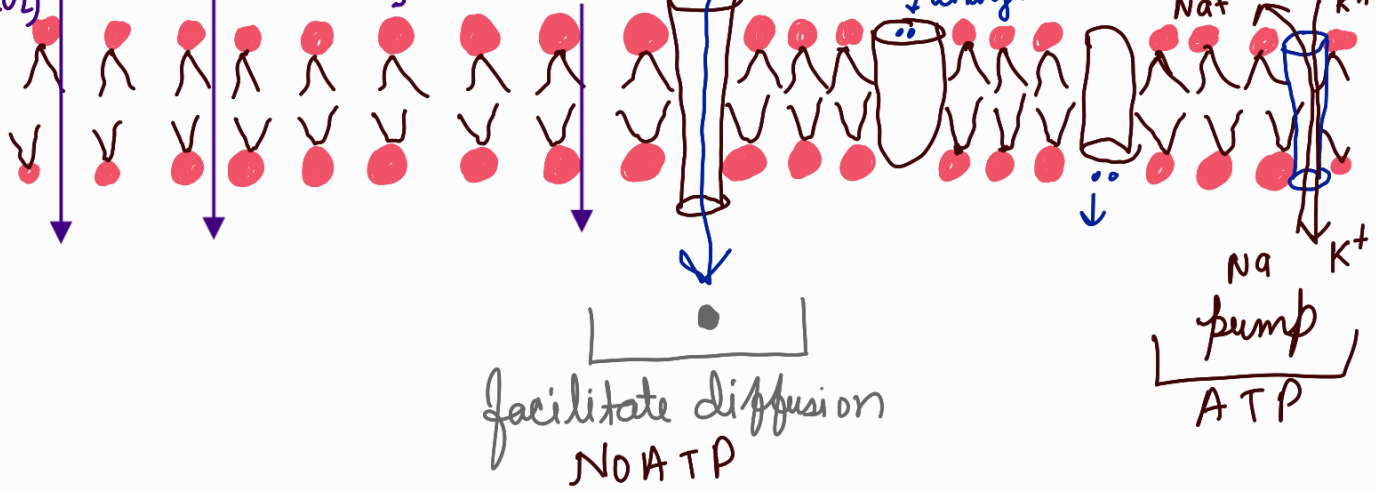
(non-polar steroid hormone)

Polar – Glucose, Na^+ – channel / carrier (facilitated diffusi

Glut 4

charge

Na^+ K^+



Na K^+ pump
ATP

facilitate diffusion
NO ATP

Summary

	Name of transporting molecule	type of transport
1.	Gas	
2.	Water	
3	Non-polar	
4	Na^+	facilitated diffusion
5	Glucose	facilitated diffusion
6.	Na^+ K^+	pump

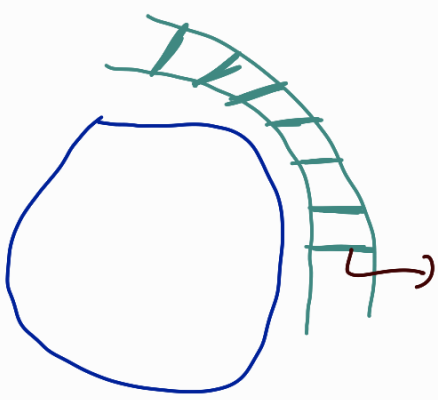
cell wall

Present in cell → Fungi (chitin) (polymer of NAG) & plant cell (major component of cell)

other cell also have cell wall (Bacteria, protista)

living or non-living → cell wall is a non-living part of cell (secreted by cellulose).

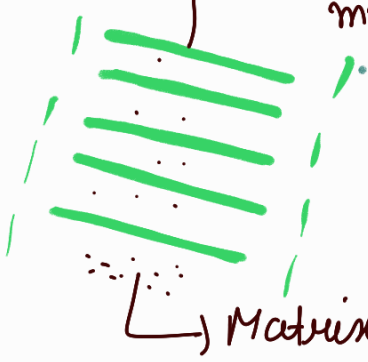
Algae cell wall

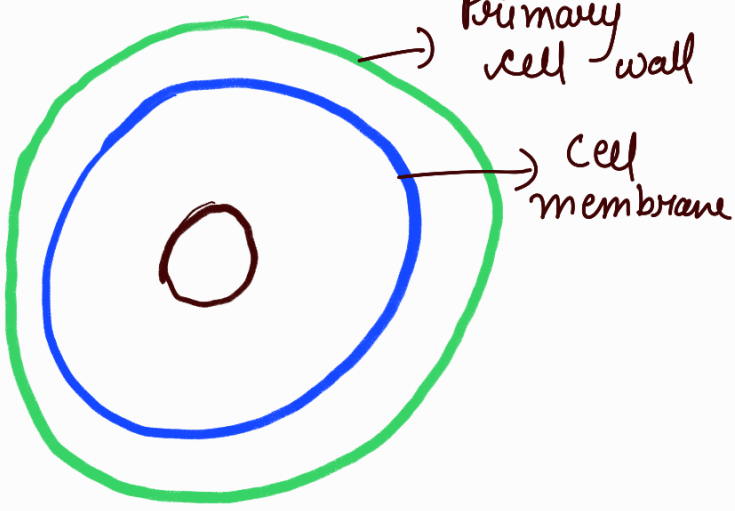


→ cellulose (main component)
+
Galactans
Mannans
$CaCO_3$ (stiffness)

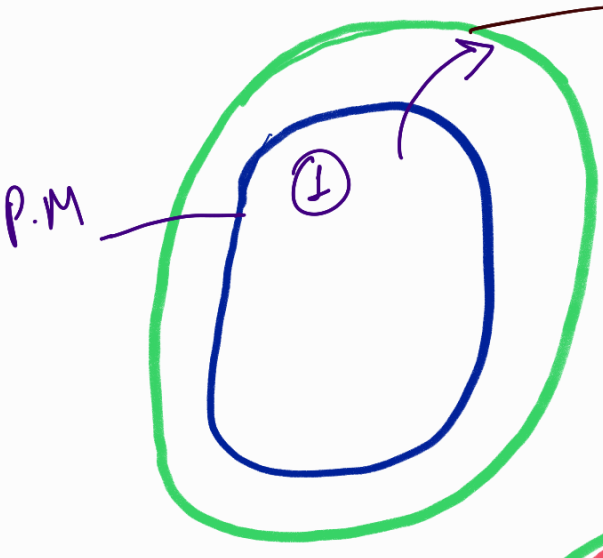
Plant cell wall

Chemical composition

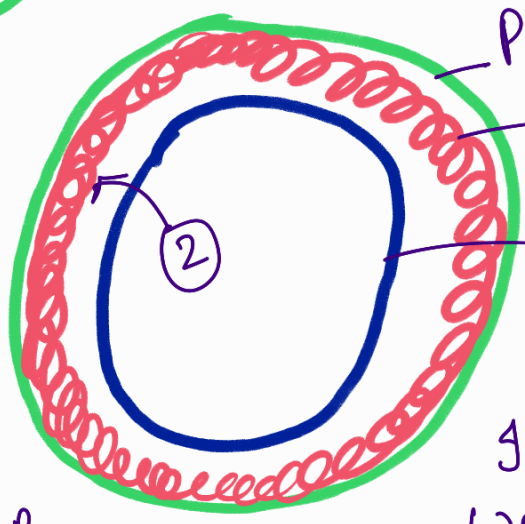




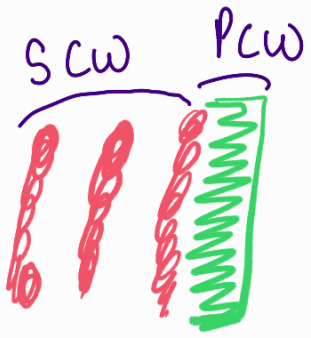
(pectin + Hemicellulose + protein) — Primary cell wall (1)



PCW (primary cell wall)
↳ elastic & growth slow
↓
cell release chemical to synthesis primary cell wall + Intussusception



Inner to primary cell wall between cell membrane & primary cell wall



Note :⇒ when SCW form some part of PCW also get utilised

(some material deposit in PCW - (Accretion)

(2) Secondary cell wall → chemically → cellulose + Pectin or lignin or cutin

Example of cell with PCW → meristematic parenchyma

SCW → Fibre vessels, tracheids, collenchyma sclerenchyma

Role of cell wall

(1) Provide shape

(2) Give rigidity

(3) Give protection from macromolecule & infection

(4) Prevent from osmotic lysis

Comparison

	PCW	SCW
Location →	Inner to middle lamellae	Inner PCW & cell membrane
chemical →	cellulose, Hemicellulose Pectin, Protein	cellulose + lignin or cutin
Growth occur or not	Yes	No
Pits	No	Yes (deposition absent)
	Present	less watery
Amount of water	Growth (Intussceptional)	Accretion- deposition in already form structure

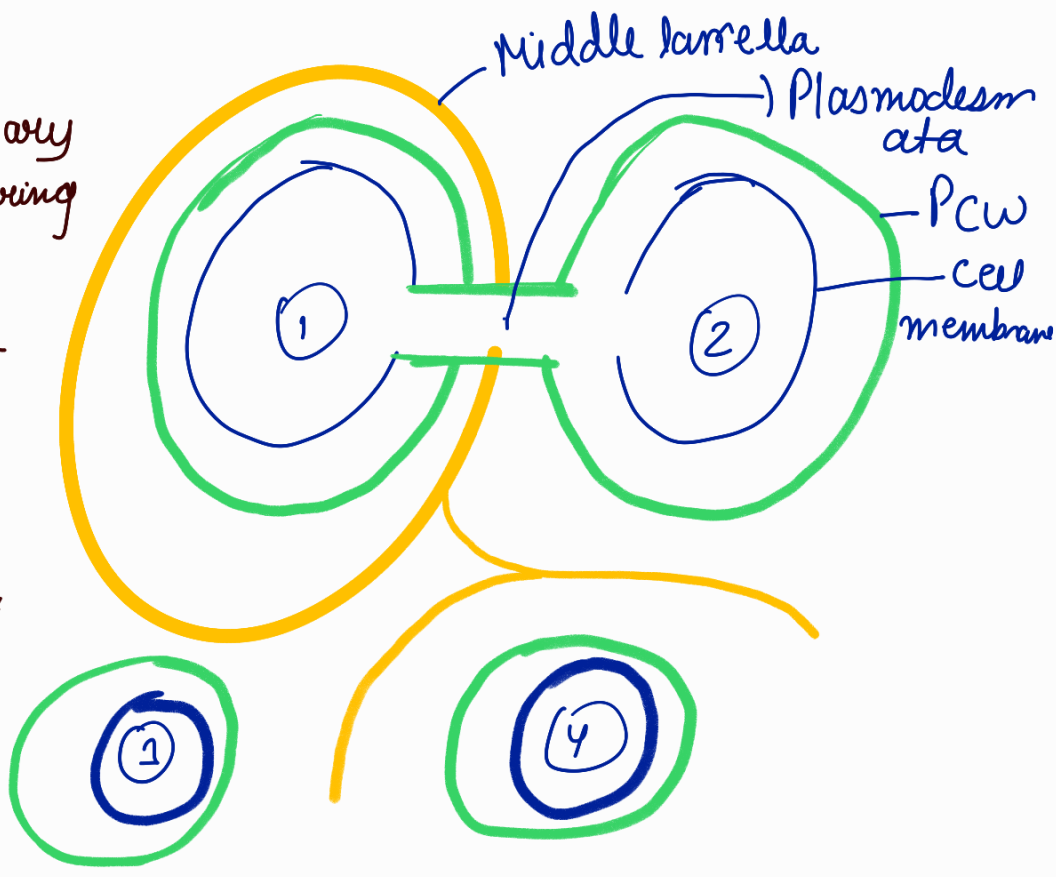
Middle lamellae

Location → B/w two primary cell wall of neighbouring cell.

It is absend on free surface

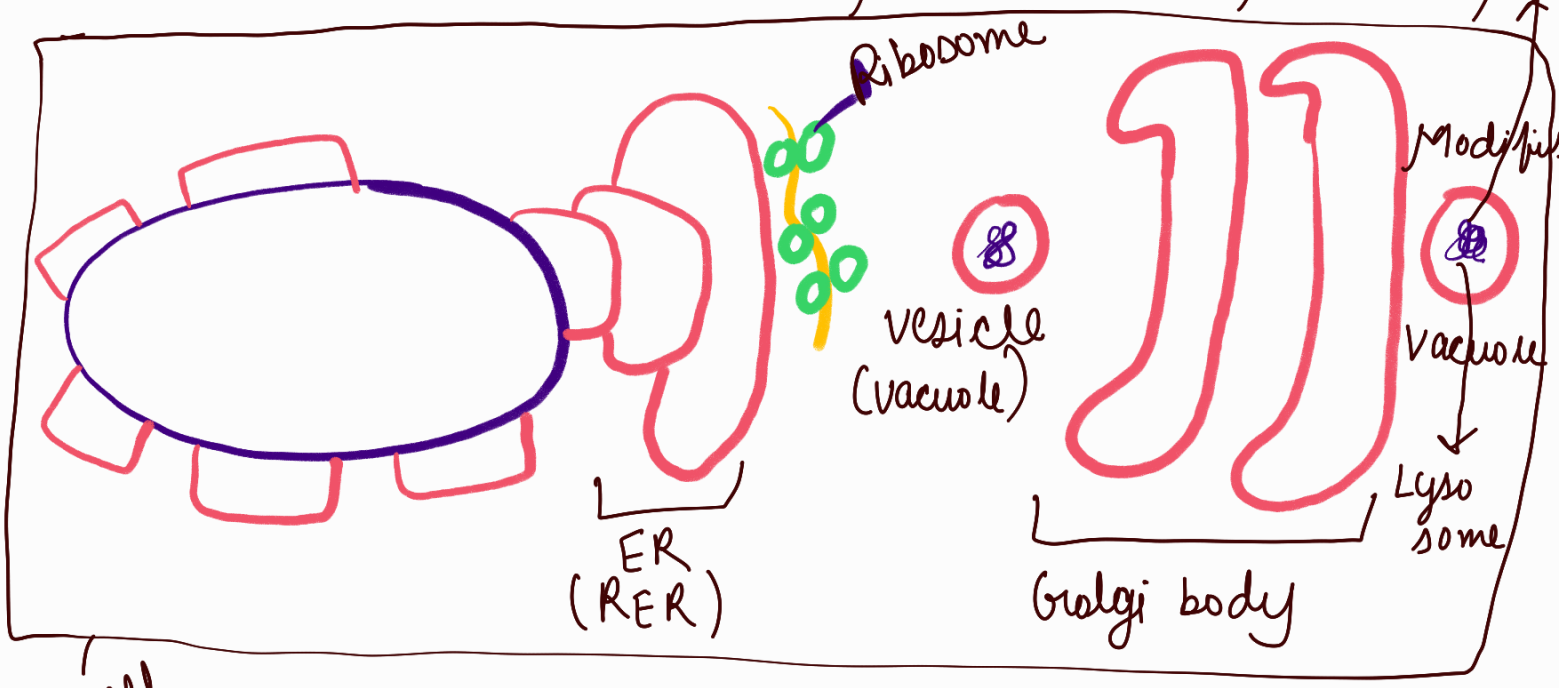
chemically - calcium pectate & Magnesium pectate

Role - It glue / attach neighbouring cell



Enzyme = Polygalacturonase - Digest middle lamellae (Ripening of fruit)

middle lamellae - absent in plasmodesmata (plant cell)



Endomembrane System

↳ Eukaryotic cell → membrane bound organelle present

↳ Some organelle have membrane + function coordinated

Organelles = membrane + function coordinated

↳ ER
↳ Golgi body
↳ Lysosome
↳ vacuole / vesicles

→ Endomembrane system

Note:- Mitochondria, plastids, peroxisome - is not part because work is not coordinated

Ribosome is also not part + No membrane

Endoplasmic Reticulum

Inside → Protoplasm

membrane [Inside cell membrane system]

Visible in → Electron microscope

Type → RER → Rough Endoplasmic reticulum (Ribosome)

SER → Smooth endoplasmic reticulum

Compartment → ER divide cytoplasm into two compartment

(a) luminal compartment → Inside lumen of ER

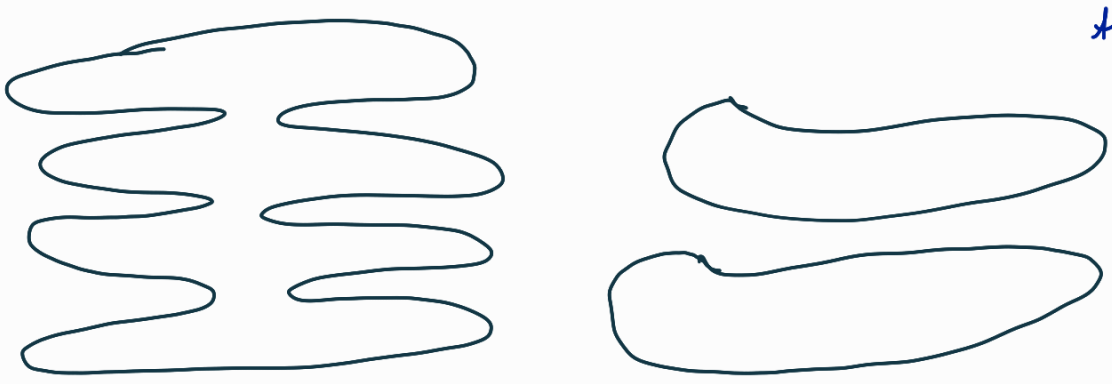
(b) cytoplasmic compartment.

Biosynthesis

↳ Nuclear membrane → RER → SER

Structure → RER → mainly tubule [RER can have – vesicles, cisternal, tubule]

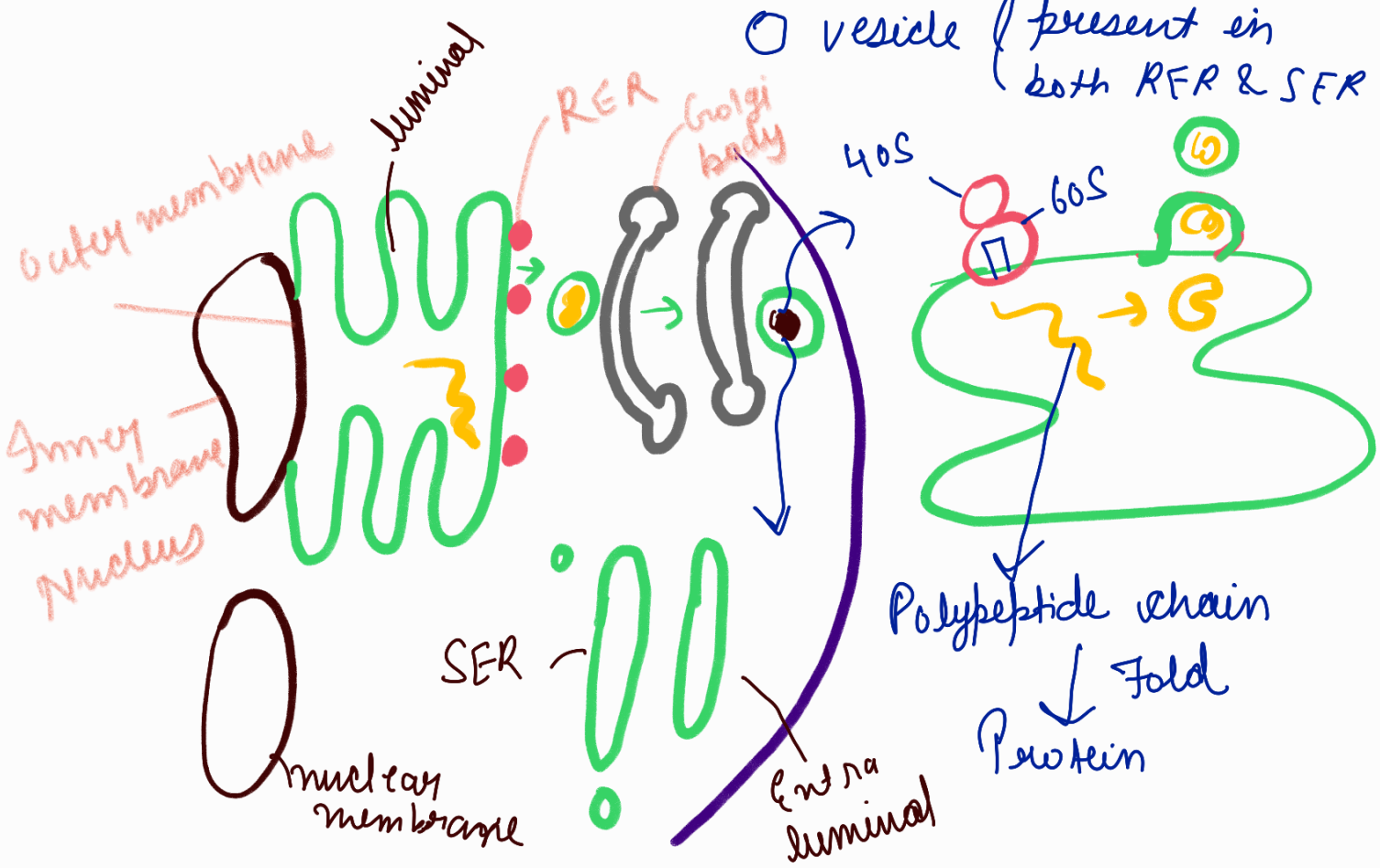
SER → mainly cisternal [SER can have – vesicles, cisternal, tubules]



Tubule

cisternal

○ vesicle (present in both RER & SER)



Role Of ER

(1) RER → (a) protein folding inside lumen of RER

(Ribosome large subunit bind on ER)

[large no. of RER present in those cells which involve in protein synthesis) →

Enzyme form

(2) SER – Lipid synthesis in cell

↳ Steroid hormone produce inside SER (testosterone, progesterone, Estrogen

↳ Liver cell → have large no. of SER

(a) detoxification (cytochrome P_{450}) → of drugs, alcohol, pollutant

(b) Glycogen synthesis

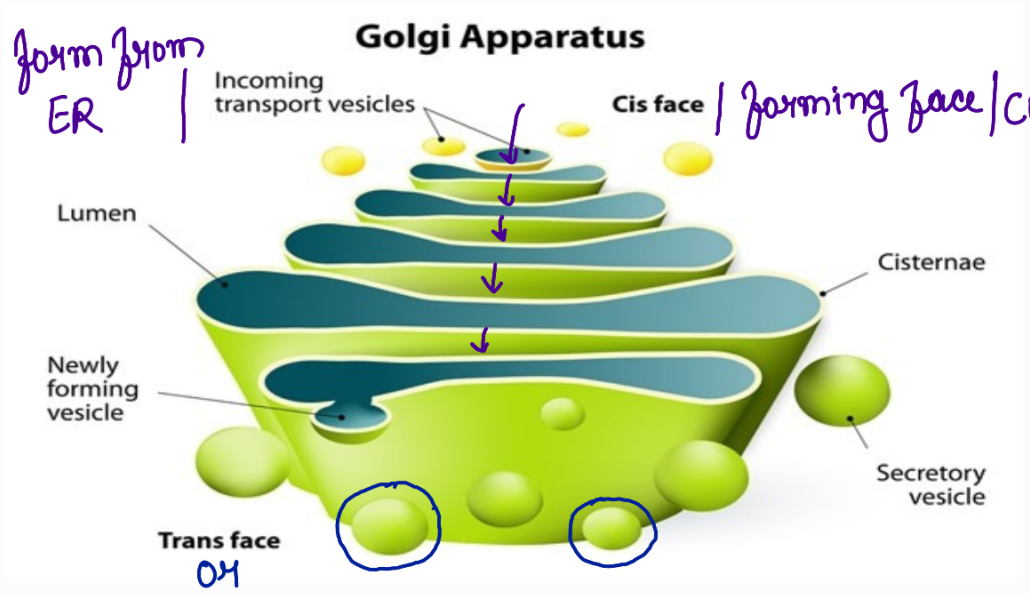
(c) Muscle cell → Sarcoplasmic reticulum

⇒ Golgi body → Postman or Post office of the cell

- By camillo Golgi (1898)
- densly stained reticular structure around the nucleus
- Plant Cell → Dictyosomes present
- In Eukaryotic cell only Exception
  a) Mature sieve tube
  b) Mature mammalian RBC
  c) Sperm of Bryophytes and Pteridophytes

- Absent in prokaryotic cells
- cisternae

1. No ribosome
2. Resemble SER
3. flatenned s are like structure
4. number: vary (4-8)
   - In fungi - 1 cisternae → unicisternal Golgi
   - vesicles directly behave as lysosome

- 

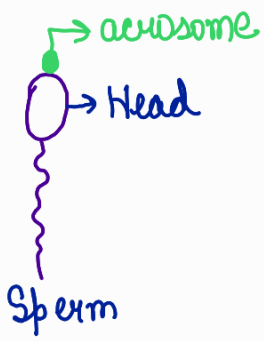
form from ER | forming face / convex face
or mature face or concave face

⇒ FUNCTIONS

1. process → package → Transport
   ↓
   of transport vesicles from ER
   within intracellular targets / secreted out of cell

2. SECRETION

3. ACROSOME FORMATION



↓

modified Golgi

↓

Secrete Enzyme For digestion of Egg membrane

→ facilitate the process of fertilisation

4. Modification of lipid

↓

known as Glycosidiation

- Lipid+ carbohydrate (glucose)

  Glycolipid

5. Modification of Protein

↓

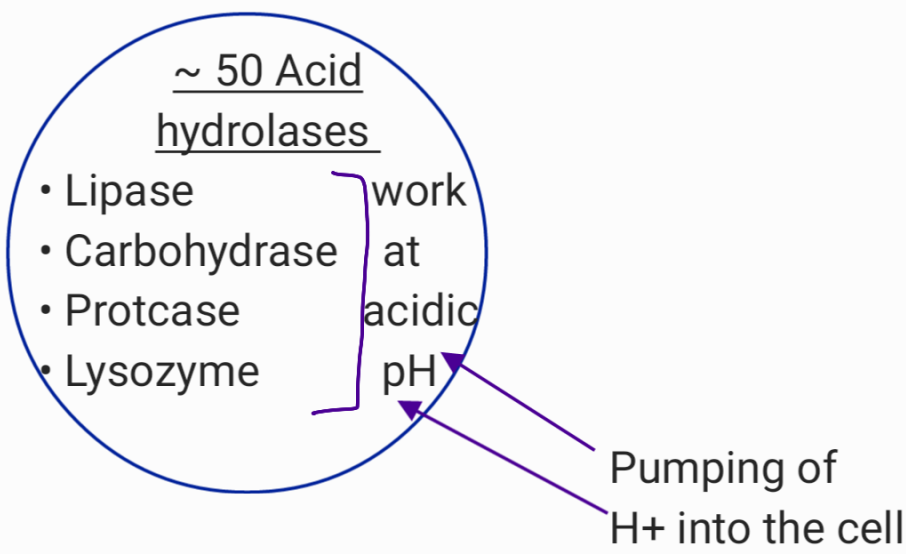
GLYCOSYLATION

Protein + carbohydrate = Glycoprotein

6. Secrete Mucilage for Lubrication.

⇒ Lysosomes " Suicidal Bags"

- Spherical structure bounded by single membrane.
- Rich in Hydrolytic Enzymes.
- Contain Enzymes for digestion of
  - →Lipid
  - → Carbohydrate
  - → Protiens
  - → Nucleic acid

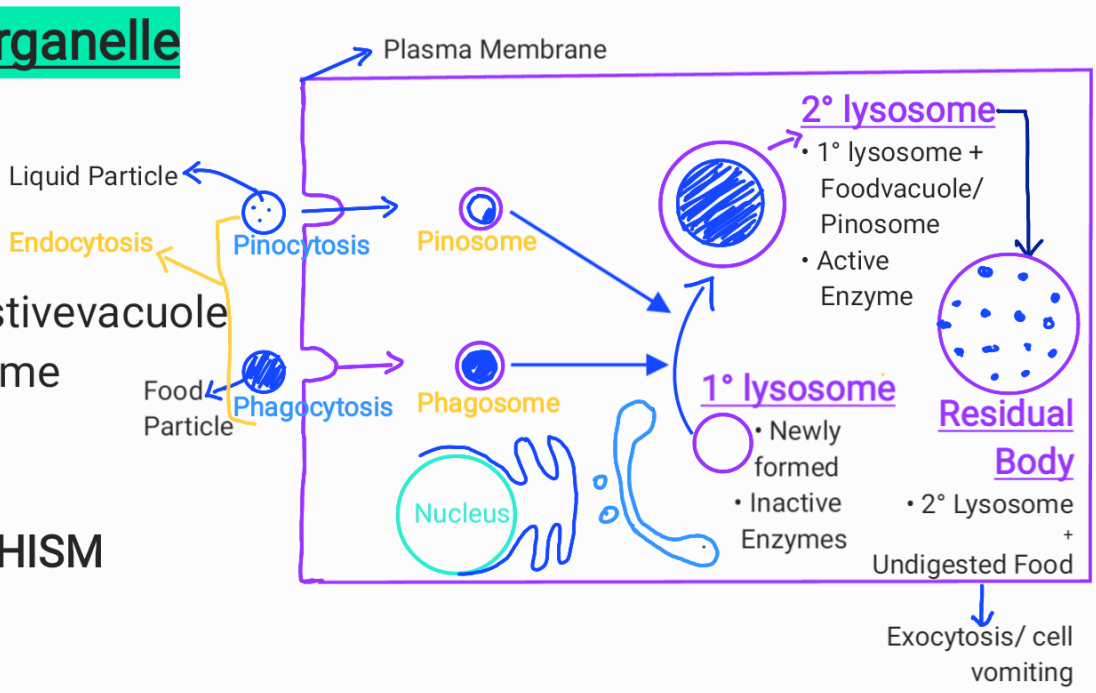


⇒ Polymorphic Organelle

many forms

1) 1° lysosome
2) 2° lysosome/Digestivevacuole / Heterophagosome
3) Residual Body
4) Autophagosome

* **Exhibit POLYMORPHISM**



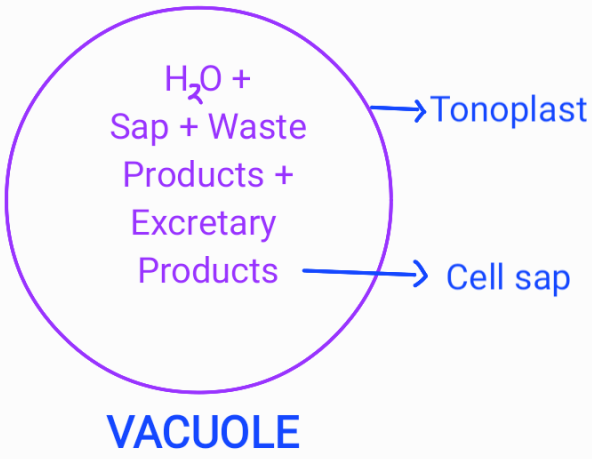
⇒ Vacuoles/ Sap vacuole

- Spherical structured, bounded by single membrane.

↓

TONOPLAST

1) Selectively Permeable
2) allows material to pass by active transport.



- In plants, 90% of volume is occupied by Vacuole.

⇒ Three types of Vacuoles

1) Contractive Vacuole
   - Ex - Amoeba → for Excretion + Osmoregulation [Controls Exmotic expansion of Cell]

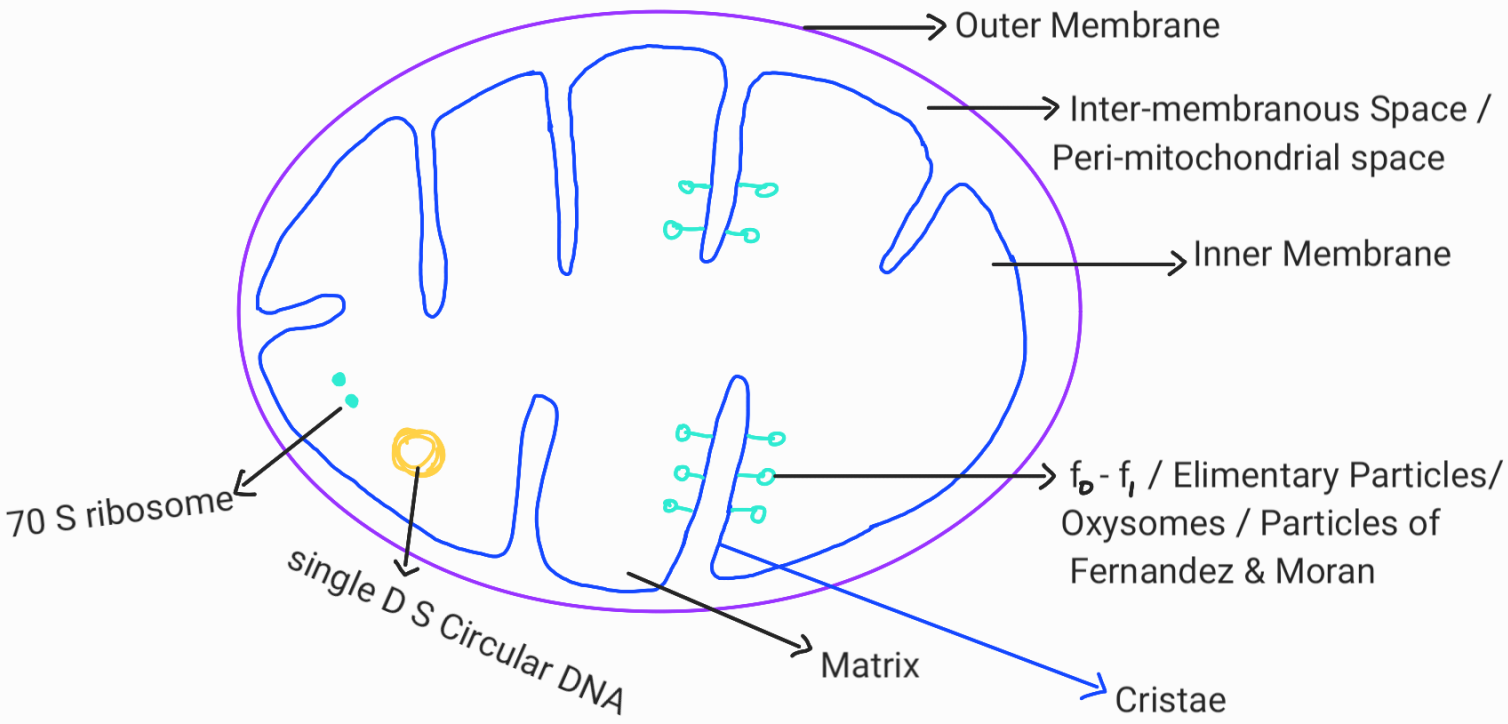
2) Food Vacuole
Ex- Protists

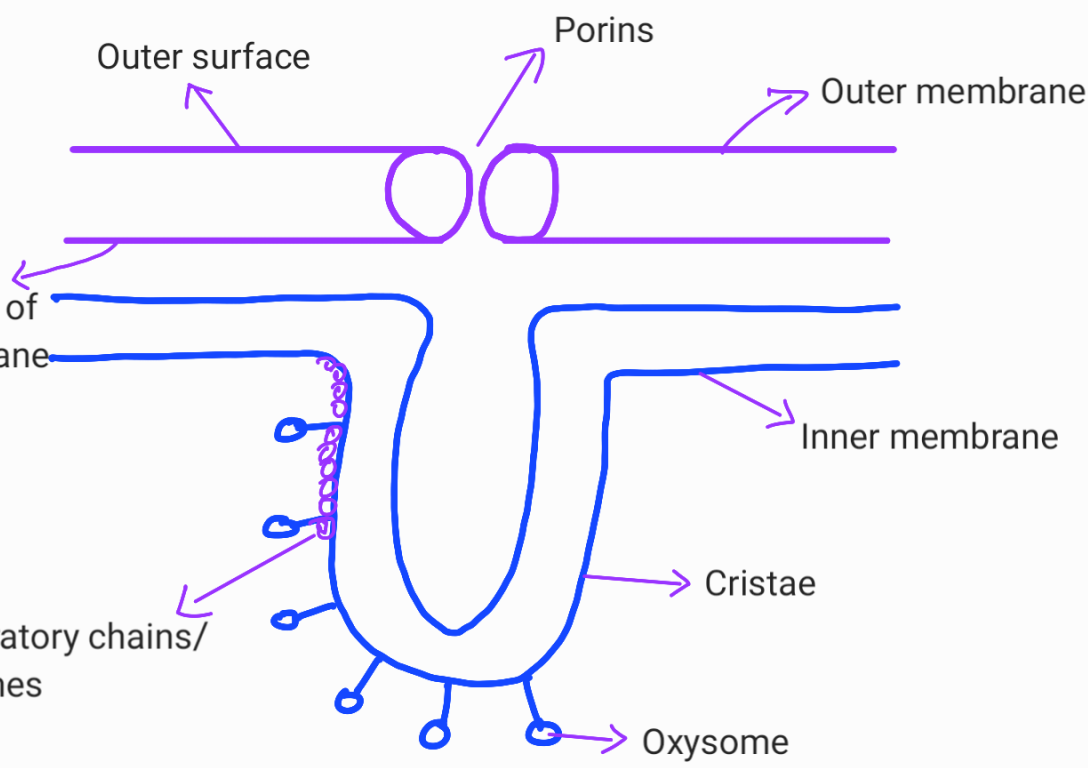
3) Gas vacuole / Pseudovacuole
Ex- Bacteria
   - Membraneless
   - in BGA + Purple Green sulphur Bacteria
   - provide Buoyancy

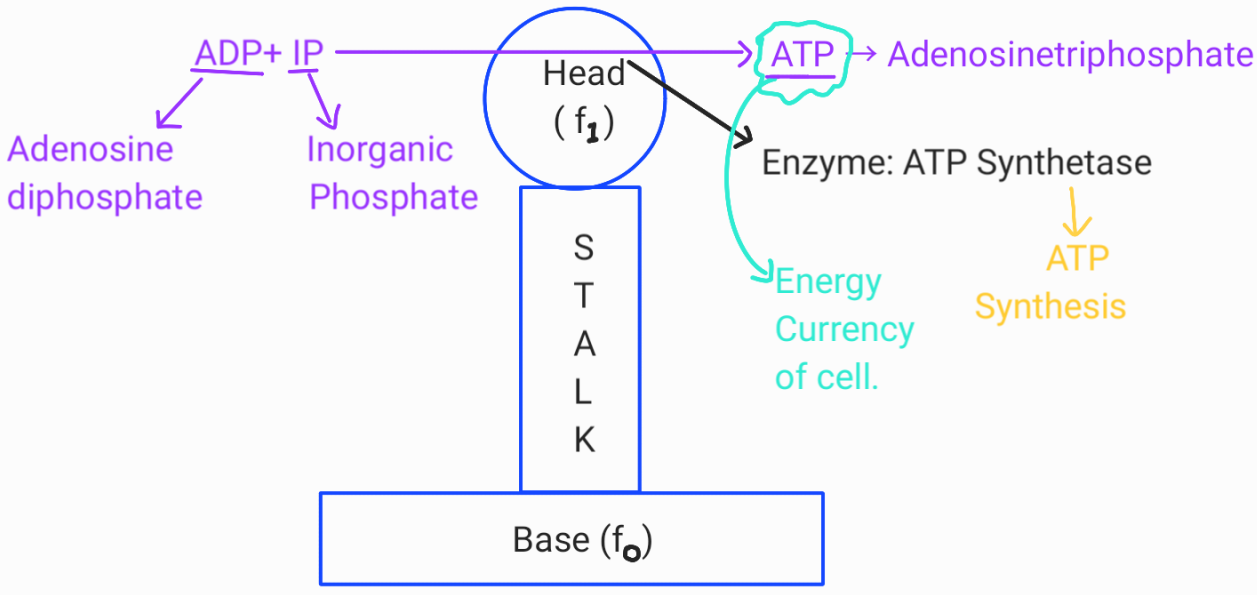
⇒ Mitochondria

1) Power house of the cell.
   ↓
   ATP Production
2) size: Diameter: 0.2 - 1 μm
   Length: 1 - 4.1 μm
3) Number: Vary [depending on Physiological Activity of cell] or Energy requirement of the cell.
4) Double Membrane bound organelle.

5) Shape: Cylindrical/Sausage shape
6) Stain: Janus Green (vital stain)
7) Not easily visible under Microscope.







ATP formation inside mitochondria → OXIDATIVE PHOSPHORYLATION

* Mitochondria Divide by fission.
* Matrix
* DNA + RNA + Ribosomes
Enzymes for TCA / KREB

↳Tricarboxylic Acid Cycle

Outer Membrane

1) PORINS +nt
2) CRISTAE -nt
3) More Permeable
4) Enzymes ↓

Inner Membrane

1) PORINS -nt
2) CRISTAE +nt → site of oxidation - Reduction; → Increase Surface Area
3) Less permeable
4) Enzymes & e^- carriers ↓ "ETS"
   are +nt

⇒ Functions

a) Site of AEROBIC Respiration
b) Muscle contraction
c) Nerve Signal / impulse conduction

⇒ PLASTID

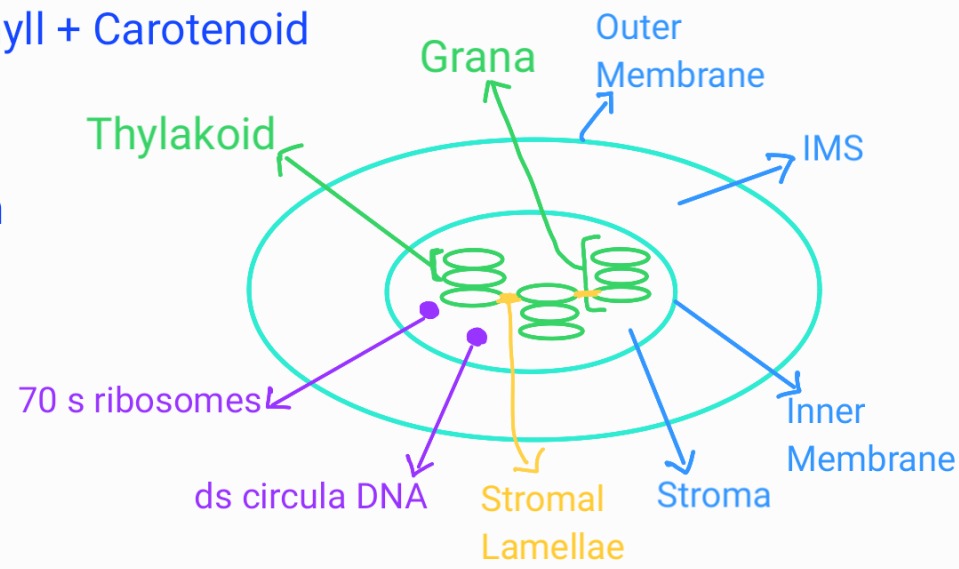
1) Double membrane Bound Organelle
2) in higher plants + Diatoms + Dinoflagellates + Euglenoids
3) Storage + Synthesis
4) 3 types : → convertible from one type to

1) LEUCOPLAST ↓
   - white (Colourless); Pigment -nt
   - Agranum (grana is - •t)
   - storge

   ↳Fat: ELAIOPLAST
   ↳Starch: Amyloplast
   ↳Protein: Aleuroplast
   → 3 types of Leucoplast

2) CHROMOPLAST ↓
   - colour ; pigment +nt ↓ CAROTENOID
     ↓ other than green (Red / Orrange / yellow)

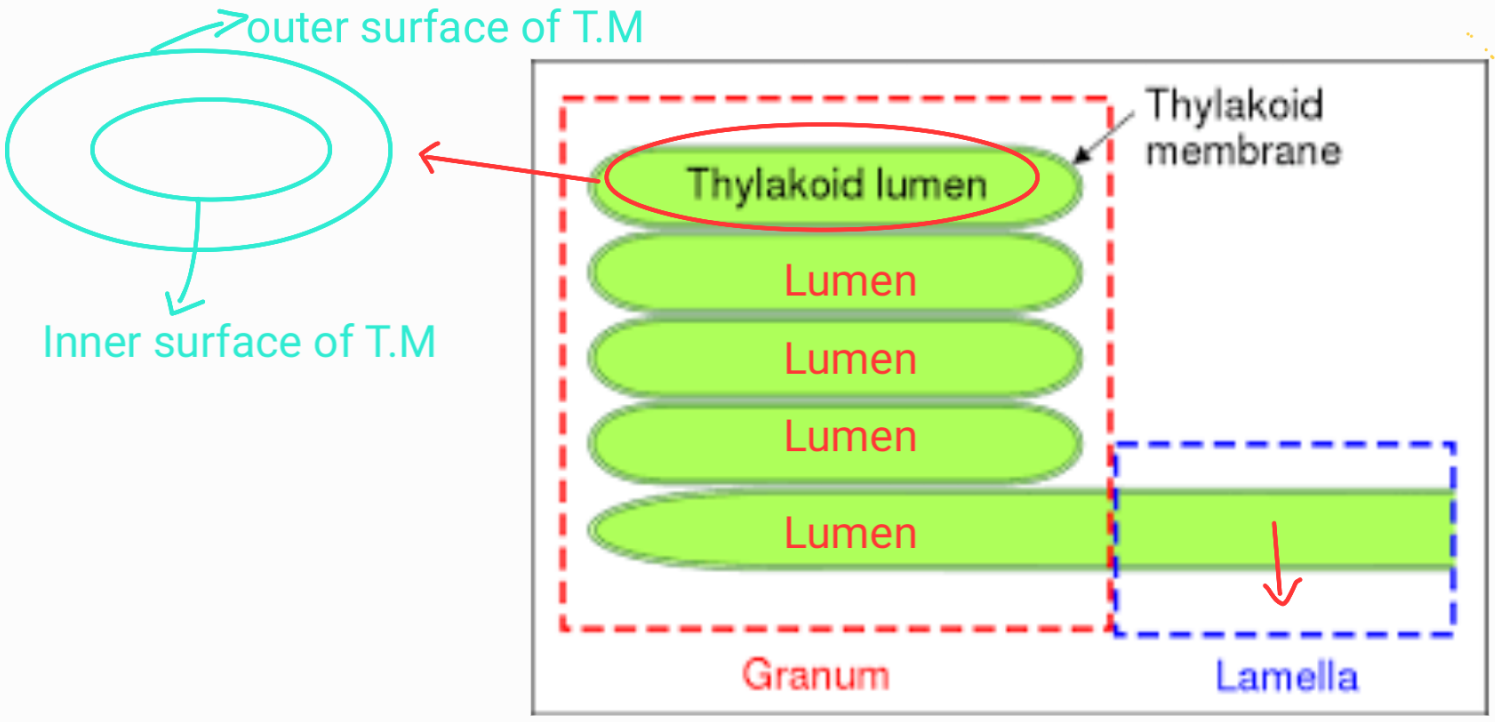
3) CHLOROPLAST ↓
   - Grass green
   - Greenish plastid
   - pigment: Chlorophyll + Carotenoid



- Majority of plants, seen in Mesophyll cells of leaves.
- Number →vary
- Shape → vary

disciod : disc like
oval, reticulate, star like,
Ribbon like

- Double membrane bound.



⇒ Functions

1) PHOTOSYNTHESIS

↳ a) Light RXN

- Site: GRANA thylakoid → Pigment +nt
- formation of ATP & $NADPH_2$ → Photophosphorylation

b) Dark RXN

- Site: stroma
- Synthesis of sugar (glucose)

2) Storage of starch

Note:

1) Mitochondria + chloroplast → Semi-Autonomous organelle / self- duplicating organelle

Endo- Symbiotic theory

Reason →
- Own DNA / RNA
- 70 s Ribosomes
- Fission
- Protein Synthesis

- Mitochondria & chloroplast are evolved from Bacteria.
- Proof:
  1) d s circular DNA → G ≡ C Rich → A, T, G, C
  2) PORINS +nt [Gram - ve]
  3) 70 s ribosome
  4) divide by fission

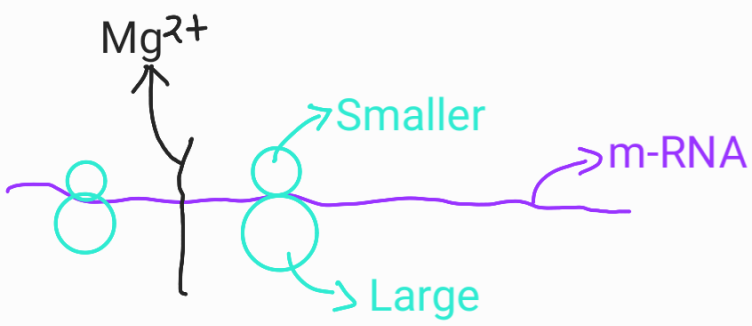
A, T, G, C → Eukaryotic DNA / Prokaryotic DNA

⇒ RIBOSOMES

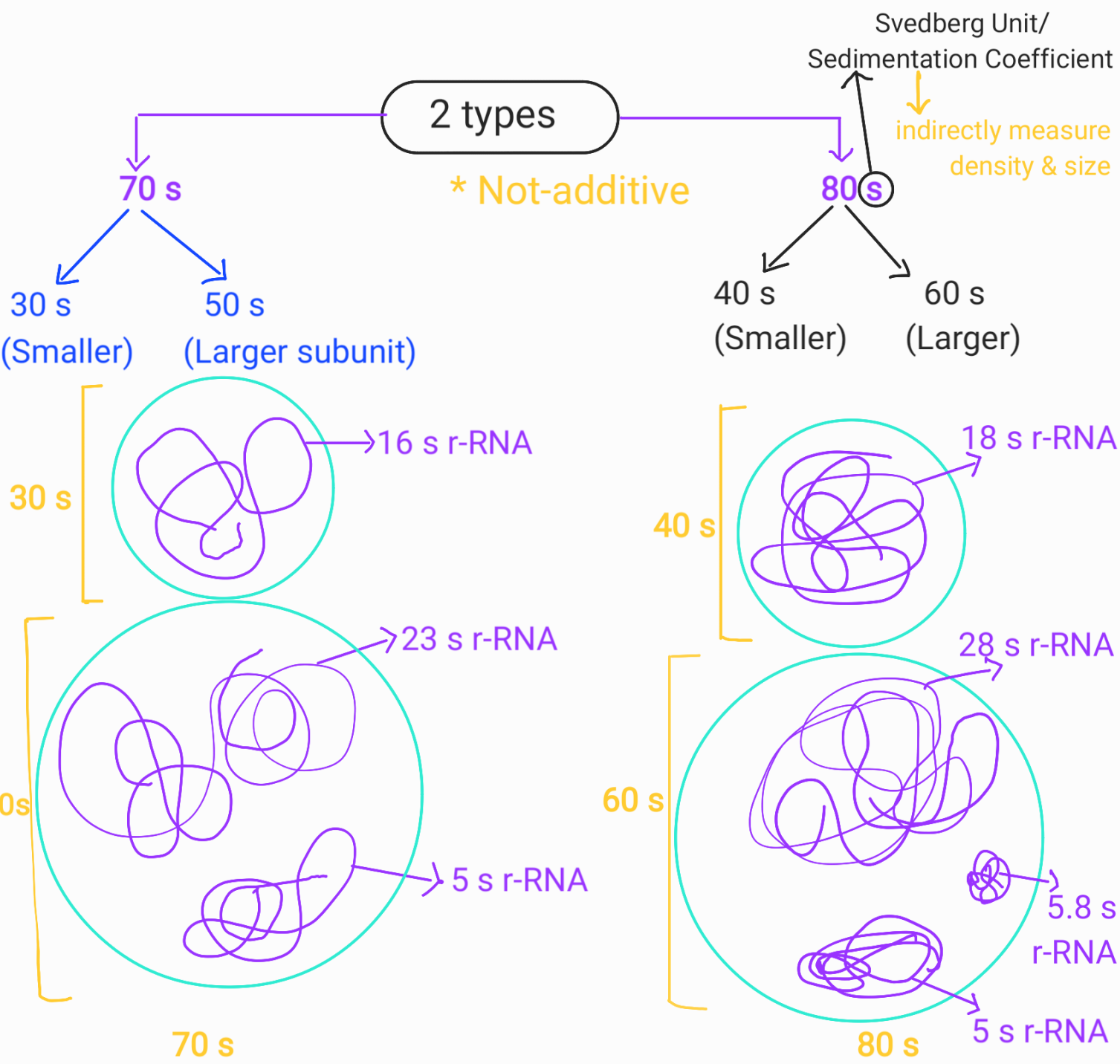
→ Protein Factory

- Non-Memberanous
- Smallest organelle
- Organelle within organelle
- Universal organelle
- Ribonucleo Proteins
  - ↓ r-RNA
- Composed of r-RNA + proteins
- 2 Subunits → Larger
  - → Smaller

- 2 subunits are joined by Mg^{2+}
- single m-RNA + many ribosomes - POLYSOME/Poly ribosome



- k/a Palade particles
- on ER (RER), Mitochondria, chloroplast (Euk.)
- associated with plasma Membrane (Prok.)



Note:

Non-Secretory Proteins → Synthesized by cytoplasmic ribosomes

Secretory Proteins → by Ribosomes +nt on ER

⇒ **Cytoskeleton** → i) Proteinaceous
ii) filamentous
iii) fibrous
iv) Minute

Cell framework

- Provides structural framework to cytoplasm.
- In Eukaryotic cells only.

- Function -
  - a) Maintenance of shape
  - b) Mechanical Support
  - c) Motility

- Three Types

1) Microtubule
2) Microfilament
3) Intermediate filament

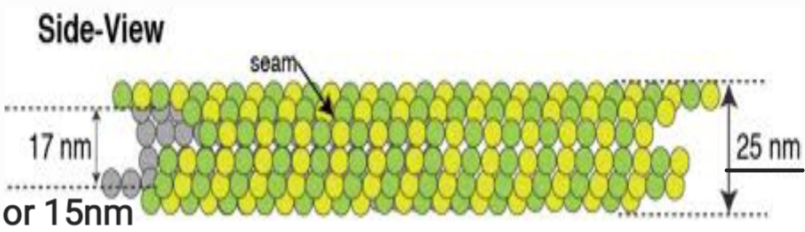
1. Microtubule

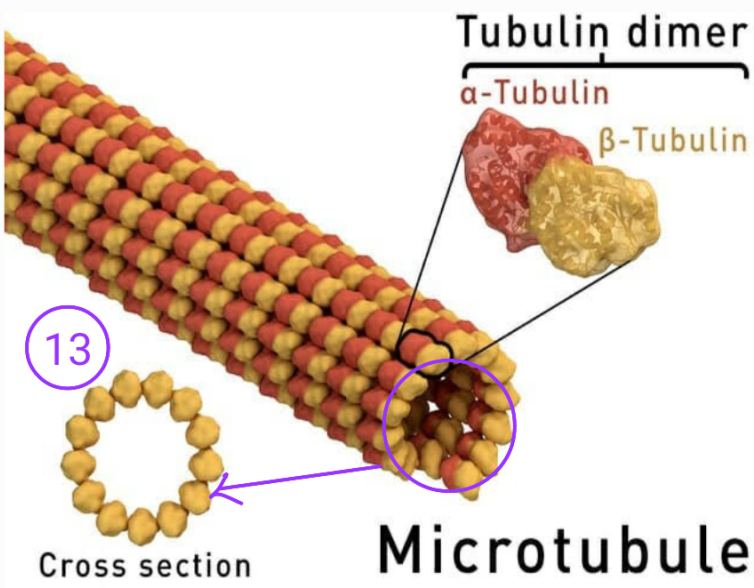
- in cytoplasmic matrix
- in Basal body of cilia & flagella Cilia & flagella, centrioles, Spindle fibre.
- in Eukaryotic cell.
- Made of 13 protofilaments

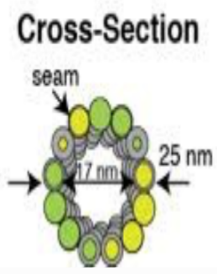
↳ Each protofilament has α and β tubulin protein
(Non- contractile protein)

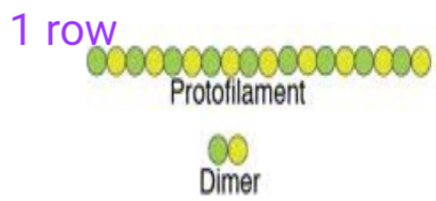
- Hollow
- Unbranched cylinder

* Assembly & dissembley
↓
require
GTP &
Ca^{2+}

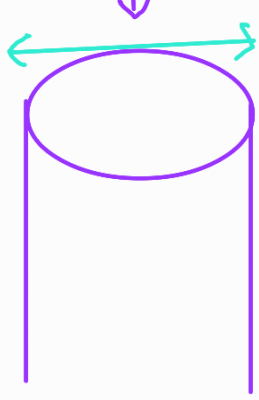






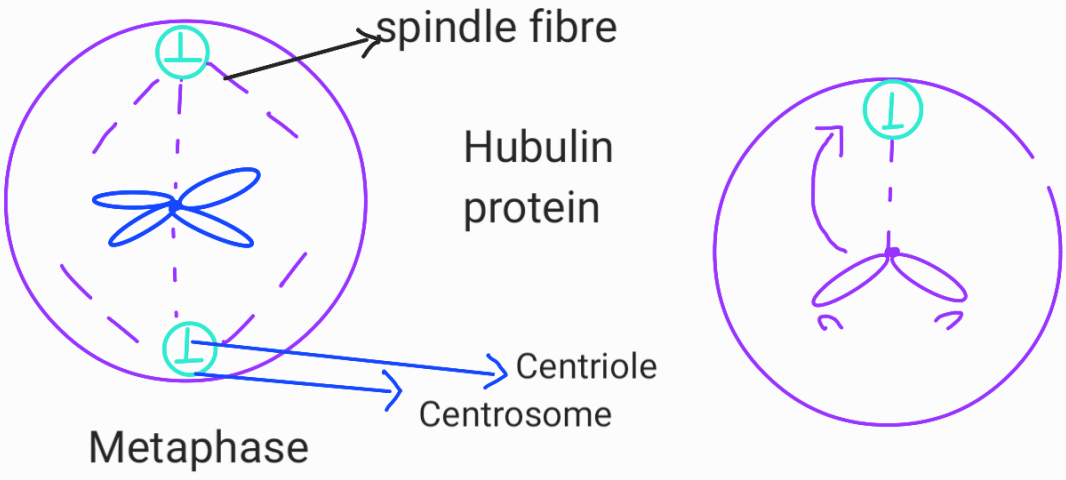


1 row ⟷ 13 rows
↓
carl inward
to form cylinder



⇒ Functions of Microtubule

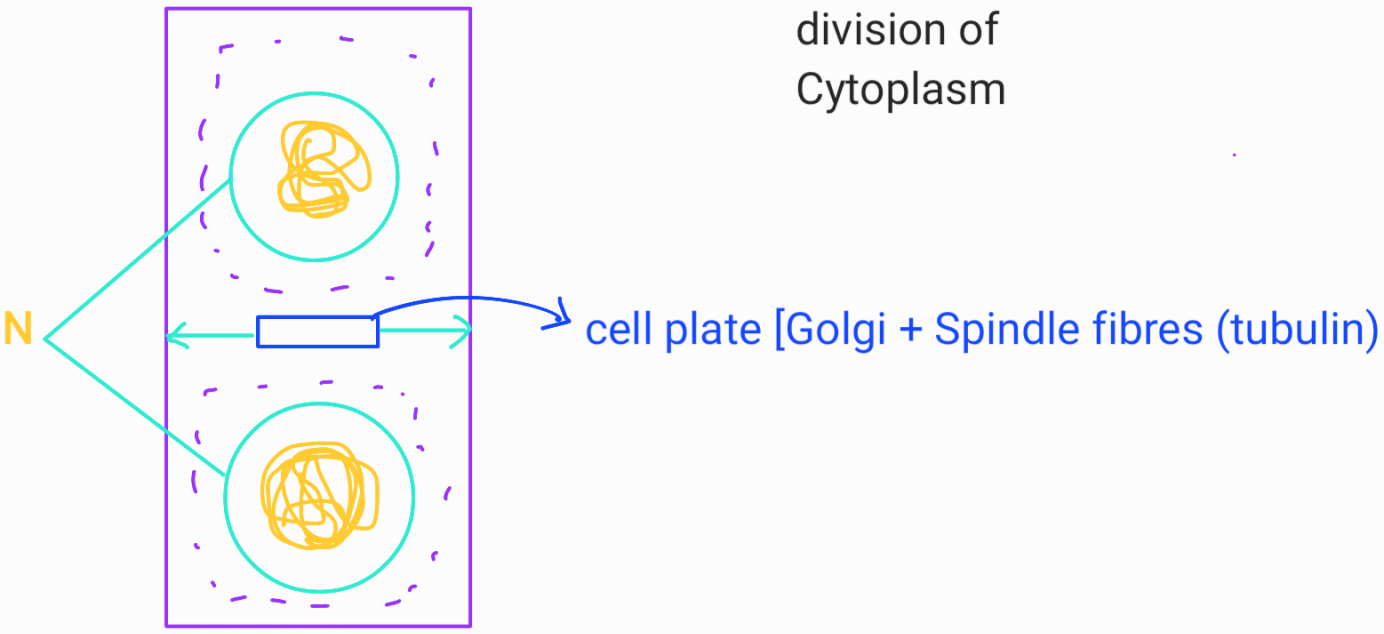
1) Spindle fibre formation
2) Anaphasic Movement of chromosome



3) Decision of cell plate formation during plant cytosinesis.

↓

division of Cytoplasm



4) support
5) Intracellular transport of nutrients

↓

within

2. Micro filament → Proteinaceous Structure

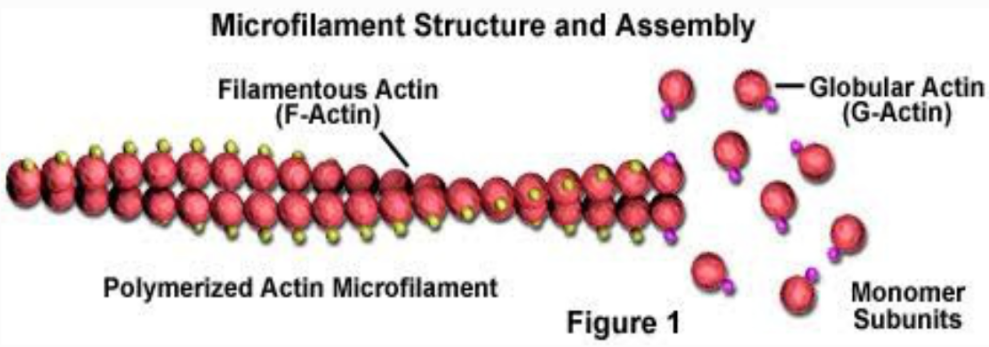
↓

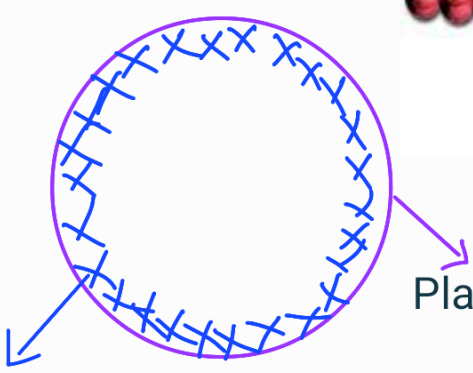
Actin

↓

Contractile protein

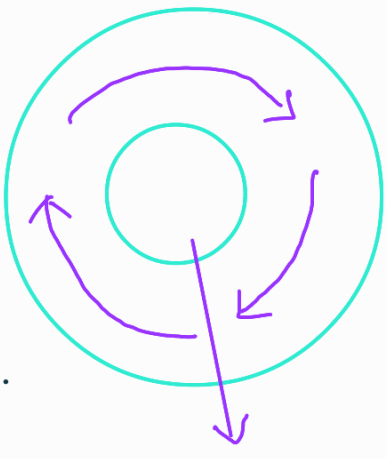
- Rod like
- Indefinite Length
- Unbranched
- found associated with Plasma membrane

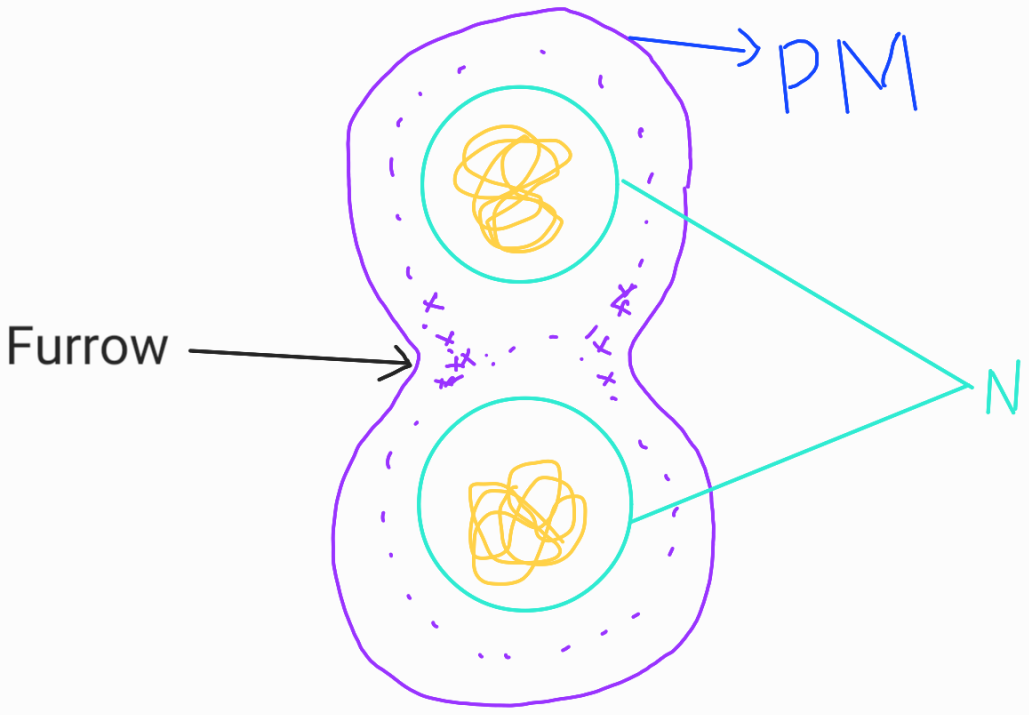




⇒ Functions

1) provide support to PM
2) cyclosis or cytoplasmic streaming
3) Psuedopodia
4) Help in amoeboid movement
5) Help in furrow formation during animal cytokinesis.





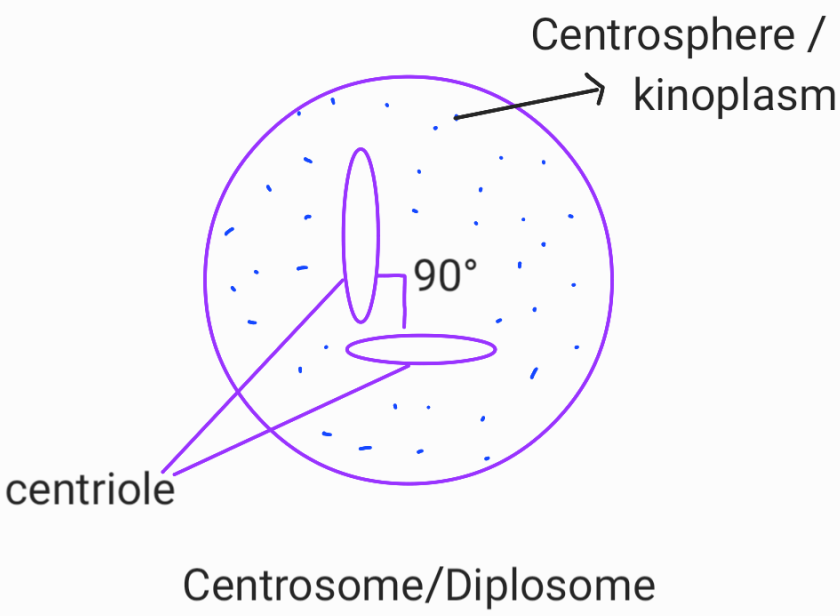
3. Intermediate Filament

- Acidic protein
- Non-contractile
- Un-Branched
- around the Nucleus
- Form Scaffold around chromatin

⇒ CENTROSOME AND CENTRIOLES

- Non-Membranous
- Contain 2 cylindrical structure

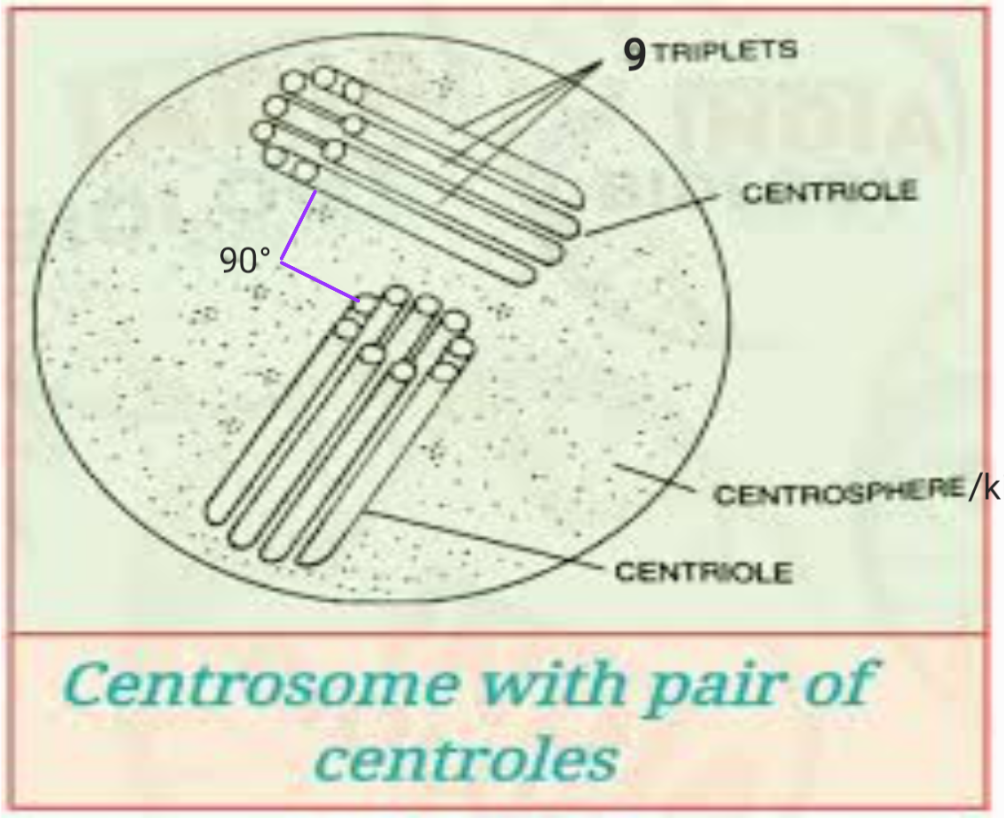
↓
CENTRIOLE
↓
arranged perpendicular to each other



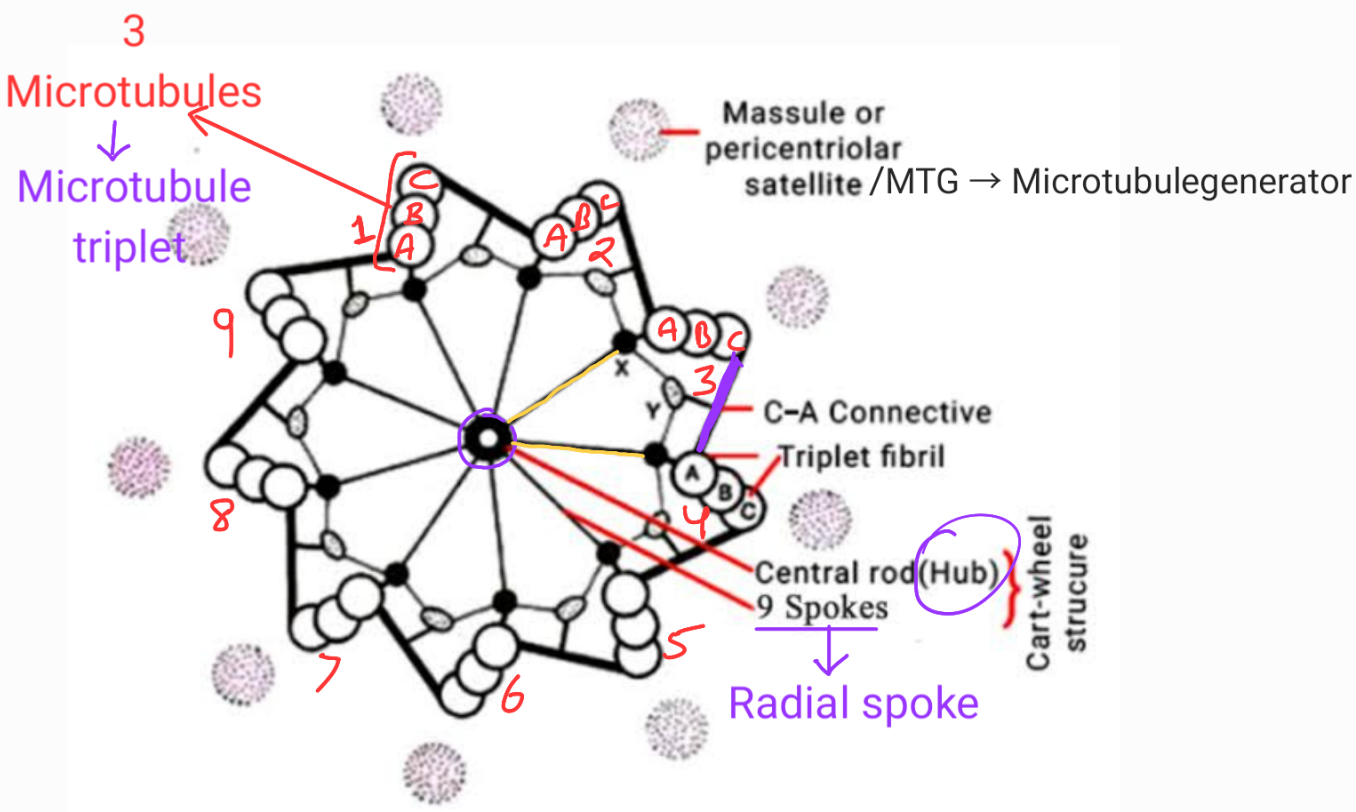
- in Euk Cells [Animals, fungi, Algae]
- -nt in Higher plants

⇒ Function

1) they form Basal body of cilia & flagella
2) they form spindle fibre



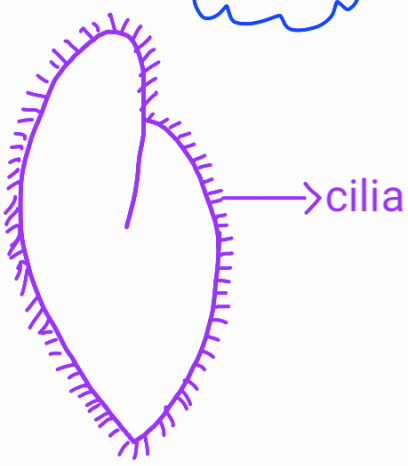
Centrosome with pair of centroles



- 9 triplet → at periphery → Periphery Triplets
- - nt in centre
- cart wheel arrangement
- 9 + 0 arrangement

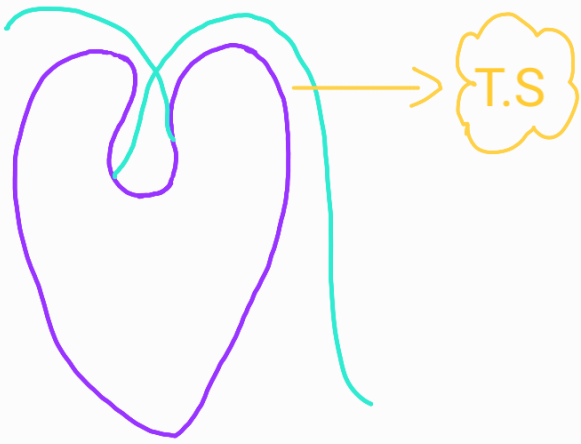
⇒ **CILIA & FLAGELLA** → Extension of plasma Membrane

- Plural
- Smaller
- Number → High
- work like OARS



- Single → cilium

- Plural
- Larger
- Number→ less



- Single → flagellum

Core → Axoneme

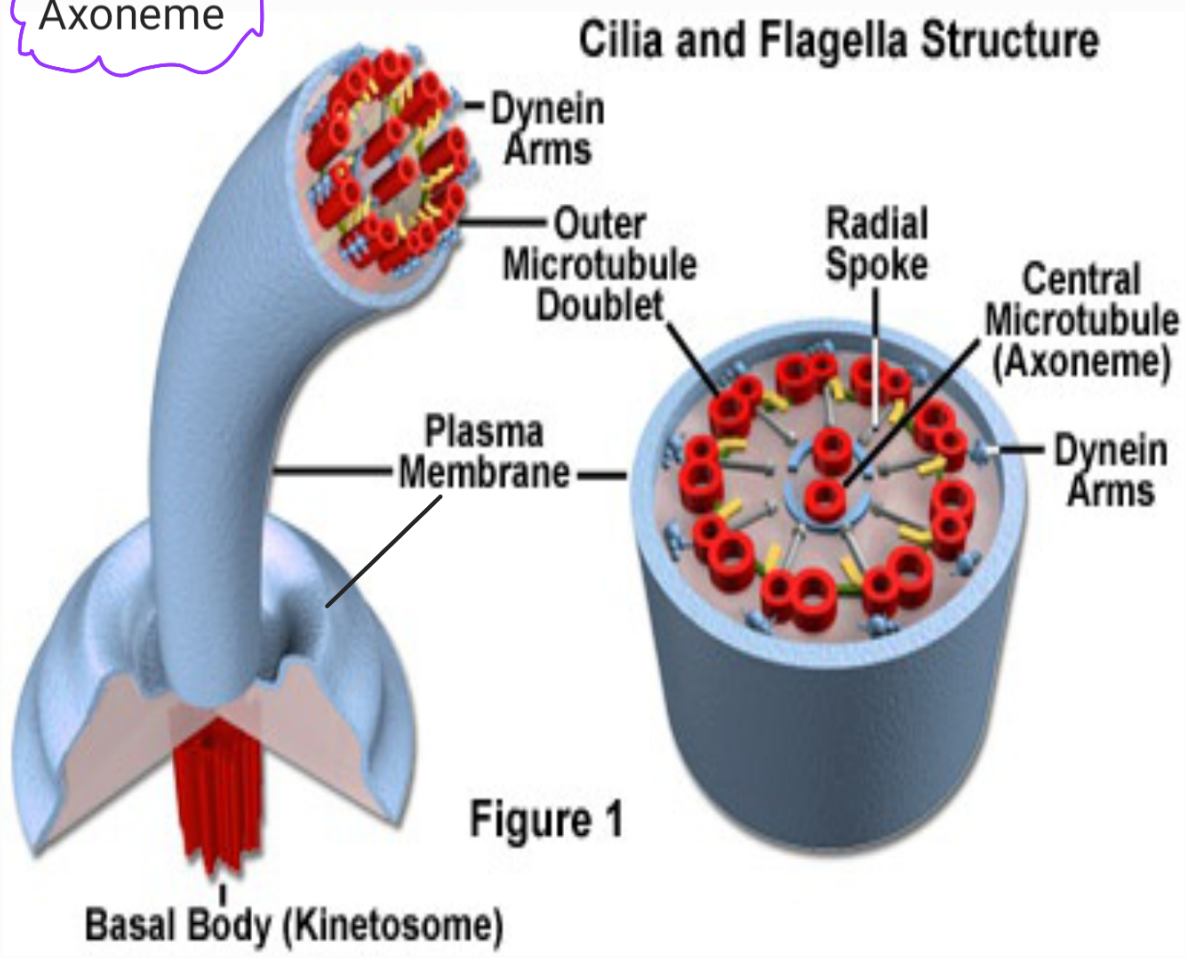
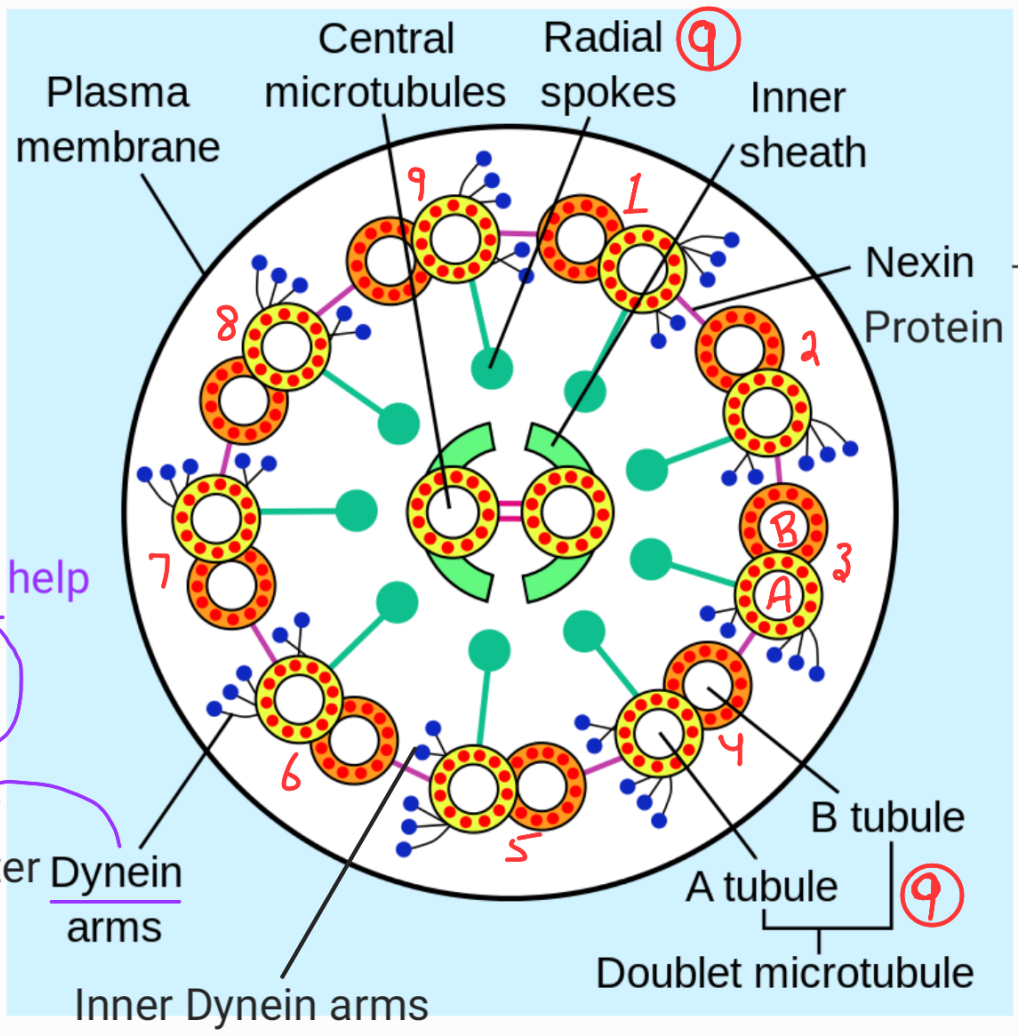


Figure 1

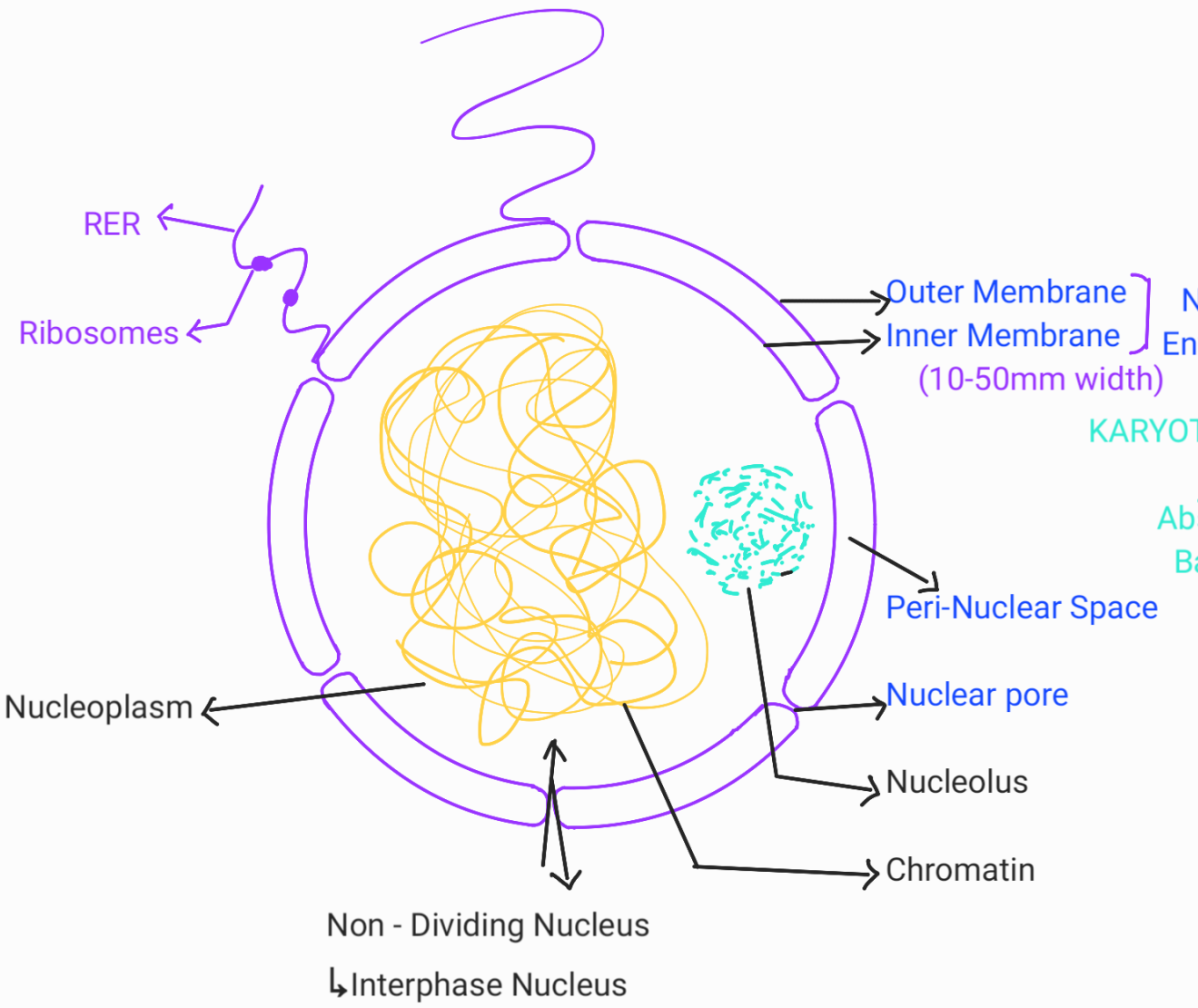


- [9 Periphery + 2 centre]
- Total number of Microtubule → [(9×2=18) + 2]

Peripheral MT → 18

⇒ Nucleus

1) Brain of the cell.
2) Double membrane bound organelle
3) Number: Vary
   - → 1: Uninucleate
   - → 2: Binucleate
     - Ex- Paramoecium
   - → Many: Multinucleate
   - → Absent: ANUCLEATED
     - Ex- Mammalian Mature RBCs, Mature Sieve tube (Phloem) → Nucleus is absent



⇒ Nuclear Envelope

- → Outer: Rough, Ribosome +nt
  - ↳ Continuous with RER
- → Inner: Smooth, Ribosome -nt

* Not Continuous, due to presence of Nuclear Pore
  - ↓ Help in Bidirectional transport of Materials

⇒ Nucleoplasm → Contain CHROMATIN + NUCLEOLUS

1) transparent
2) Semi- fluid
3) Colloidal
4) Site for M-RNA Synthesis
   - → messenger

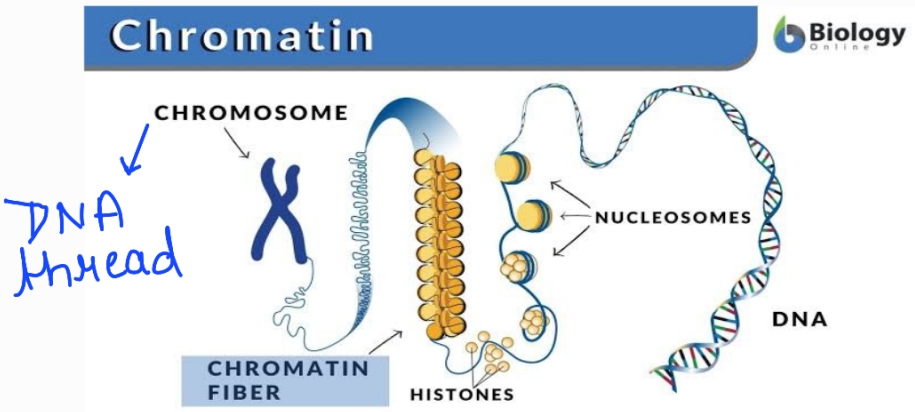
⇒ **NUCLEOLUS** → Ribosome factory

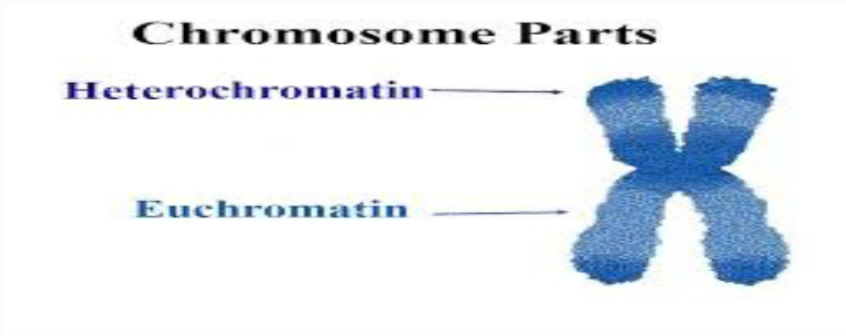
a) Non-Membranous
b) Continuous with the Necleoplasm
c) Site of r - RNA Synthesis
↳ ribosome
d) Larger & More in number, in cells involved in protein synthesis.

⇒ **Chromatin** → Human DNA → 2.2m Nucleus → 10^{-6}m

1) Named so because of its
Ability to got stained.
↳ Acetocarmine or fuelgen stain

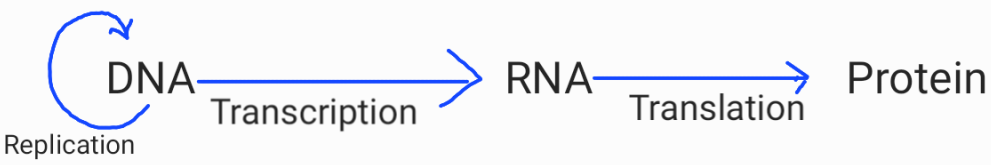
2) flemming
3) Contain DNA + RNA + Histones + Non-Histones
↓ Acidic
↓ Basic
Packaging Protein





Heterochromatin Region

- Dark
- compactly packedDNA /tightly packed DNA
- Transcriptionally in active



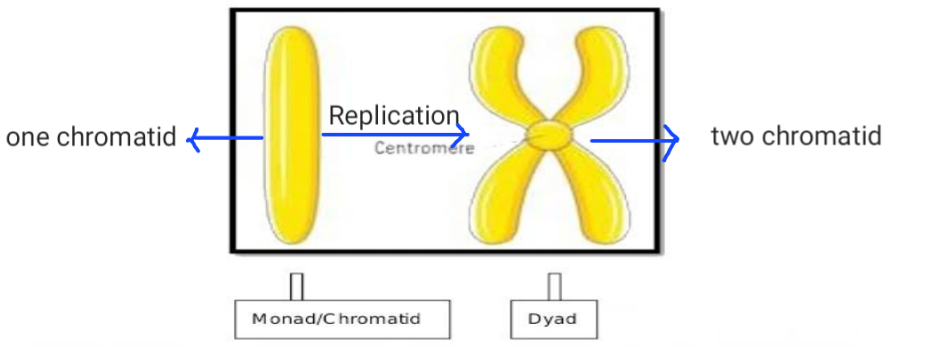
CENTRAL DOGMA

Euchromatin region

- Light
- Loosely arranged
- Transcriptionally active/ Genetically active

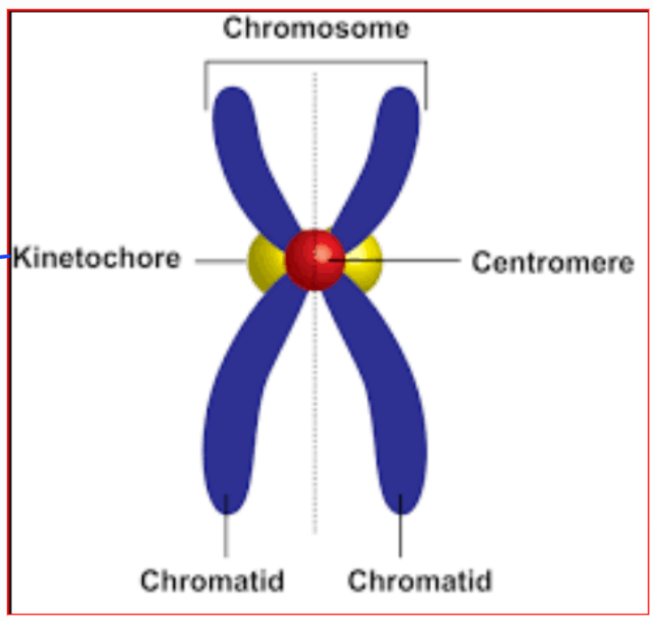
Chromatin —Histone Protein→ Chromosome

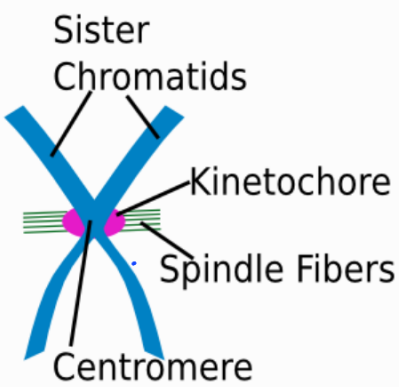
A dyad is a pair of sister chromatids while monad is referred to a single chromatid. A chromatid is one half of a replicated chromosome. Two chromatids form a single complete chromosome.



→ Disc-shape

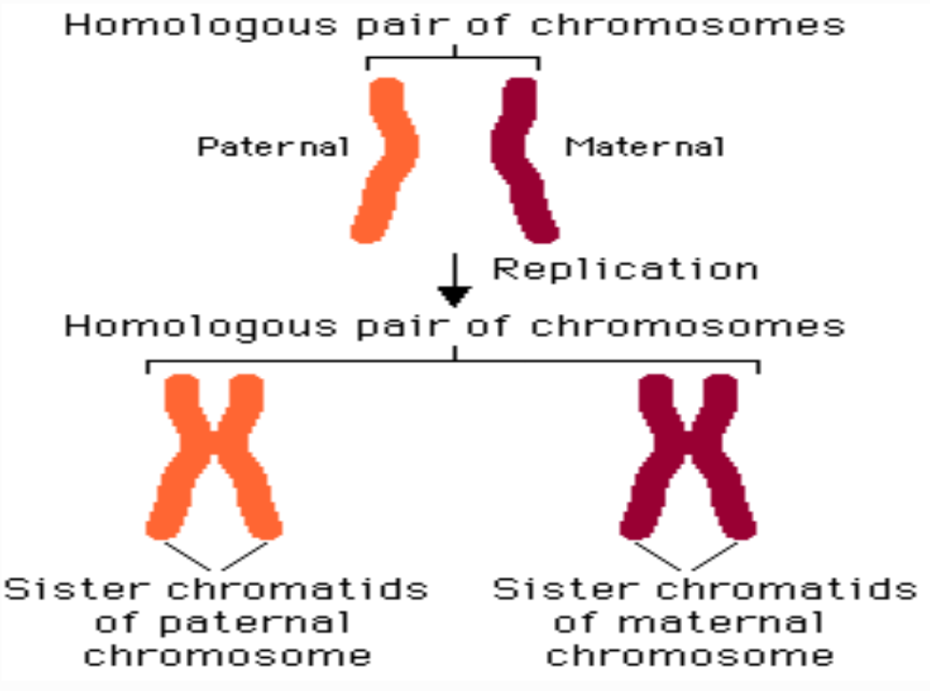
→ provide site of attachment to spindle fibre





- p arm = short arm
- q arm = long arm

Centromere location	Designation	Metaphase shape	Anaphase shape	
Middle	Metacentric	Sister chromatids, Centromere	Migration	V shape
Between middle and end	Submetacentric	p arm, q arm		L- Shape
Close to end	Acrocentric			J-Shape
At end	Telocentric			I-Shape



Genetic Material

Chromosomes are arranged in homologous pairs in the nucleus of eukaryotic cells. What is meant by the term homologous pairs?

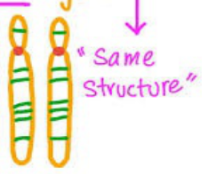
✓ A) Pairs of chromosomes that are of a similar length and that have a similar gene positioning.

B) Pairs of chromosomes that contain the same alleles.

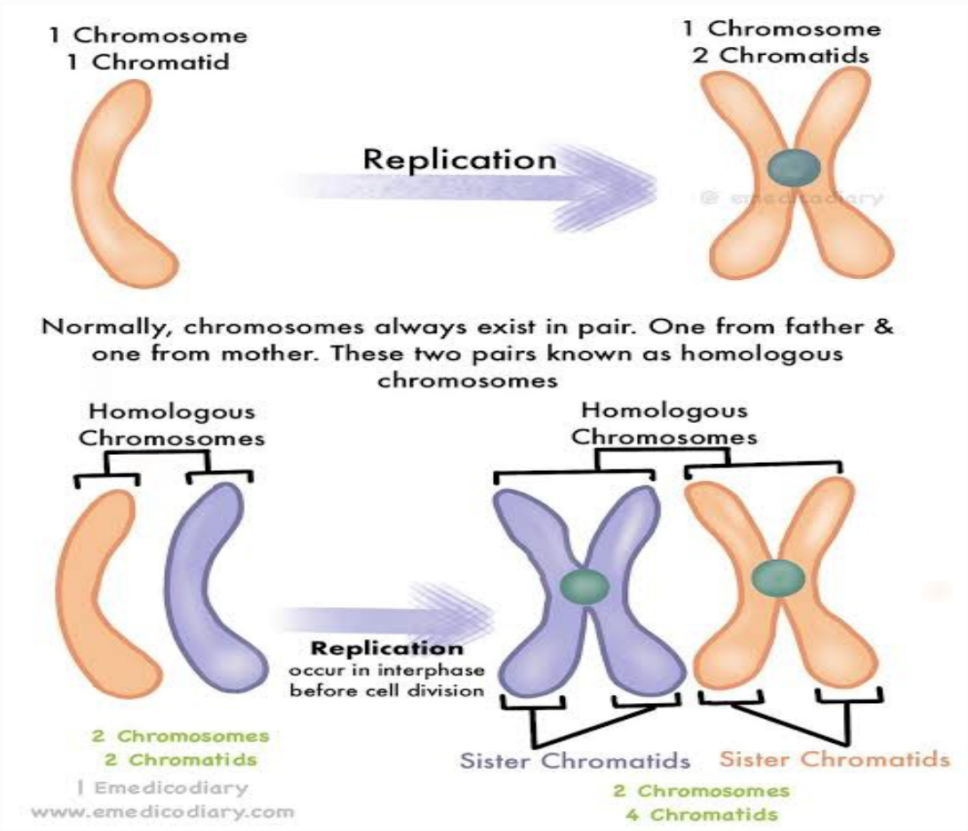
C) Pairs of chromosomes that code for the same characteristics in different organisms.

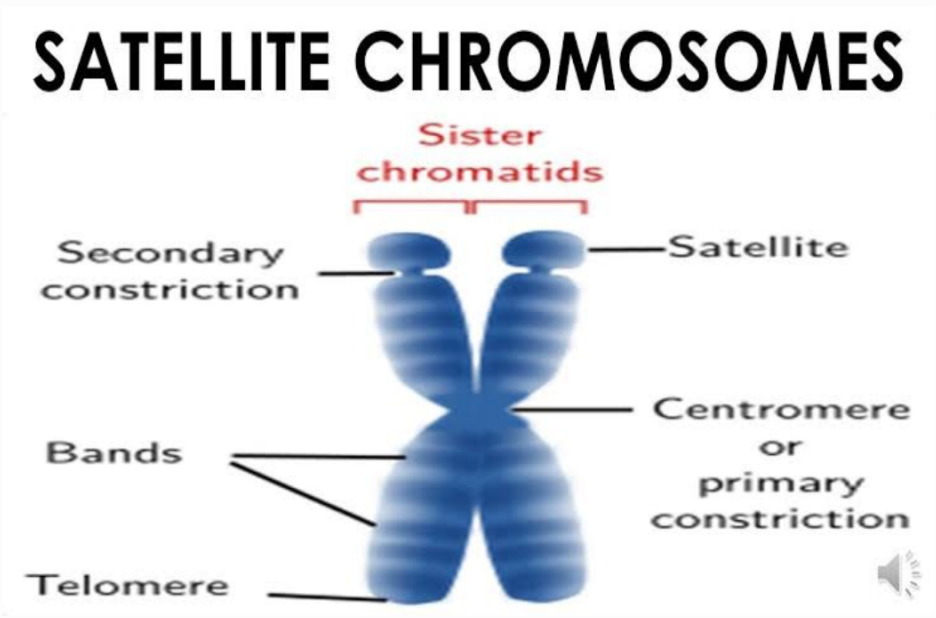
D) Pairs of chromosomes that are inherited from one parent.

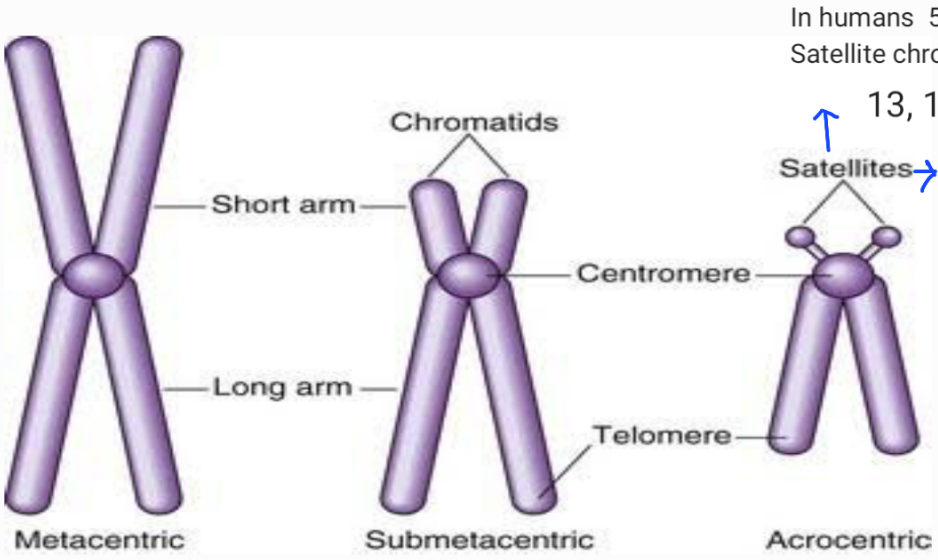
Chromosomes
Same size, same shape and same genes in same place
= Homologous



"Same structure"



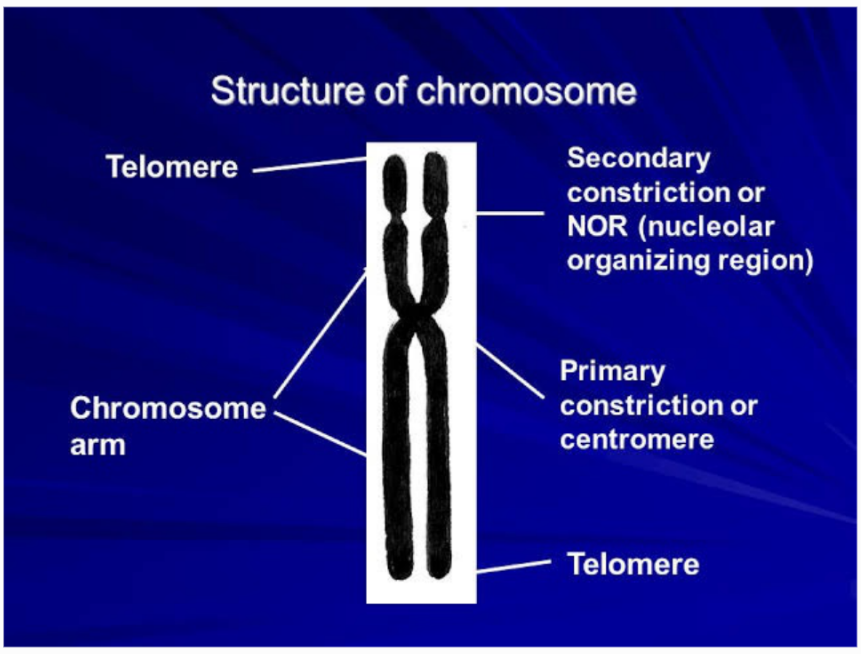




In humans 5 pairs of Satellite chromosomes

13, 14,15,21,22

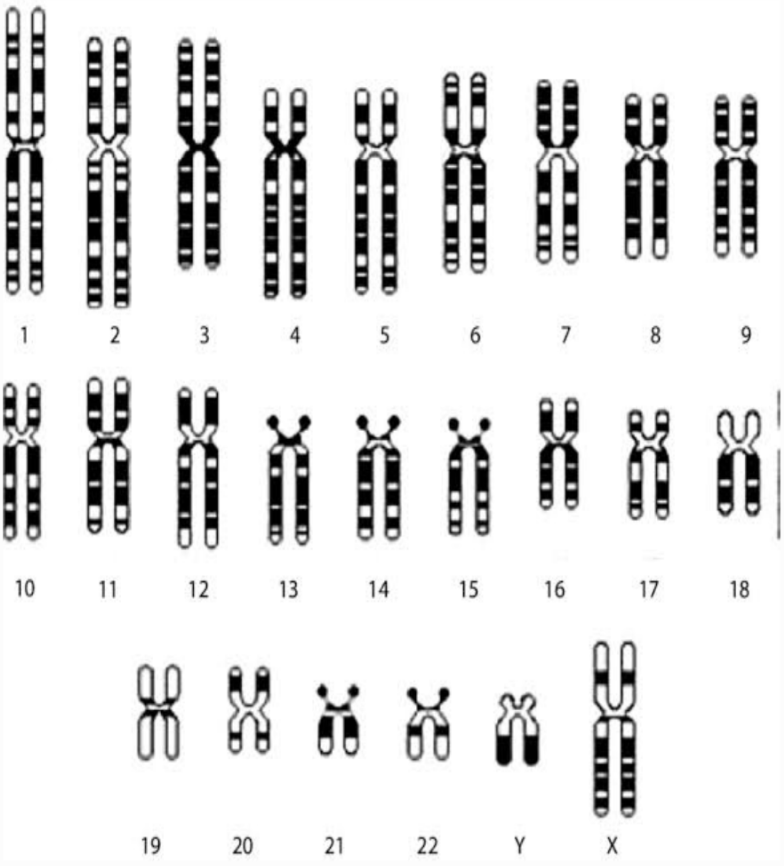
Satellites → Marker chromosomes



Karyotype Graphical representation known as idogram

Feature by which particular set of chromosome is identified

- Number of chromosome
- Relative size
- Position of centromere
- length of arm
- 2° constriction
- satellites



Microbodies

- single membrane bound structure
- 3 types of microbodies

1. Peroxisome

Enzyme for Peroxide synthesis (oxidase)

Enzyme- catalase ⟶ Breakdown of peroxide
In Plantst animals

2. SPHEROSOME

Synthesis & storage of fats

Endosperm of oil seeds

contain hydrolytic Enzyme known as plant lysosome

3 . GLYOXYSOMES

site for Glyoxylate cycle

Fat → carbohydrate

Gluconeogenesis ⟶ absent in animals