Eng Version
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ASC, Faridabad Cadet College

Medical and Dental Admission Program-2020

BIOLOGY

Lecture : B-02

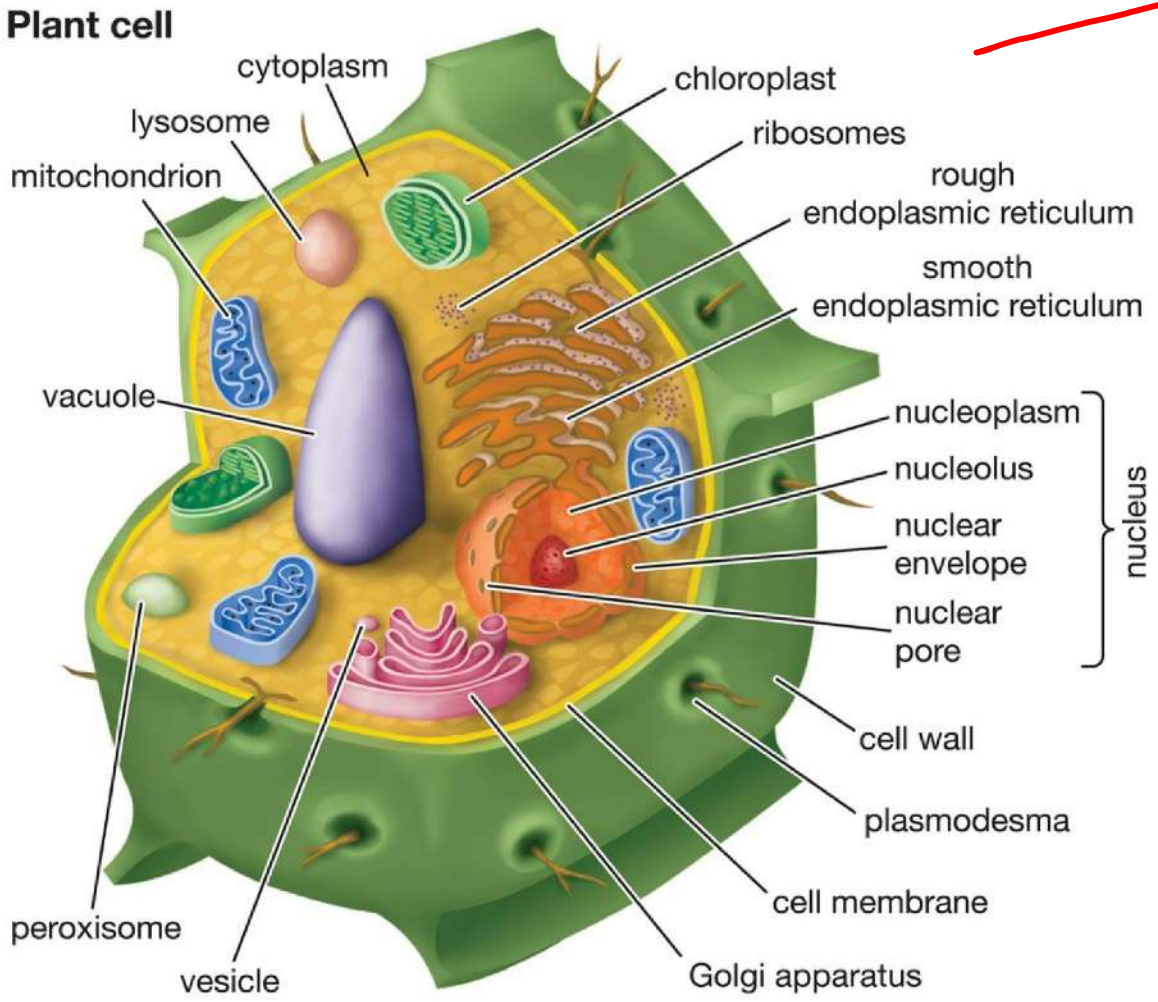
Chapter 01 : Cell and its structure (up to chromosomes)

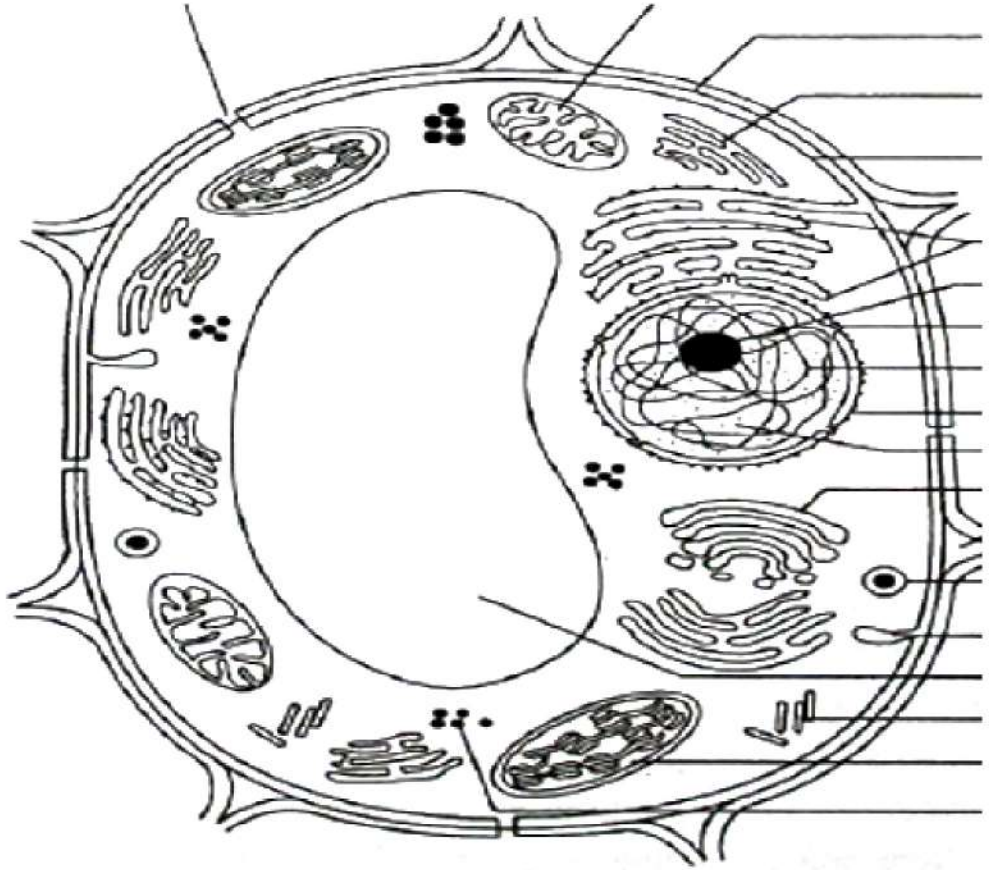
All important topics for medical and dental admission test

Importance.	Topic	Admission test years
✪✪	Cell and structure of an ideal cell	MAT: 19-20, 13-14, 11-12; DAT: 18-19, 09-10
✪✪✪	Cell wall	MAT: 11-12, 05-06, 03-04; DAT: 02-03
✪✪✪	Ribosome	MAT: 18-19, 11-12, 06-07; DAT: 10-11
✪✪	Golgi body	MAT: 13-14, 11-12; DAT: 09-10
✪	Lysosome	MAT: 09-10; DAT: 00-01
✪✪✪	Mitochondria	MAT: 12-13, 11-12; DAT: 19-20, 16-17, 07-08
✪✪✪	Plastid	MAT: 17-18, 16-17, 15-16, 02-03; DAT: 19-20, 17-18
✪	Centriole	MAT: 13-14
✪	Cytoskeleton	MAT: 10-11, 00-01
✪	Nucleus	DAT: 10-11
✪✪✪	Chromosome	MAT: 15-16, 14-15, 13-14; DAT: 16-17, 09-10
✪✪✪	Nucleic acid (DNA and RNA)	MAT: 15-16, 12-13, 05-06, 03-04, 02-03; DAT: 08-09, 07-08
✪✪	Replication, Transcription, Translation	DAT: 19-20
✪✪✪	Gene	MAT: 18-19, 16-17, 15-16, 14-15, 13-14, 12-13, 05-06, 03-04, 02-03; DAT: 16-17, 09-10, 08-09, 07-08

Cell

HSC/MQ


Plant cell
cytoplasm
lysosome
mitochondrion
chloroplast
ribosomes
rough endoplasmic reticulum
smooth endoplasmic reticulum
vacuole
nucleoplasm
nucleolus
nuclear envelope
nuclear pore
nucleus
cell wall
plasmodesma
cell membrane
peroxisome
vesicle
Golgi apparatus

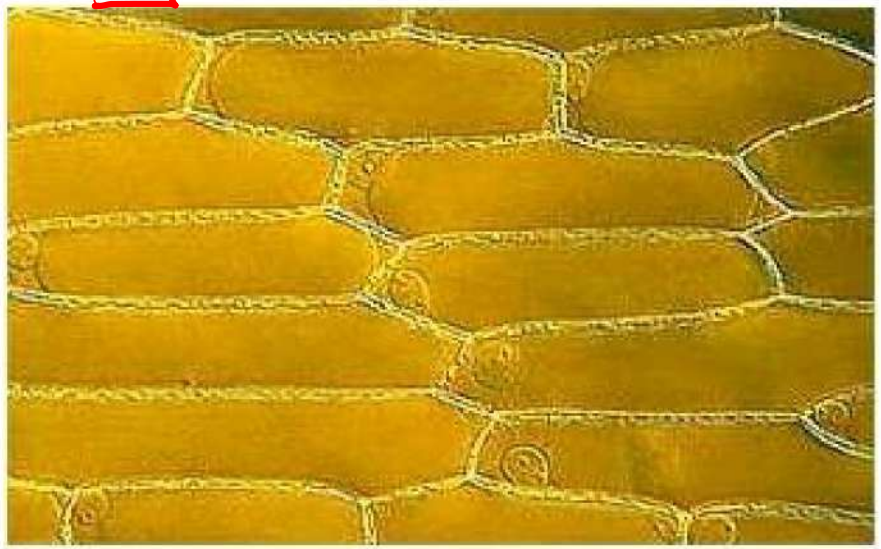


Cell

Cell nomenclature:

- Robert Hooke first noticed the cell and cell wall in 1665 using a microscope. He reported his findings in his book, Micrographia.

- Carl P. Swanson is the father of Modern Cytology.

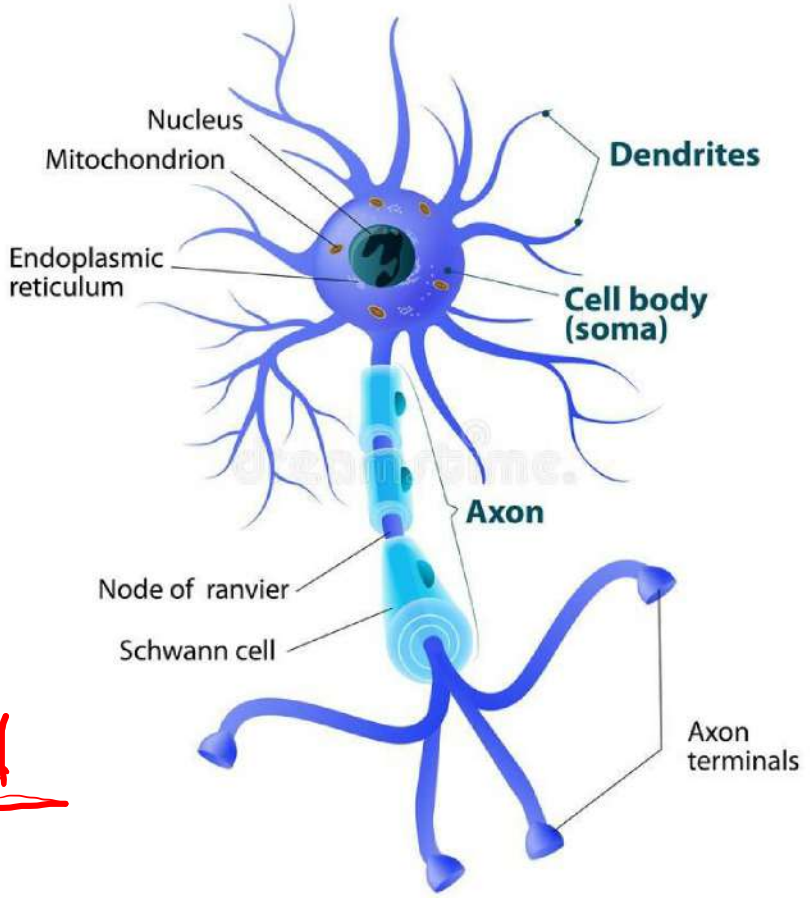


NTK- (Need to Know)

NSI = Not So Important

- Ostrich egg is the largest cell (17 cm ×12.5 cm).
- The smallest cell-Mycoplasma. Its name is PPLO (Pleuro Pneumonia Like Organism)
- Human neuron cells are around 1.37 m long (longest cell of the human body).

MOTOR NEURON



Shape of Cells

Longest cell motor neuron

?? Which one is the smallest cell of human body?

PLATELET

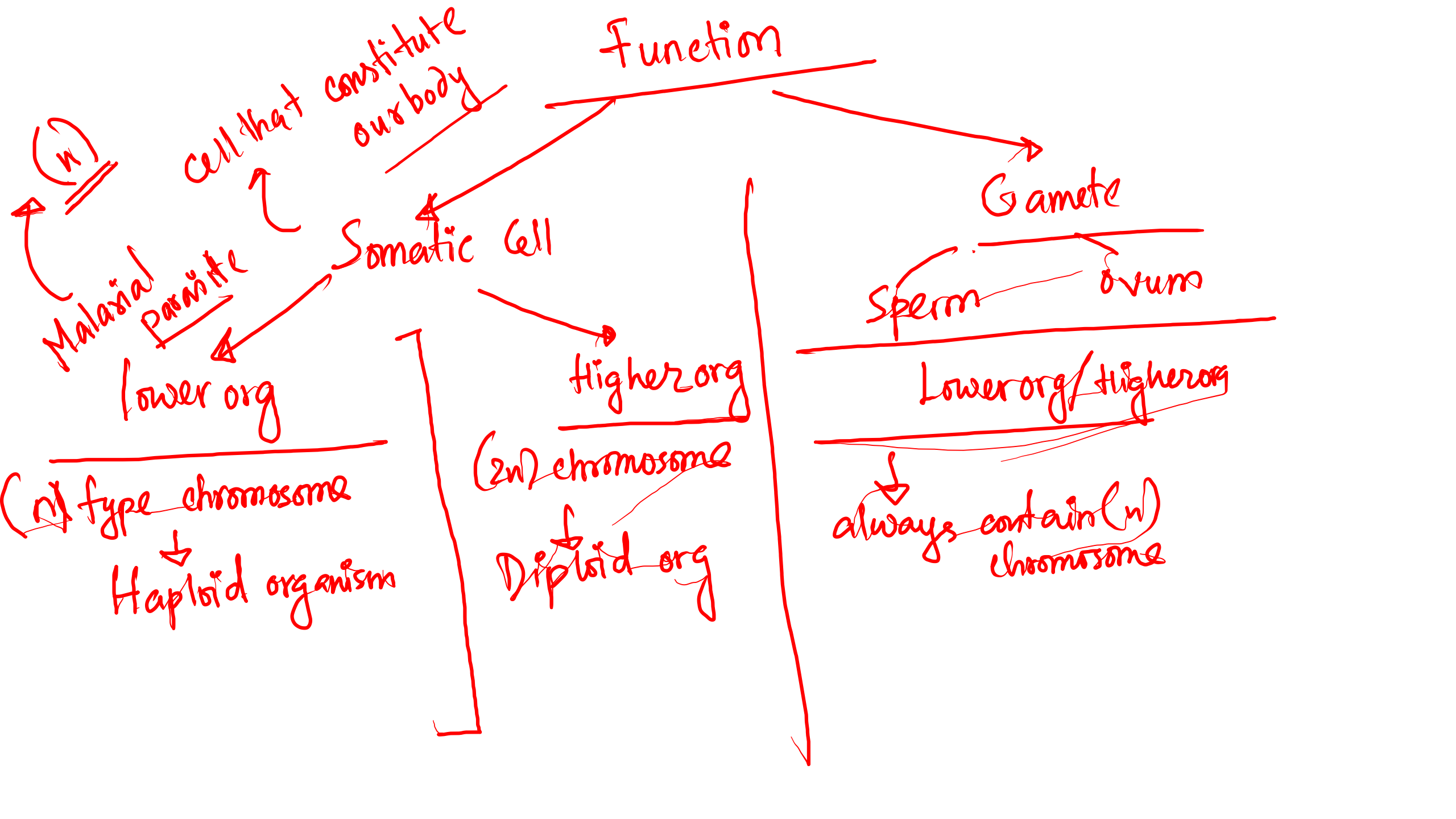
Cell theory:

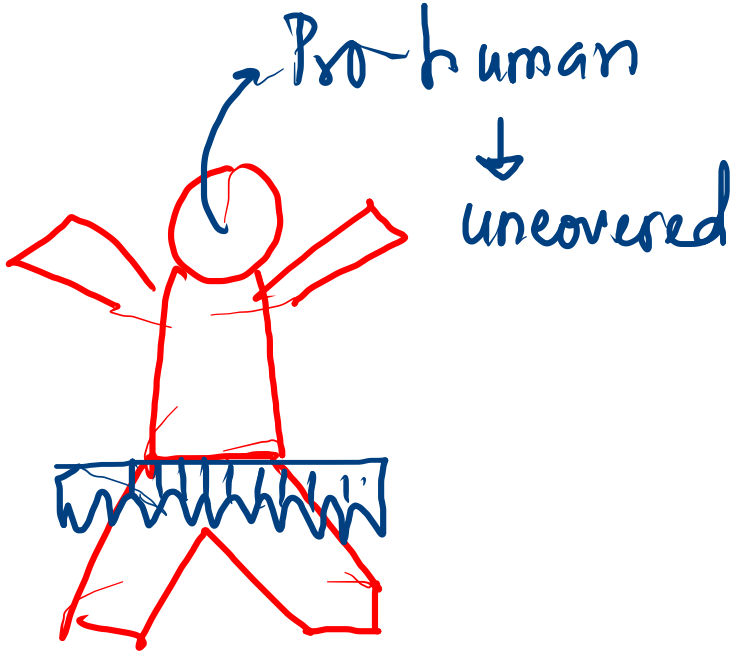
Proponent	• Mathias Jakob Schleiden • Theodor Schwann
Theory	1.Cells are structural, functional and organizational units of living organisms. 2.Cells are the fundamental units of life. 3.Cells are genetic units. 4.All types of organisms are made up of one or more cells, and new cells are formed from the previously formed cells.

Types of cell

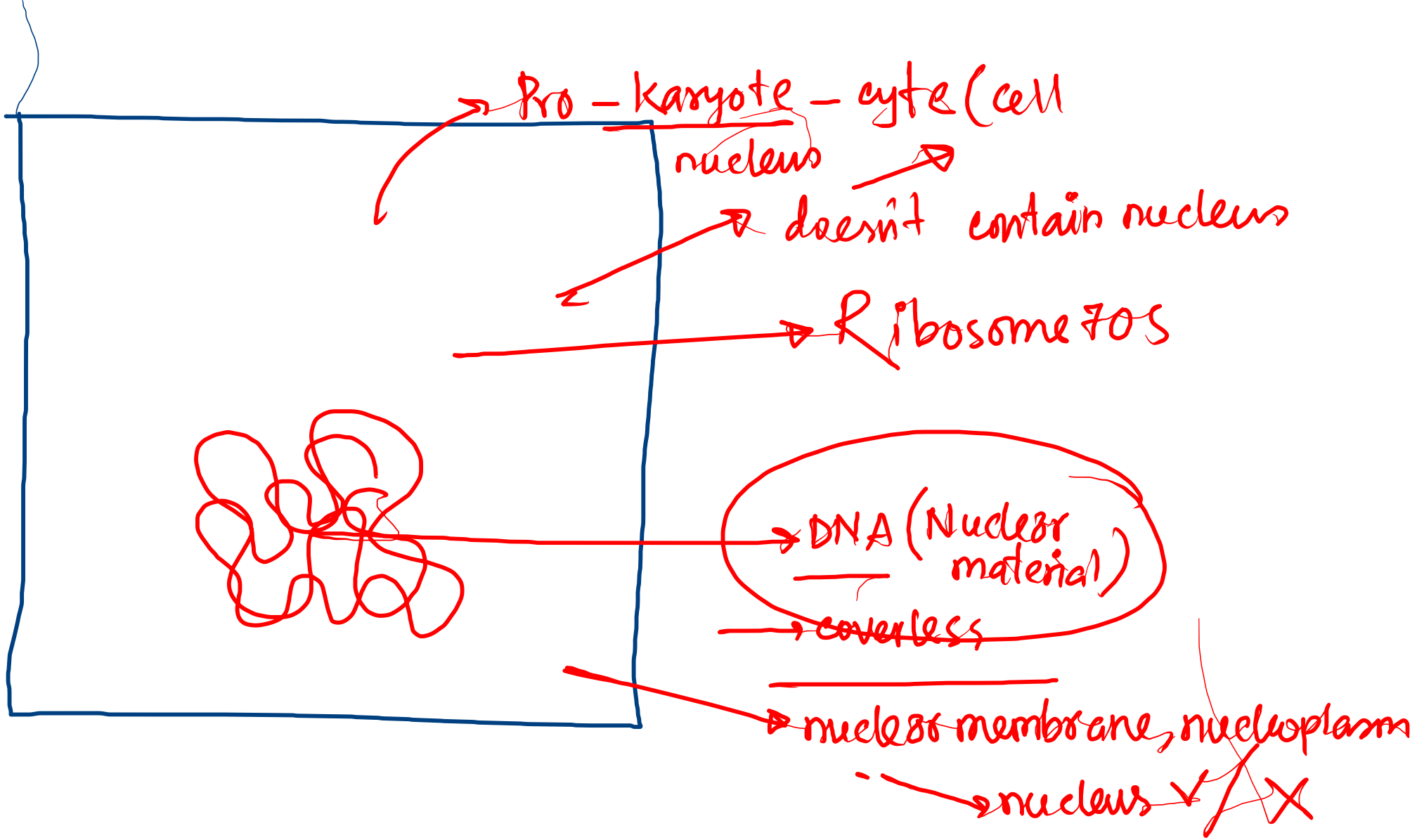
1. On the basis of physiological function
   (a) Somatic cell
   (b) Germ cell or gamete

02. Based on the structure of nucleus
   (a) Prokaryotic cell
   (b) Eukaryotic cell


Function
cell that constitute our body
(n)
Malarial Parasite
Somatic Cell
Gamete
Sperm
Ovum
Lower org
Higher org
Lower org/ Higher org
(n) type chromosome
Haploid organism
(2n) chromosome
Diploid org
always contain (n) chromosome

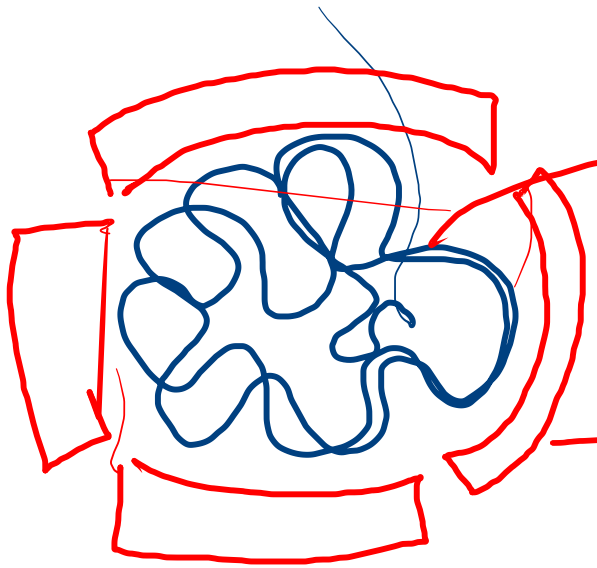

Pro-human
uncovered


Developed
cover


Pro – karyote – cyte (cell
nucleus
doesn't contain nucleus
Ribosome 70S
DNA (Nuclear material)
coverless
nuclear membrane, nucleoplasm
nucleus ✓ / X

Pro & Eu Difference

Eukaryotic cell

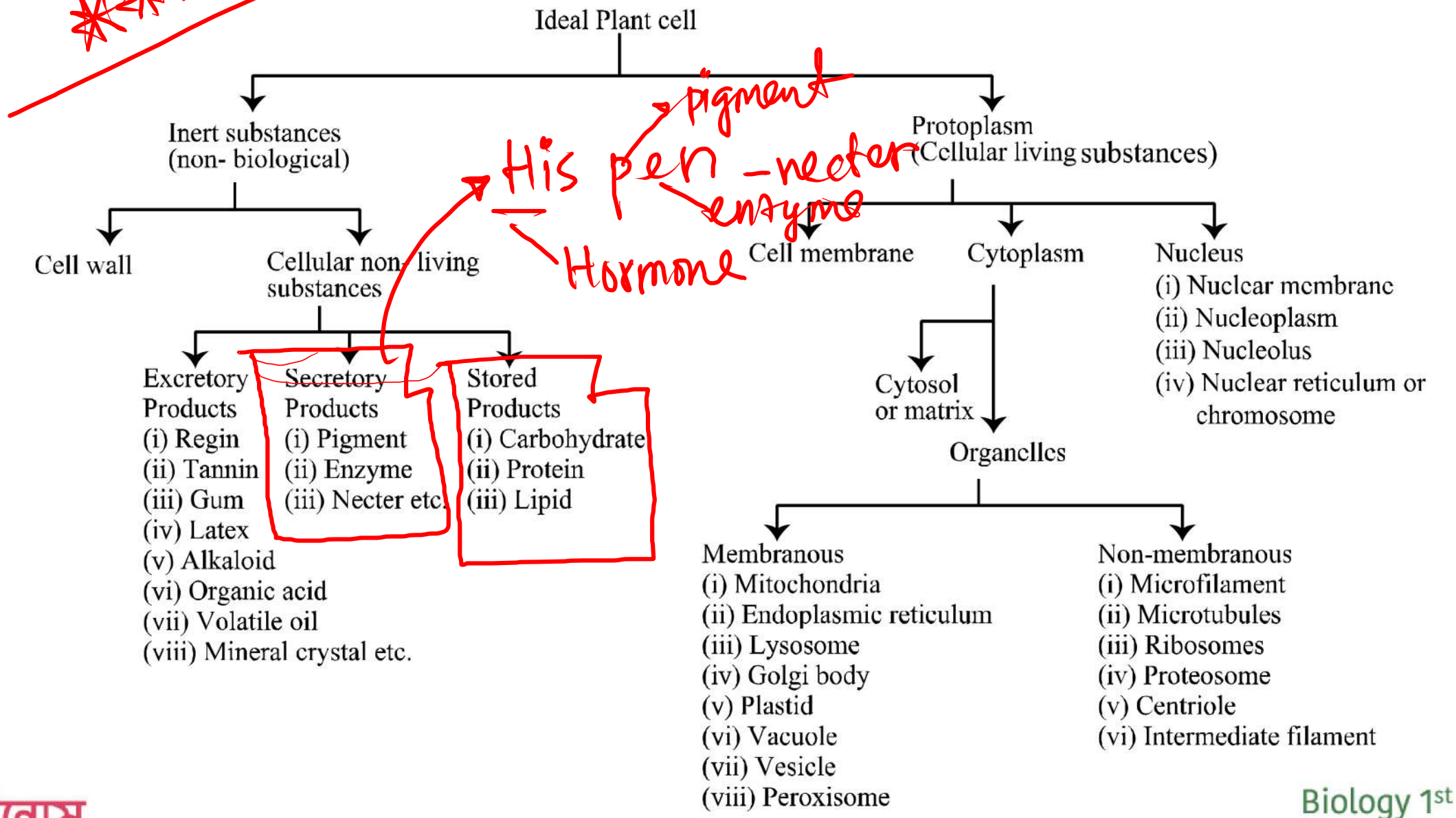


Ribosome 80S

Nucleus

contain all other organelle

Ideal Plant Types of cell



Membrane-bound and membrane-free cellular organelles

Membrane bound

❖ ঝিল্লিবদ্ধ কোষীয় অঙ্গাণুঃ মা এই লেবুগুলো প্লাষ্টিকে ভরে ভ্যানে পার কর।

মা	এই	লেবু	গুলো	প্লাস্টিকে	ভরে	ভ্যানে	পার করে
↓	↓	↓	↓	↓	↓	↓	↓
Mitochondria	Endoplasmic reticulum	Lysosome	Golgi body	Plastid	Vacuole	Vesicle	Peroxisome

Membrane-less organelle

❖ ঝিল্লিবিহীন কোষীয় অঙ্গাণুঃ মামারা প্রতি সেকেন্ডেই ইমোশনাল।

মা	মা	রা	প্রতি	সেকেন্ডেই	ইমোশনাল
↓	↓	↓	↓	↓	↓
Microfilament	Microtubules	Ribosome	Proteosome	Centriole	Intermediate filament

❖ নিঃসৃত পদার্থঃ His PEN.

His	P	E	N
↓	↓	↓	↓
Hormone	Pigment	Enzyme	Necter

Previous years questions

In which of the following organisms primitive cell is present?

(a) Bryophytes (b) Fungi (c) Algae (d) Bacteria

Which one is not a criteria of prokaryotic plants?

(a) No membranous organelle except ribosome

(b) Definitive nucleus present

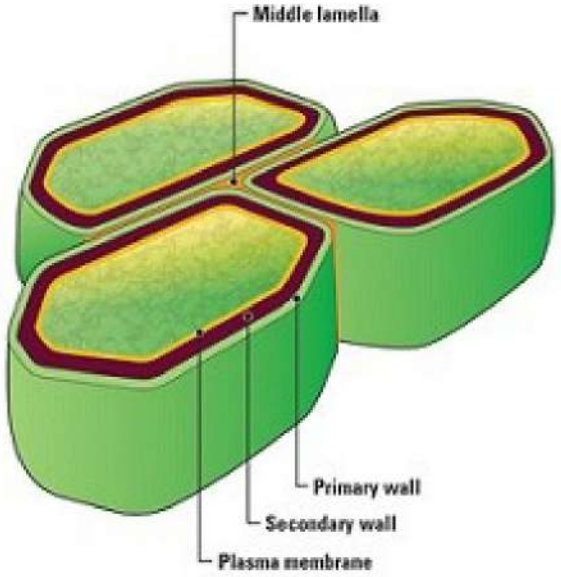
(c) Well formed plastid absent for photosynthesis

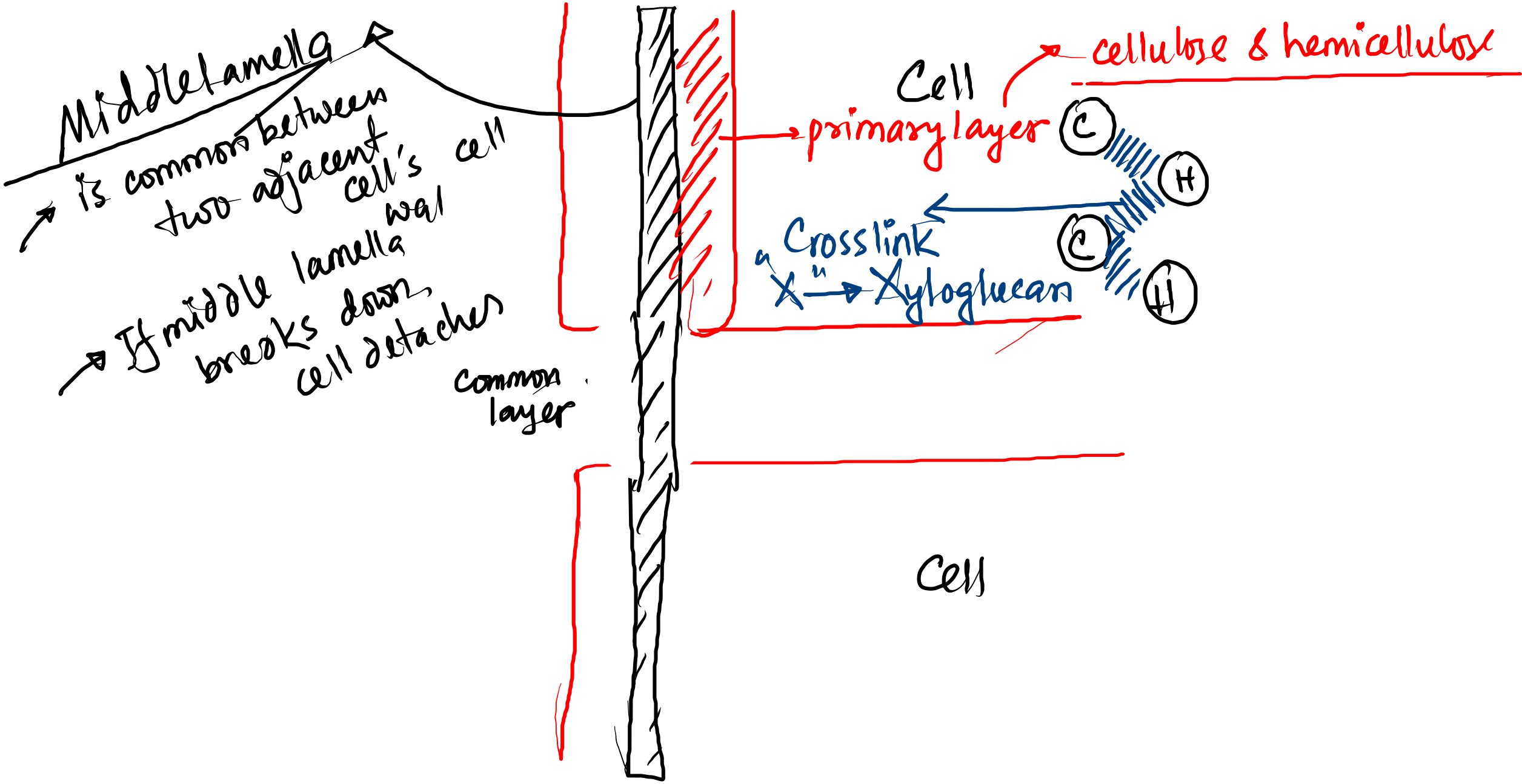
(d) Cell division occurs by amitosis

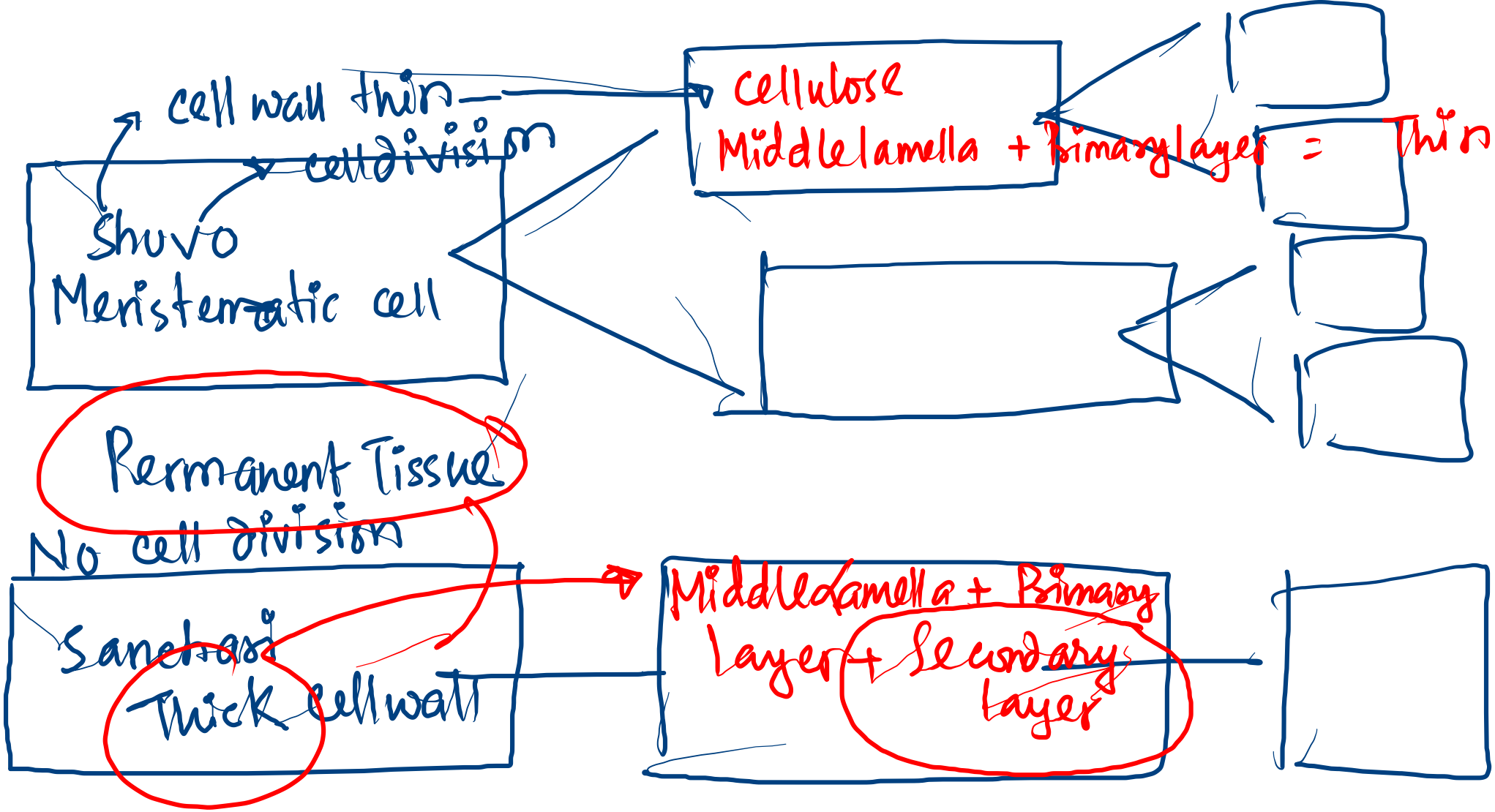
Cell wall

Suggested 100%

- Cell wall is a unique feature of plant cells.
- Primary cell wall is not formed around the pit area.
- The middle lamella starts to form during telophase
- Middle lamella contains large amounts of pectic acid.
- Primary wall mainly contains cellulose, hemicellulose and glycoprotein.
- Secondary walls are found in following cells → Tracheid, Xylem and Phloem fibres.
- Lignin and pectin accumulate in the secondary cell wall; it consists of 3 layers.
- Fungal cell wall is made of chitin and bacterial cell wall is made of a lipid-protein polymer.



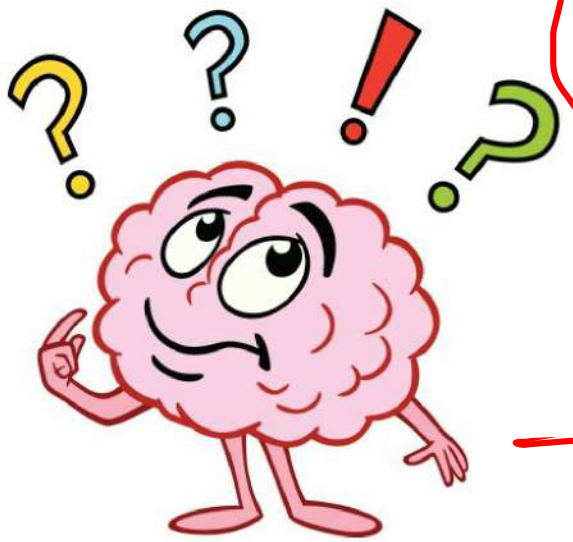

Middle lamella
→ is common between two adjacent cell's cell wal
→ If middle lamella breaks down, cell detaches
common layer
Cell
primary layer
cellulose & hemicellulose
C
H
C
H
Crosslink
X
Xyloglucan
Cell


cell wall thin
cell division
Shuvo
Meristematic cell
Cellulose
Middle lamella + Primary layer = Thin
Permanent Tissue
No cell division
Sanchari
Thick cellwall
Middle lamella + Primary layer + Secondary layer

Cell Wall

Kingdom Plantae

?? Can Cell Wall be found in another cell??



Fungi

Algae

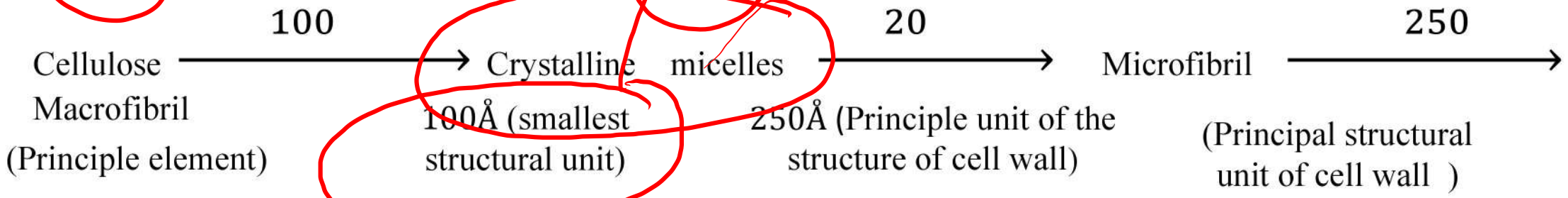
The microscopic structure of cell wall

- Many β - D glucose molecules = Cellulose
- 1-3 thousand Cellulose molecules = Cellulose chain
- Around 100 Cellulose chain = Crystalline Micelles (Smallest structural unit of Cell wall.)
- 20 micelles = Microfibril (This is the main structural unit of cell wall)
- 250 microfibril = Macrofibril
- Many macrofibrils = Fibre

Structural unit

MICROFIBRIL

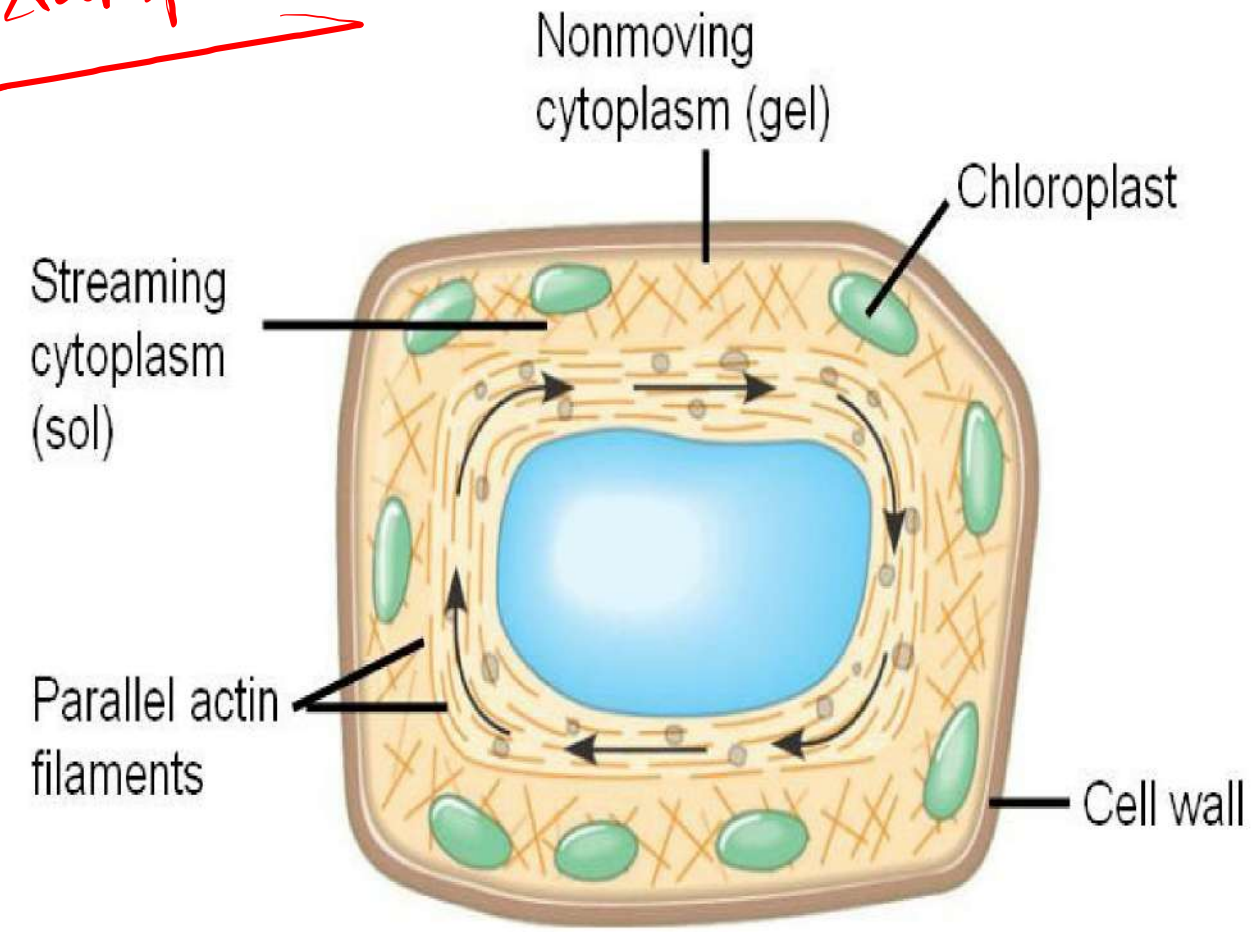
The microscopic structure of cell wall



Locomotion of protoplasm

Example:

- Cyclosis
  - (a) Unidirectional movement or rotation: cellular protoplasm of Pata jhajhi/*Chara corallina*.
  - (b) Multidirectional movement or circulation: cellular protoplasm of *Tradescantia*.

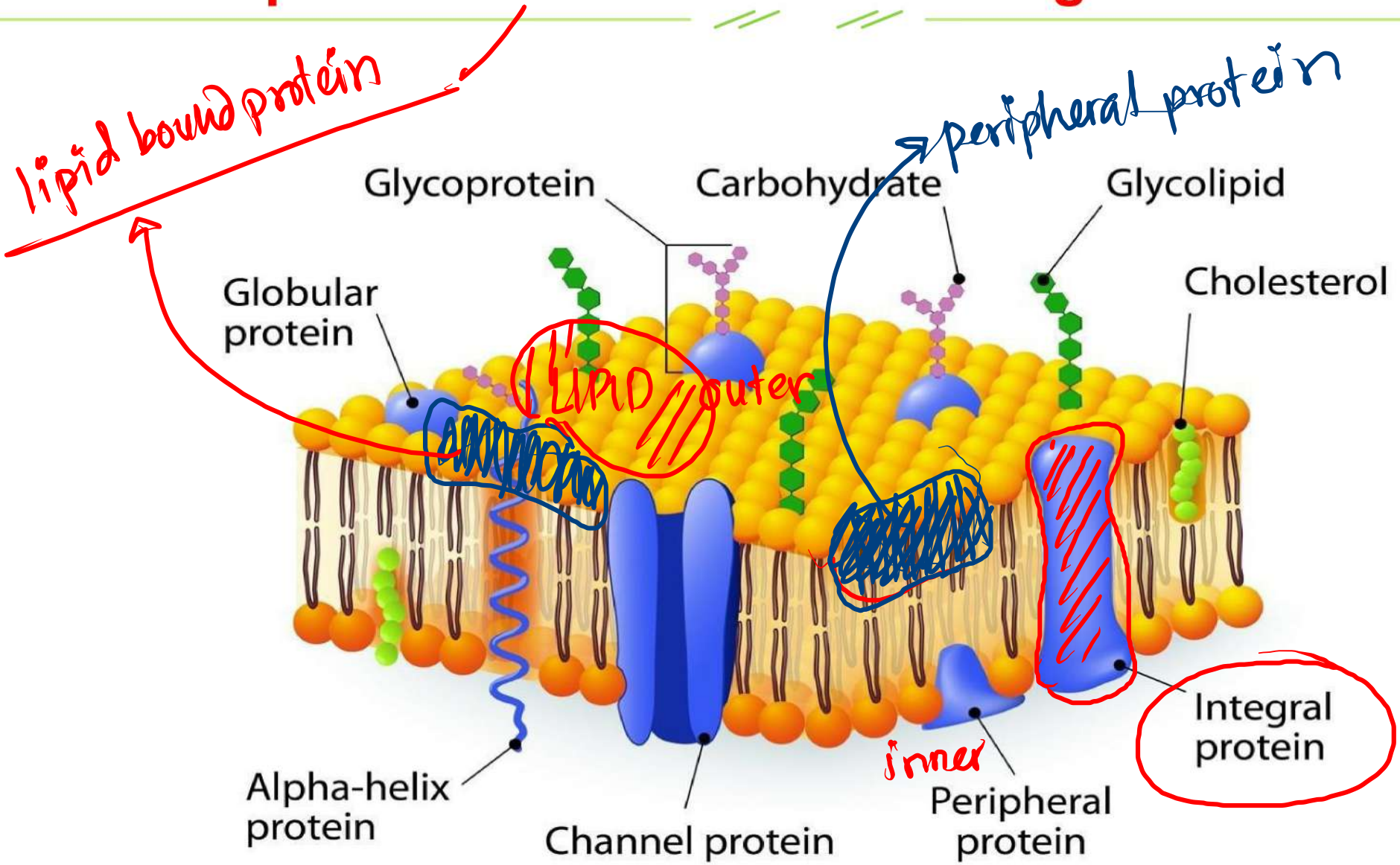


Plasma membrane or cell membrane

Different models related to structure and composition of plasma membrane:

Name of the model	Scientist
• Sandwitch model (bilayer model) - first definite model	Danielli & Davson
• Lipid-protein trilayer model	Danielli & Schmitt
• Unit membrane hypothesis	Robertson
• Fluid mosaic model or Iceberg model	Singer & Nicolson
• Protein crystal model	Vanderkoff & Green

Structure of plasma membrane according to Fluid mosaic model



Structure of plasma membrane

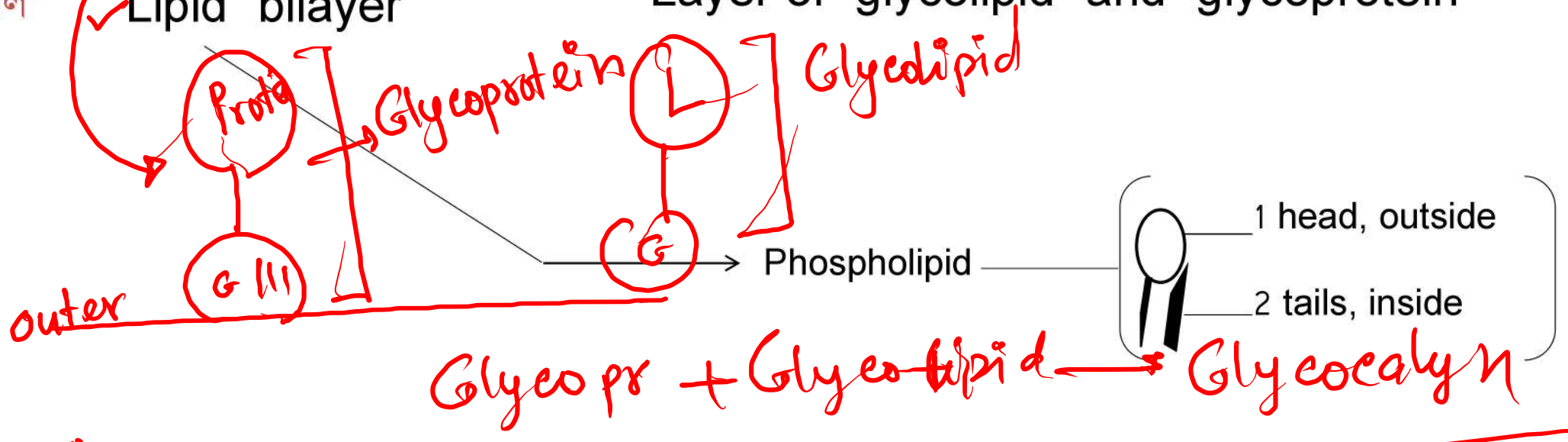
Tips **Components**

মেম ✓ Membrane protien → 3 Types: i.Integral, ii.Peripheral and iii.Lipid related protein

কোই ✓ Cholesterol

গে ✓ Glycocalyx → Layer of glycolipid and glycoprotein

লি ✓ Lipid bilayer

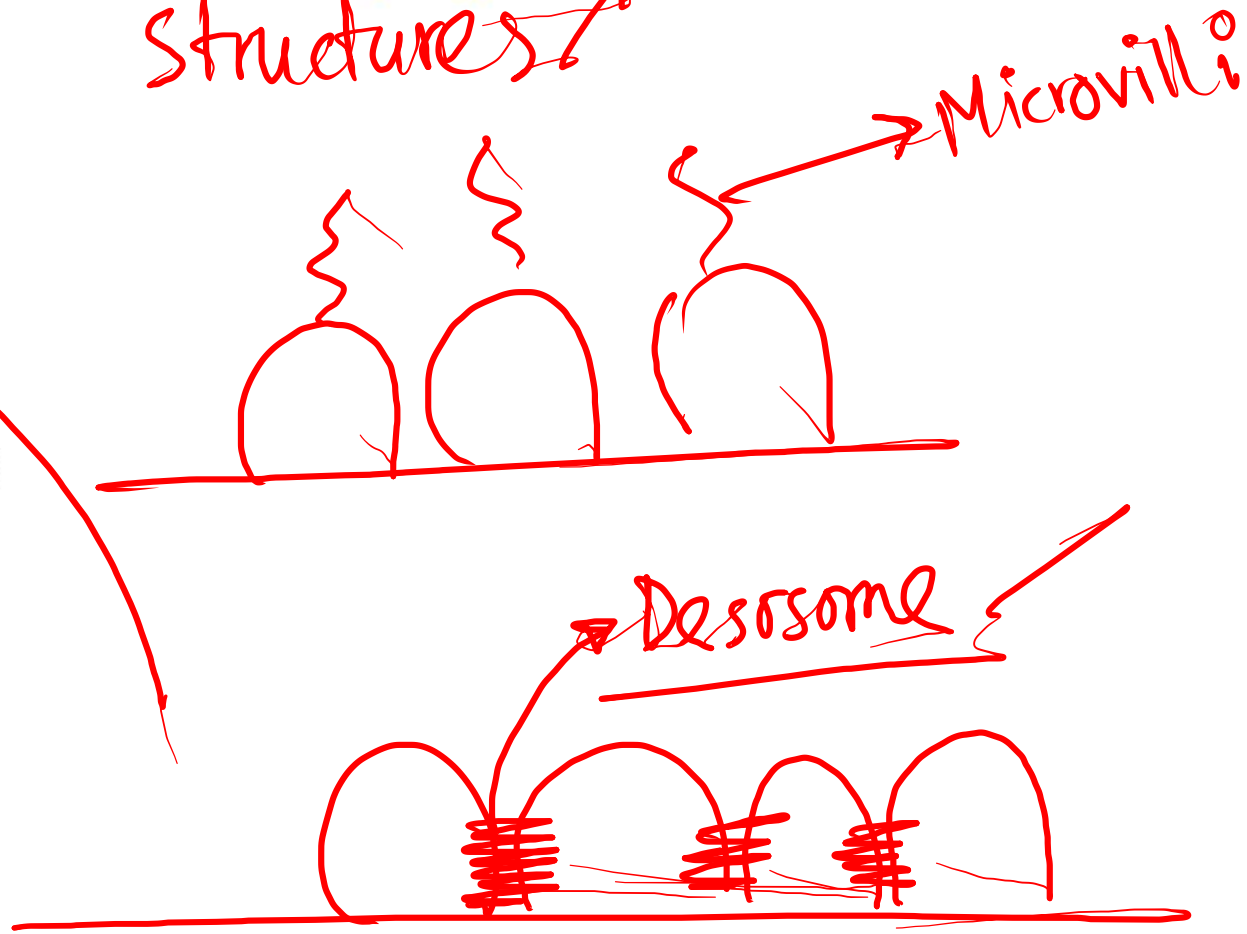


Different ~~Phase~~ of Cell membrane

Reading/R

- ✓ Microvilli
- ✓ Desmosome
- ✓ Phagocytic vesicle
- ✓ Pinocytic vesicle

Structures?



Functions of cell membrane

1. This surrounds everything in the cell.
2. Protects the internal contents of the cell from outer adverse environment.

   Transfer of substances occurs through cells
4. Can synthesize various macro-molecules.
5. Also has a role in mutual bonding, growth and locomotion.
6. Secretes enzymes and antigens.
7. Collects information as neurotransmitters, hormones, etc.
8. Transmits nerve stimuli.

Previous years questions

- **According to fluid mosaic model, which is not a structural ingredient of cell membrane?**
  (a) Starch
  (b) Cholesterol
  (c) Lipid bilayer
  (d) Membrane protein

- **Not a function of plasma membrane–**
  (a) Helps in food intake by phagocytosis and pinocytosis process
  (b) Regulates acidity and alkalinity of cell
  (c) Forms a frame for the arrangement of specific enzymes
  (d) Synthesis of large molecules

Ribosome

- Albert Claude noticed organelles containing RNA after centrifuging cytoplasm of liver cells and named them microsomes.
- Richard B. Roberts named it ribosome
- Protein synthesis is the main function of ribosome.
- When many ribosomes are arranged as pearl necklace in the cytoplasm is known as Polyribosome or polysome

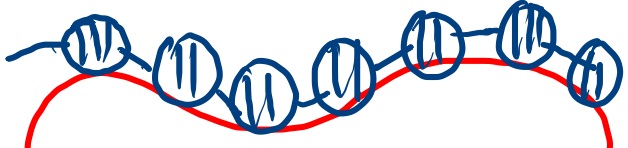
P.C

Ribosome

free Ribosome

All organelle

polyribosome



Ribosome

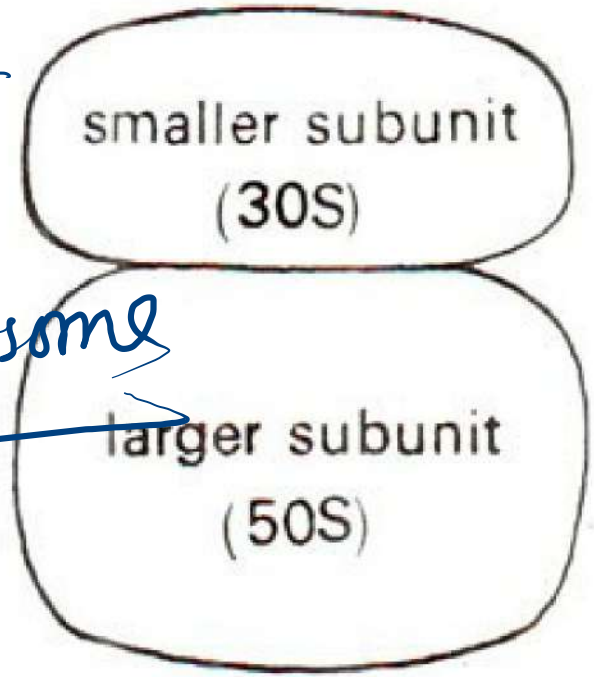
bacteria E.Coli

dry weight

22% ribosome

Functions

- Protein synthesis
- Metabolism of fat
- Phosphorylation of glucose

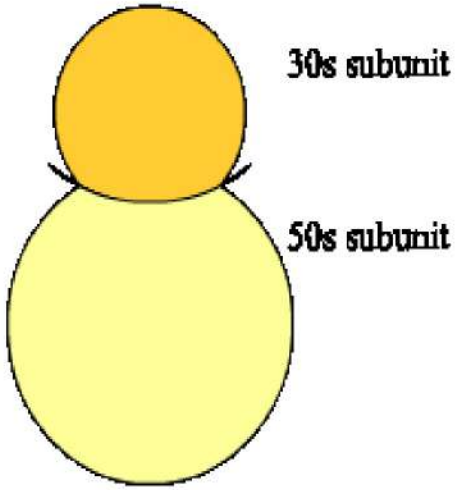


In bacterial cell *(E. coli)* the number of ribosome is almost 20 thousand

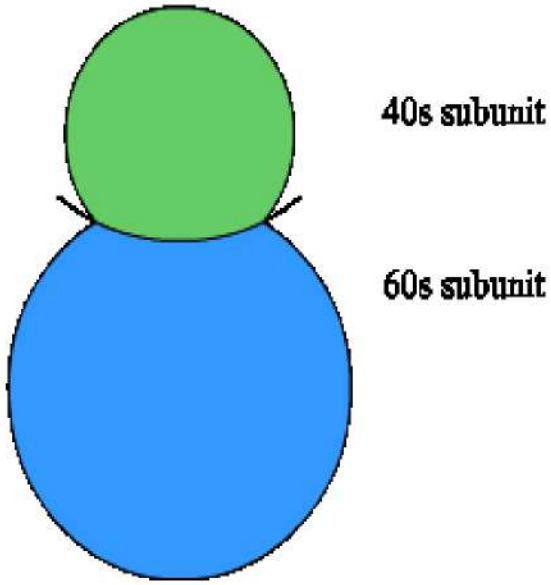
Ribosome

- **70S Ribosome (50S + 30S)**
  - ✓ Found in prokaryotes
  - ✓ Made of 3 rRNA molecules and 52 types of proteins.

- **80S Ribosome (60S + 40S)**
  - ✓ Found in eukaryotes.
  - ✓ Made of 4 rRNA molecules and 80 types of proteins.



70s ribosome



80s ribosome

Previous years questions

Which protein constitues about 50% of chemical contents of ribosome?

(a) Cytochrome reductase (b) Glyceride

(c) Histone (d) Aryl sulfatase

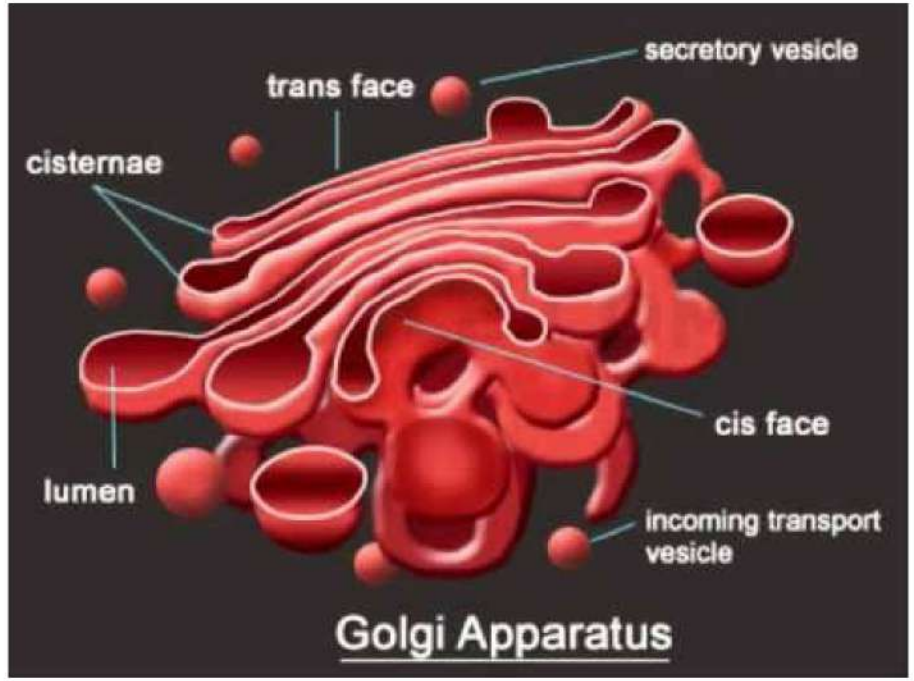
Which synthesizes protein and metabolizes lipid?

(a) Golgi body (b) Ribosome

(c) Mitochondria (d) Endoplasmic reticulum

Golgi body

- Italian neurologist, Camillo Golgi, saw these in the neurons of owls and cats
- originated from smooth endoplasmic reticulum
- Golgi body membrane is 60% protein and 40% lipid. It contains fatty acid, vitamin-K and carotenoids



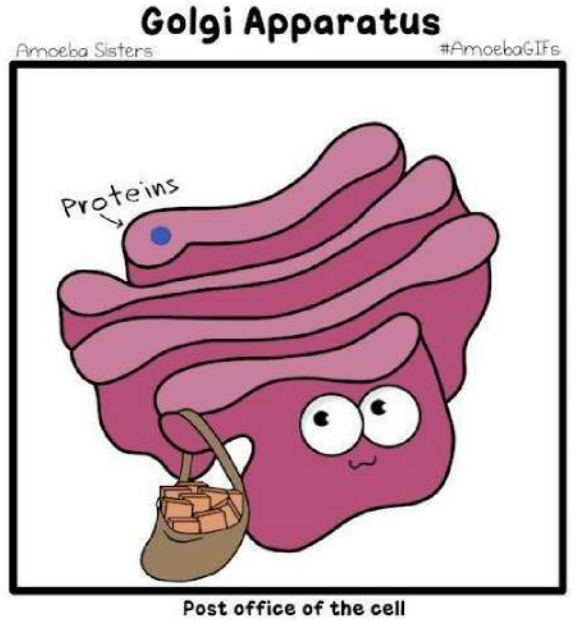
Types:

(1) Cisternae
(2) Vacuoe
(1) Vesicle

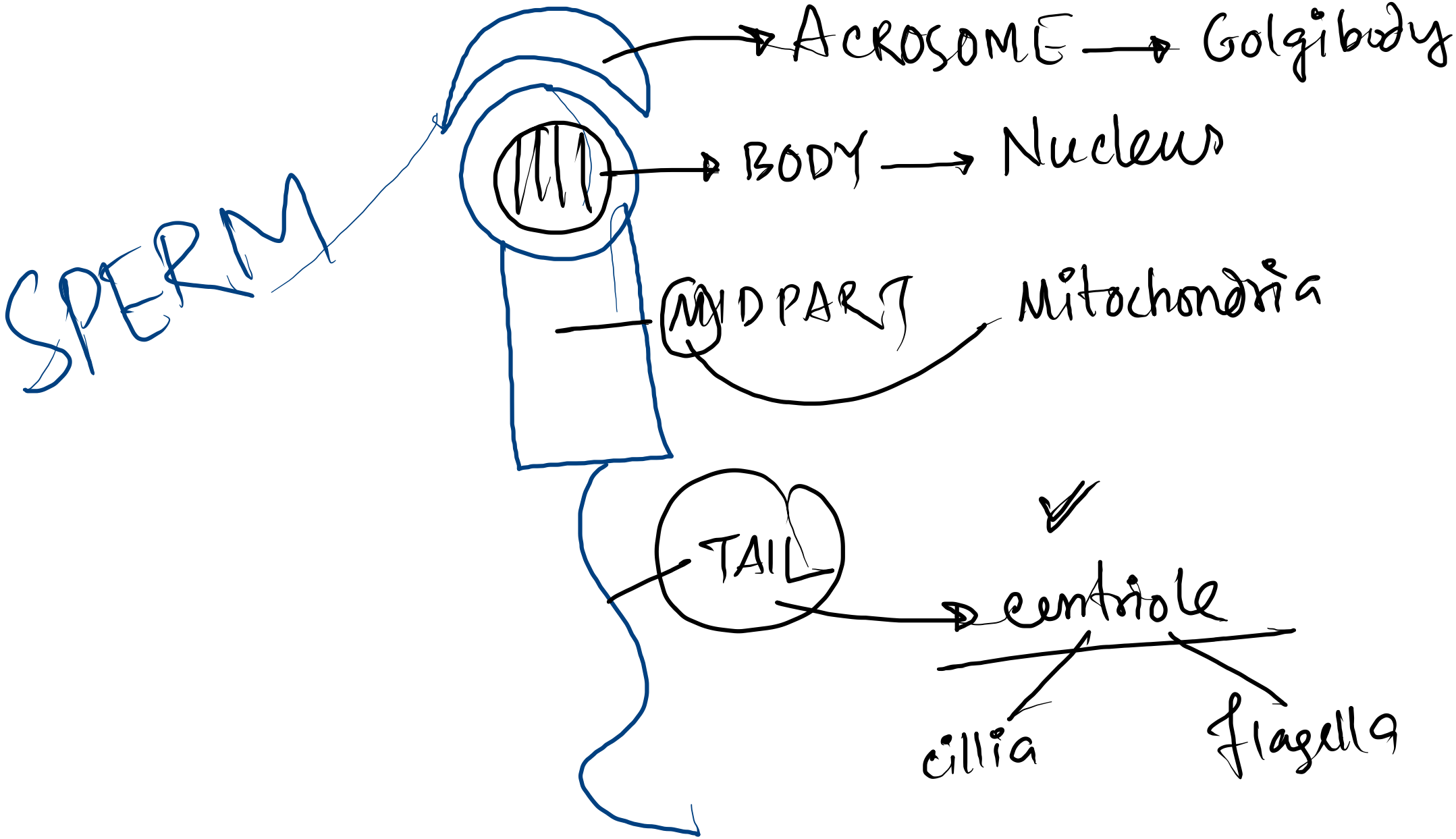
Golgi Complex/ Lypochondria

Function:-

1. Synthesis of lysosomes and vitamins.
2. Synthesis of non-protein substances.
3. Secretion of enzymes, hormones and water.
4. Formation of cell plate during cell division.
5. Packaging of prepared food particles in endoplasmic reticulum.
6. Storage of protein and Vit-C.
7. Secretion of substances necessary for cell wall synthesis.
8. Helps to form acrosome in sperm.

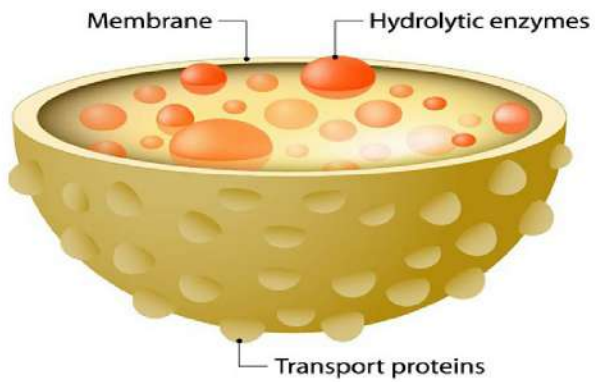


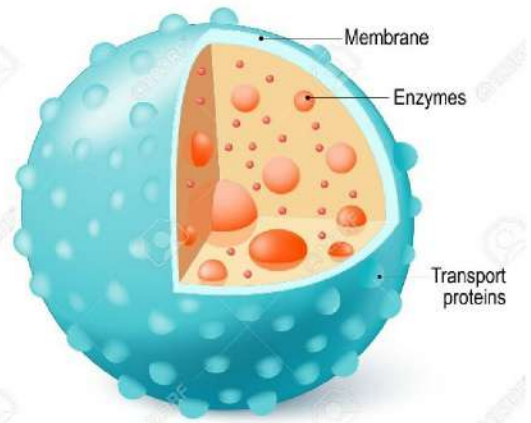
*** **Golgi body in plant cells is called carbohydrate factory.**


SPERM
ACROSOME → Golgibody
BODY → Nucleus
MIDPART
Mitochondria
TAIL
centriole
cillia
flagella

Lysosome

- Named by de Duve.
- Originated from endoplasmic reticulum and packaged by golgi bodies.
- WBCs of animals have plenty of lysosomes
- RBC do not have lysosomes
- Lysosomes of plant cells → Spherosome/ Oleosome
- Contains 40 types of enzymes while being enclosed by membrane.
- Found in LINK (Liver, Intestine, Nerve, Kidney)





Lysosome

Monocyte / Macrophage
neutrophil

Functions:

1. Does phagocytosis and pinocytosis.
2. Encloses digestive enzymes and protects other cell organelles.
3. Autolysis → lysozome breaks it own cell ber of infection
4. Can cause cancer
5. Hyaluronidase enzyme secreted by lysosomes of sperm degrades the outer covering of ovum.

VIRUS ATTACKED
Hydrolyse

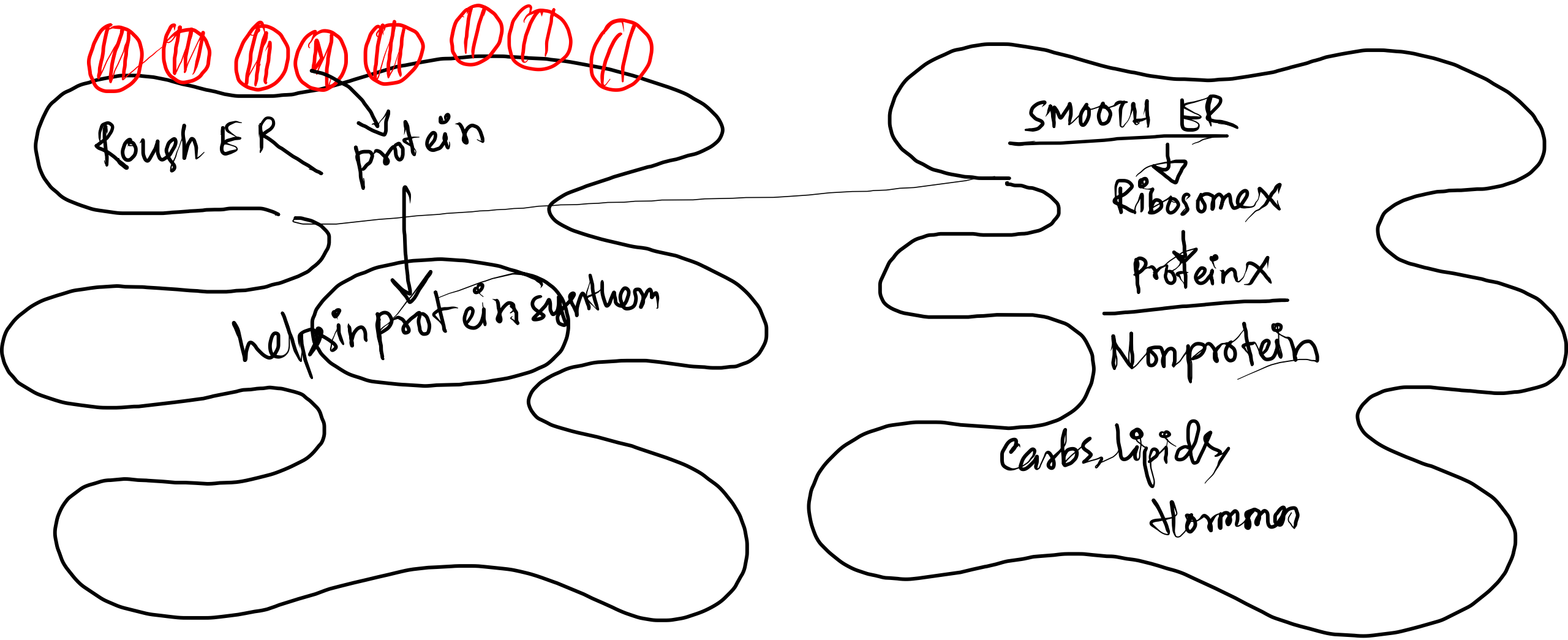
Sucidal squad

*** They are called sucidal squad as they destroy useless cells by autolysis.

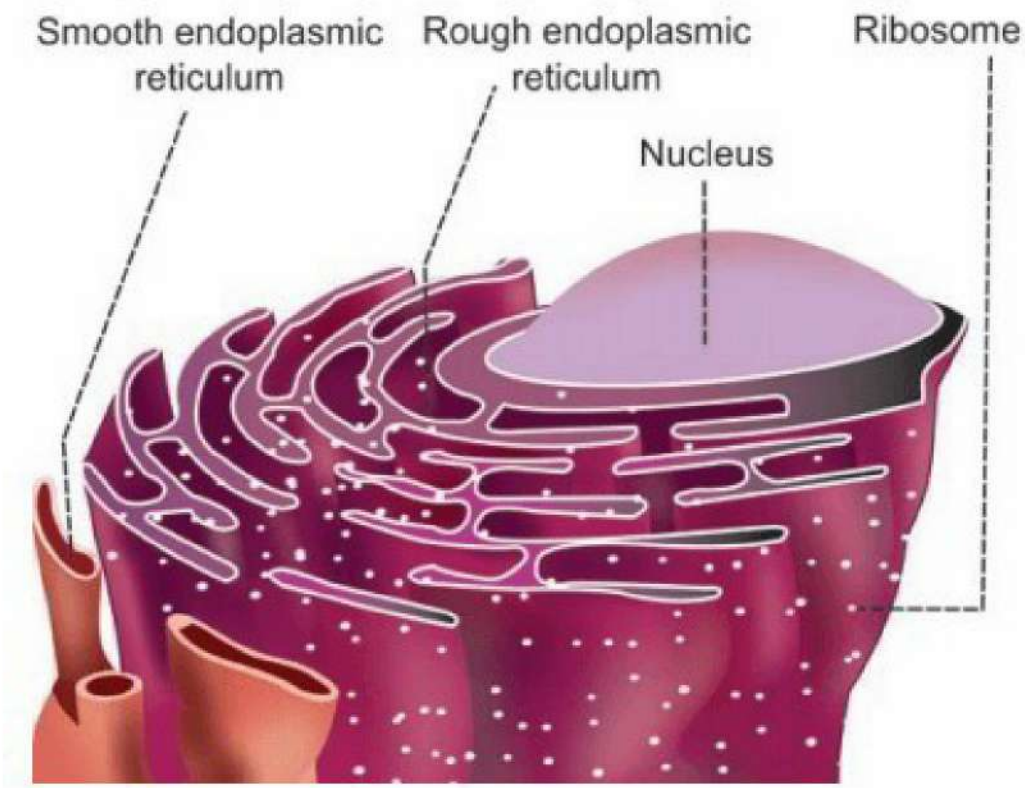
Endoplasmic reticulum

- K. R. Porter and his associates first discovered it in liver cells and named it.
- Albert Claude and Keith Porter discovered from cytoplasm of chicken embryonic cells.

- Principal chemical elements are- protein (60-70%) and lipid (30-40%).
- Almost 15 types of enzymes are found here.
- Small discrete parts of the rough endopasmic reticulum are called microsome.


Rough ER
protein
help in protein synthesis
SMOOTH ER
Ribosome x
protein x
Nonprotein
Carbs, lipids
Hormon

Endoplasmic reticulum



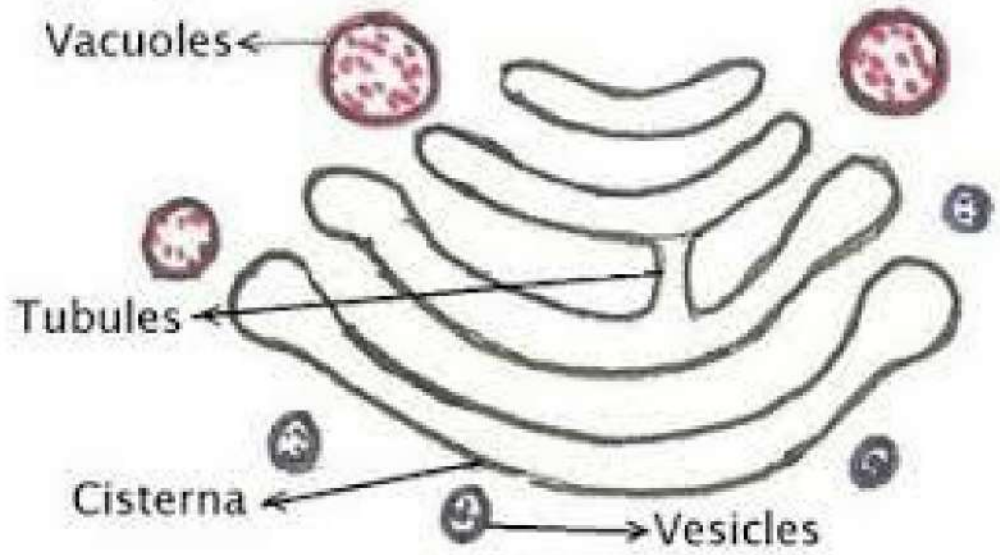


Fig of Golgi Apparatus

Endoplasmic reticulum

Functions:

1. Acts as frame of protoplasm.
2. Acts as internal carrier of lipids and proteins.
3. Proteins are synthesized in rough endoplasmic reticulum.
4. Lipid, hormone, glycogen, vitamin and steroid are synthesized in smooth endoplasmic reticulum.
5. Neutralizes toxins entering the body.
6. Described as transport system of cell
7. Plays an important role in transport of proteins synthesized by ribosomes.

Previous years questions

- **Which one is not a special name of golgi body?**

(a) Dictyosome
(b) Idiosome
(c) Lipochondria
(d) Camillo Golgi

- **Which one is Golgi body's function?**

(a) ATP synthesis
(b) Help in fat metabolism
(c) Control ionic balance of cell
(d) Control cellular secretions

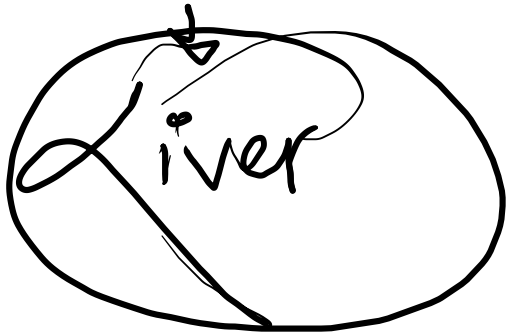
Mitochondria

- **Discovery :** Kolliker

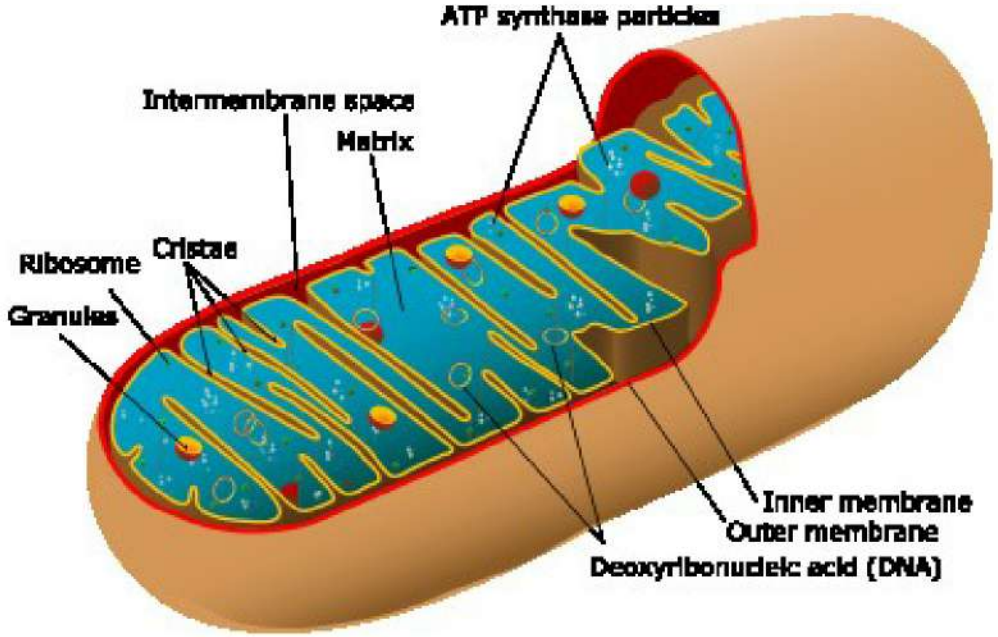
- Normally 300-400 per cell.
  - 1,000 or more in liver cells.
  - More in *Amoeba.*

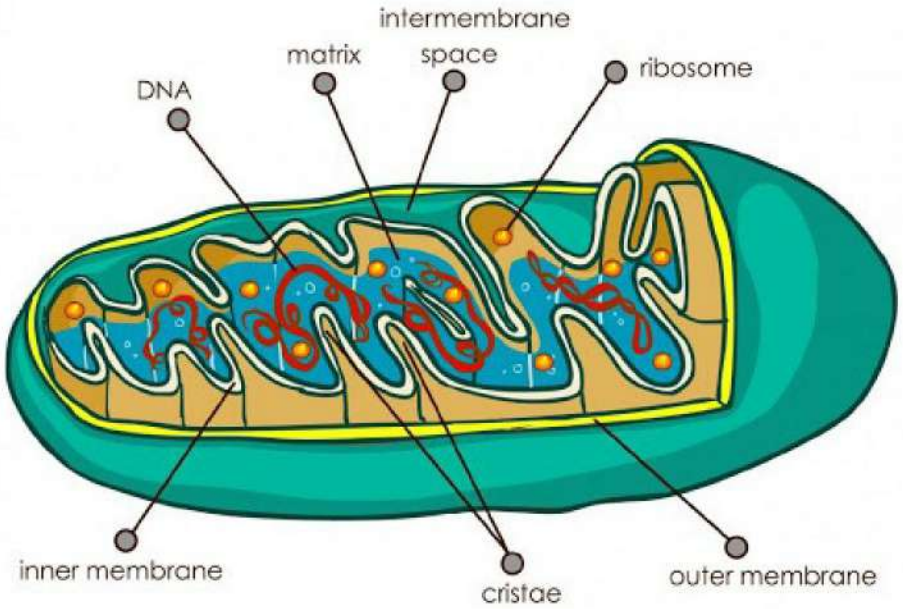
- 20 % of cell volume is mitochondria.

- There are 100 types of Enzymes and Co enzymes



Mitochondria

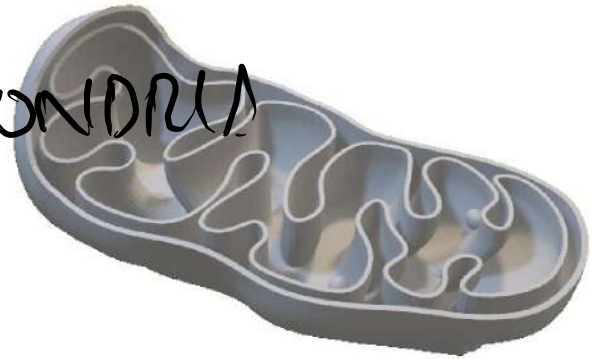




Mitochondria

Functions:

1. Produce energy.
2. Helps in lipid metabolism.
3. Produces its own RNA, DNA.
4. All the reactions of respiration (Krebs cycle, ETS, oxidative phosphorylation) except glycolysis occur in the mitochondria.
5. Stores different cations (Ca^{2+}, K^{+}) and capable of active transport.
6. Helps in sperm and ovum formation.
7. Maintains concentration of Ca^{2+} ions in cell.
8. Regulates apoptosis of cell.



Mitochondria

BORING JOKES

?? Then how gives power to our Mitochondria ?

Poll Question: 01

➢ **Which one is known as the power house of a cell?**

(a) Mitochondria

(b) Chloroplast

(c) Ribosome

(d) Golgi body

Poll Question: 02

➢ **Mitochondria is abundant in which cell ?**

(a) Skin

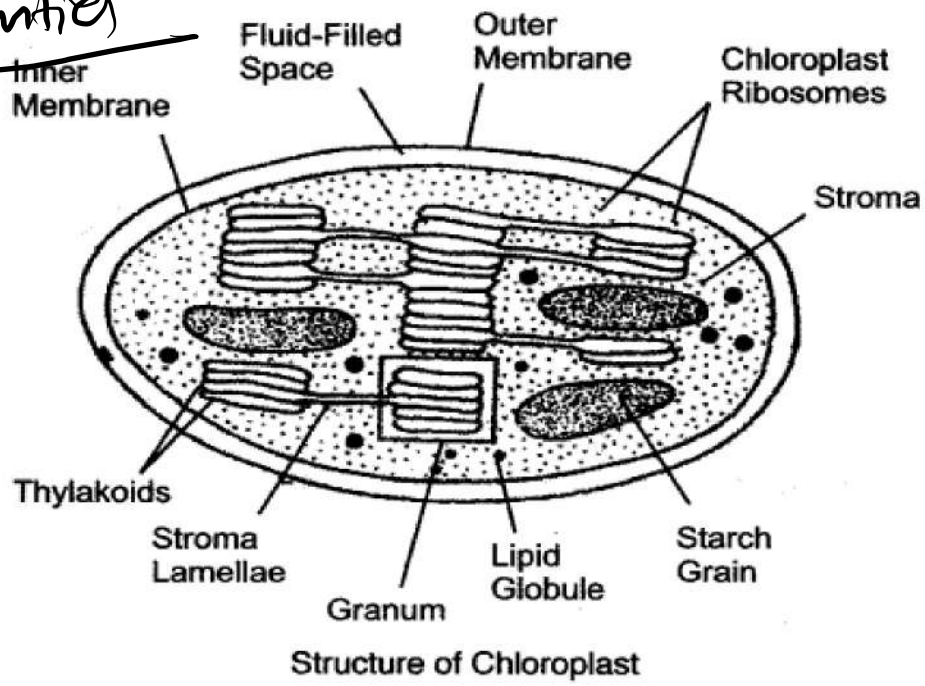
(b) Liver

(c) Stomach

(d) Eye

Plastid

- Discovery and nomenclature : **W. Schimper**
- Numbers: 10 to 40 per cell of higher plants.
- Fungi, bacteria, cyanobacteria etc. do not have plastids.
- Largest cellular organelle



Structure of Chloroplast

Plastid

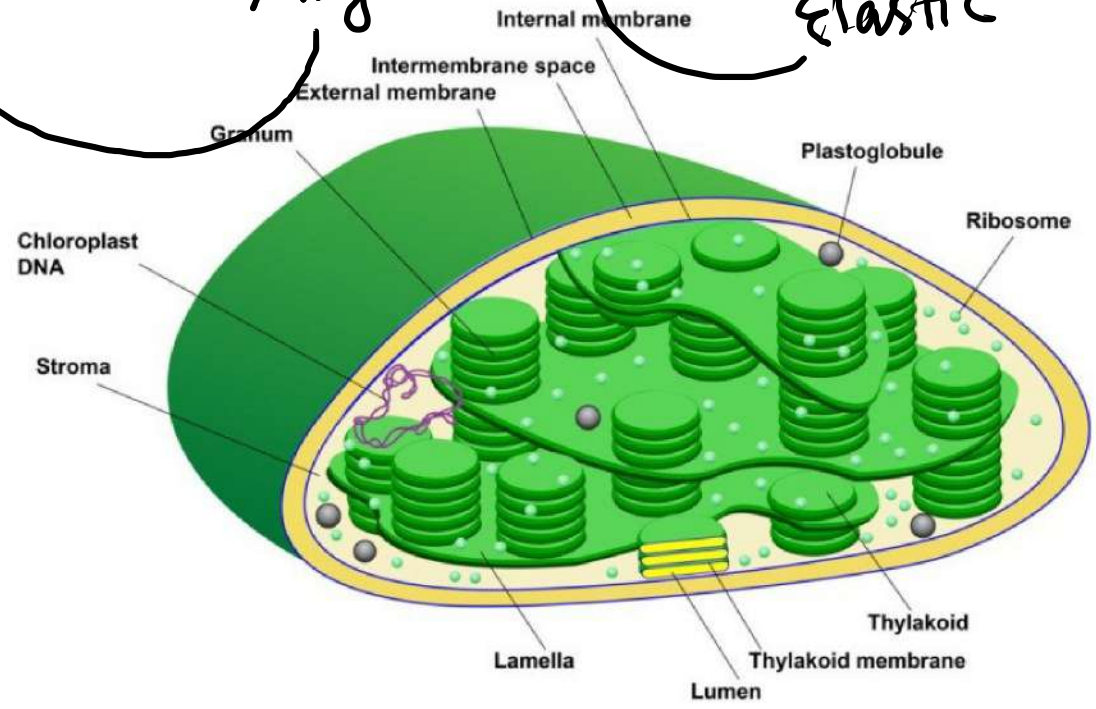
Types:

- Chromoplast
- ~~Chloroplast~~
- ~~Leucoplast~~

(i) Amyloplast: Storage of starch.

(ii) Elaioplast: storage of lipid.

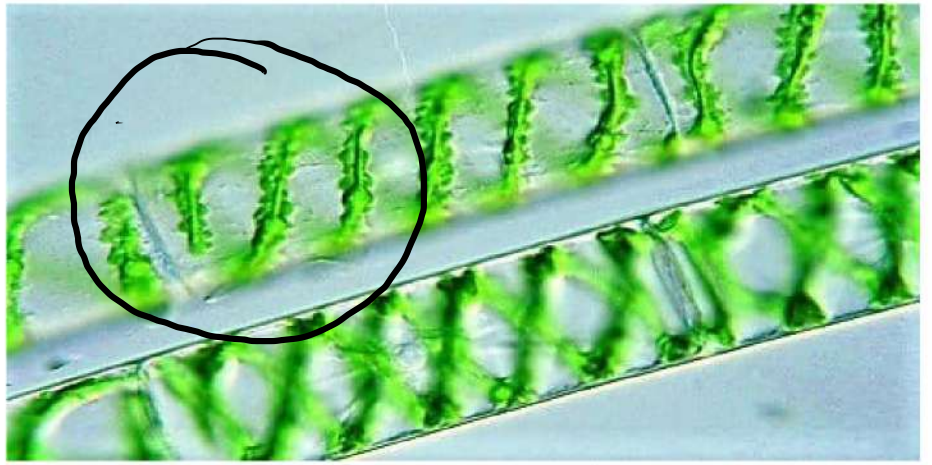
Aleuroplast/protein oplast: storage of protein.

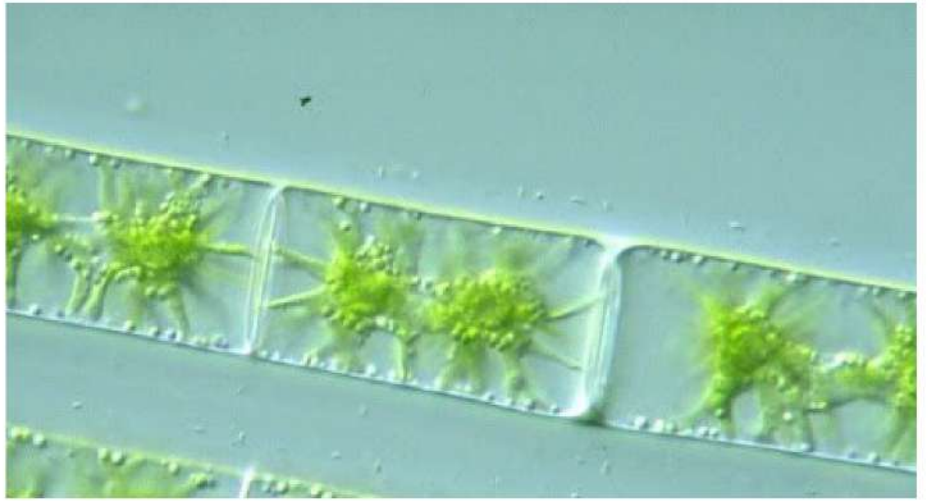


Plastid

Different shapes of Plastid

- Cup shaped → *Chlamydomonas*
- Spiral → *Spirogyra*
- Reticular → *Oedogonium*
- Stellar → *Zygnema*
- Ring shaped/Girdle shaped → *Ulothrix*
- Spherical → *Pithophora*





Poll Question: 03

- **Which plant is without plastid?**

(a) Cycas

(b) Moss

(c) Agaricus

(d) Spirogyra

Poll Question: 04

- **Which is the largest organelle in the cytoplasm of plant cell?**

(a) Golgi body

(b) Mitochondria

(c) Centriole

(d) Chloroplast

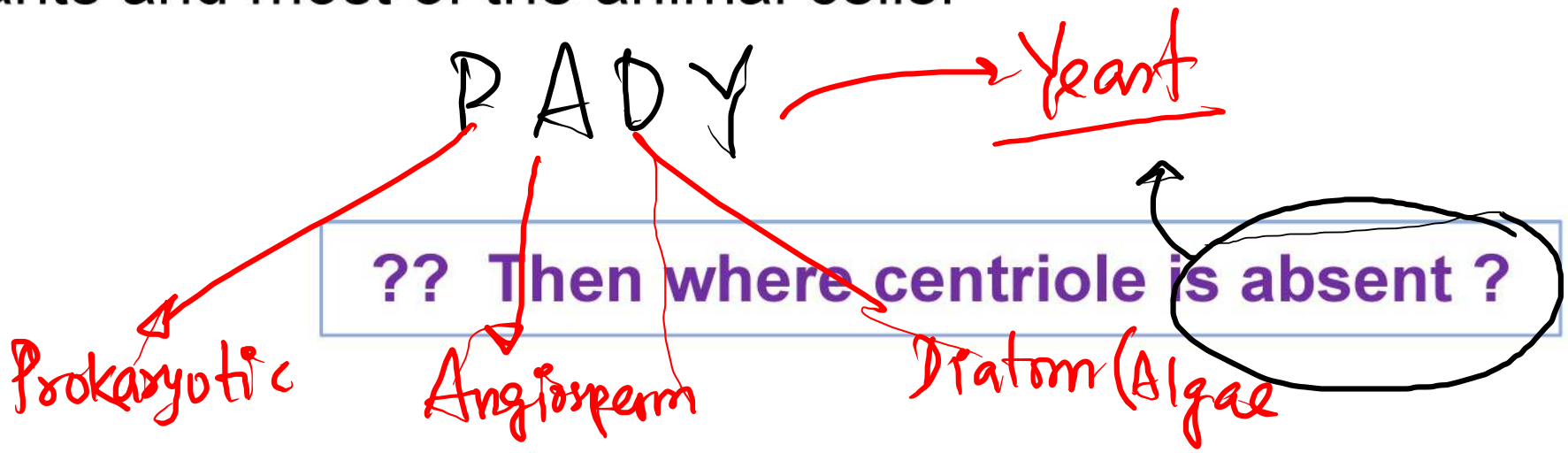
Plastid

Centriole

- **Discovery:** Van Benden.
- **Nomenclature:** Theodor Bovery

NSI

- Present in algae, fungi, bryophytes, pteridophytes, gymnosperm plants and most of the animal cells.

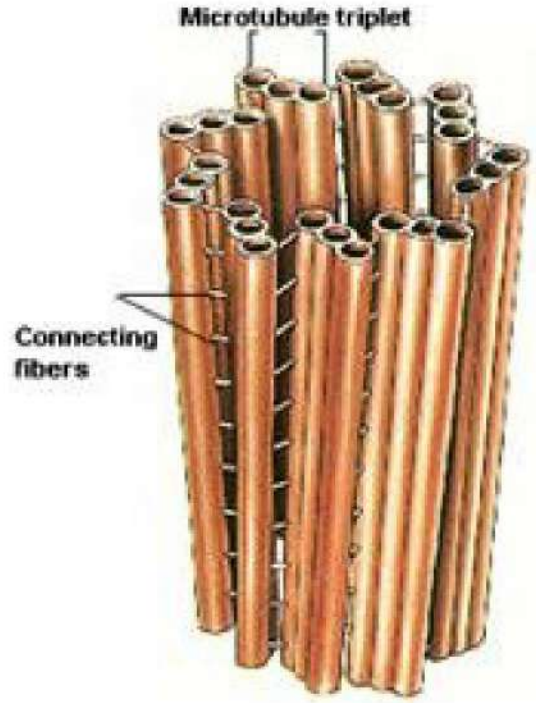


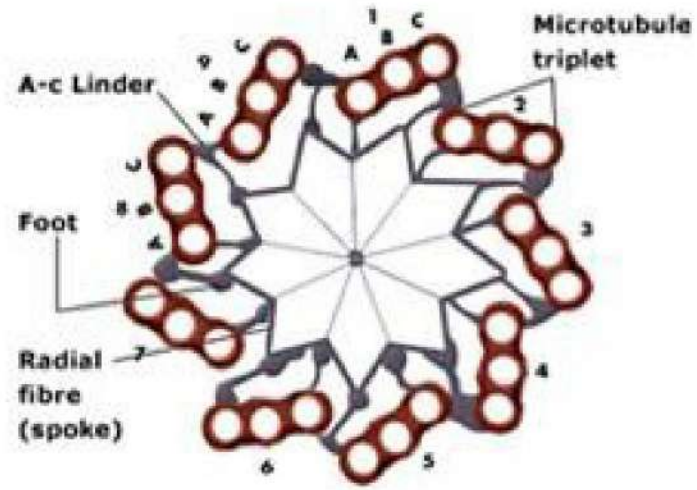
Centriole

There are three parts. E.g.-

- Cylinder wall)
- Triplets)

  [There are 9 triplets, each formed of three subtubules]
- Linkers).





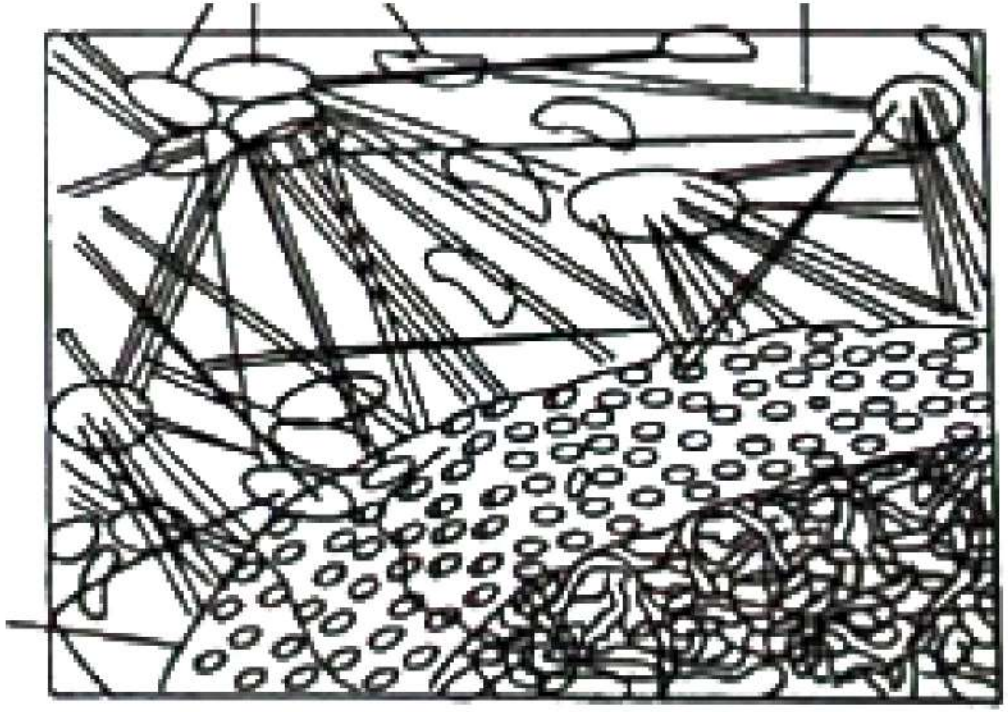
Cytoskeleton

Functions:

- Microtubules
- Microfilament
- Intermediate Filament

Functions 100%

it helps to move cillia & flagella



Previous years questions

- **Who discovered microtubules of plants?**

  (a) Svedberg

  (b) Palade

  (c) Van Benden

  (d) Porter

Nucleus

Some cells are non nucleated e.g. RBC (mature) of mammals, Platelet, eyelens, sieve cell

Discovery and nomenclature	• **1831, Robert Brown discovered nucleus in leaf cell of orchid and named it.**
Origin or name	• Latin 'NUX' means nut, from which the word 'Nucleus' was originated.
Multinucleated cells	✓ Multinucleated cells are called coenocyte. ✓ **Examples:** *Vaucheria*, *Botrydium*, *Sphaeroplea* etc. algae and some fungi including *Penicillium*.
Shape	• Nucleus can occupy 10-15% space of the cell. About 90% of sperm is nucleus.

Schizont Hepatic

Nucleus

a. Nuclear envelope

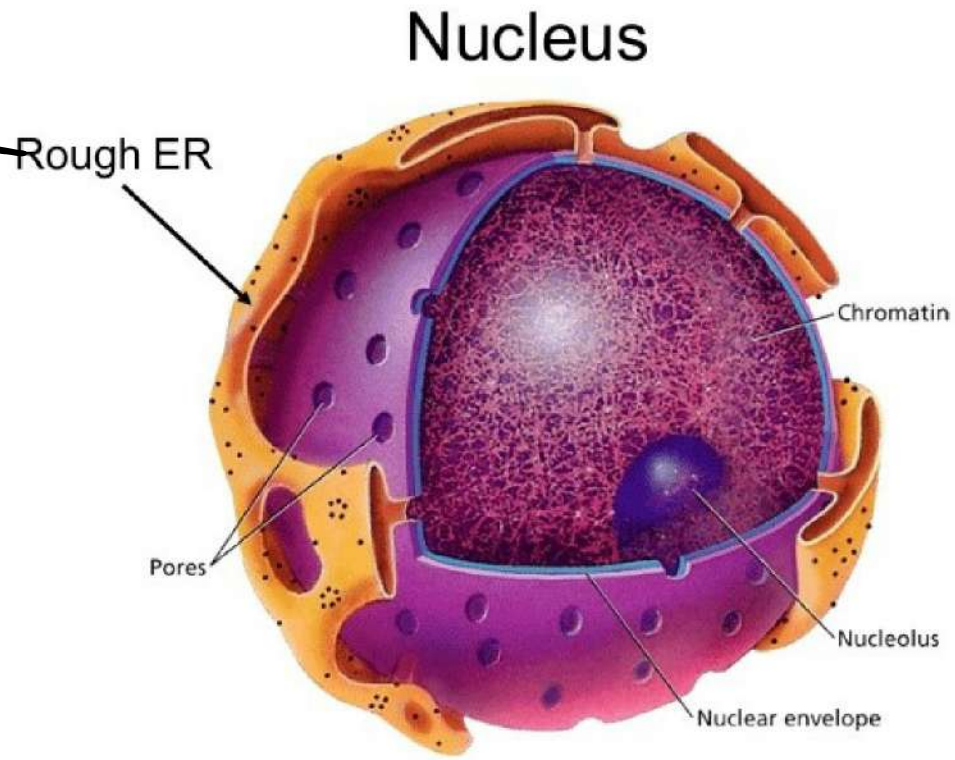
Heading

- Composed of lipid protein bilayer.
  - Diameter of nuclear pore is 8-9 nm.
  - The pore is controlled by total 8 protein granules.

b. Nucleoplasm or karyolymph

H

- Contains chromatin reticulum and nuclec
- Main site of enzymatic action.



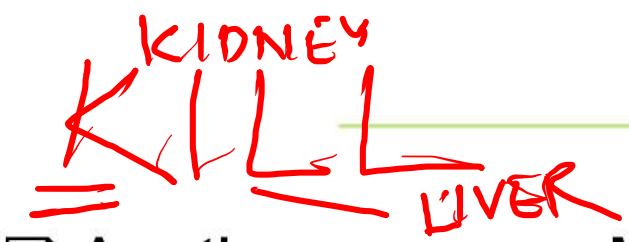
Nucleolus

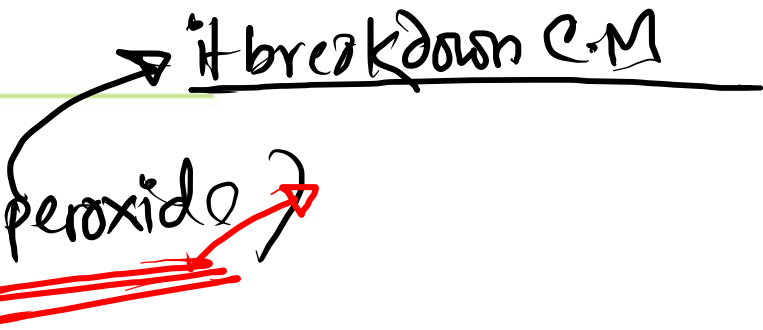
(c) Nucleolus

- Nucleus is usually divided in 3 parts – fibrous, granular and matrix.
- Principal chemical elements of nucleolus are protein, RNA and very little amount of DNA.
- Synthesizes RNA and proteins.
- No membrane has been discovered.

(d) Nuclear reticulum or chromatin fibers

- Carrier of genetic materials
- In fact, **DNA + protein (histone and non-histone) = chromatin**





- Another name → Microsome.
- Mostly present in kidney and liver cell of animals.
- Main enzyme is catalase.

Glyoxysome

- Converts lipid into sugar during germination of seed

Poll Question: 05

➢ **Which one is not Cinocytic?**

(a) Vaucheria

(b) Botrydium

(c) Penicillium

(d) Spirogyra

Poll Question: 06

➢ **How many protein granules can be found in each nuclear pore ?**

(a) 9

(b) 8

(c) 4

(d) 3

Chromosome

- ☑ Observes some filamentous structures during cell division **Strasburger**
- ☐ Observed chromosome in the nucleus of plant cell **Karl Nageli**
- ☐ Named chromatin **Walter Flemming**
- ☐ Described as a container & carrier of hereditary traits **Sutton ও Boveri**
- ☐ Named chromosome **W. Waldeyer**

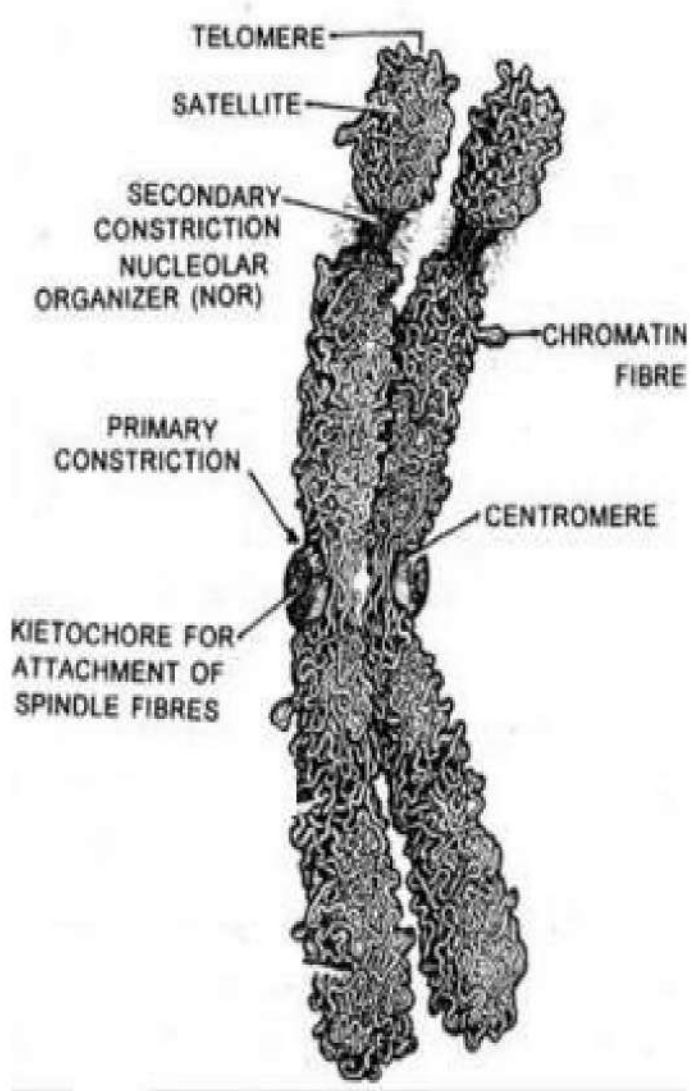
Numerics:

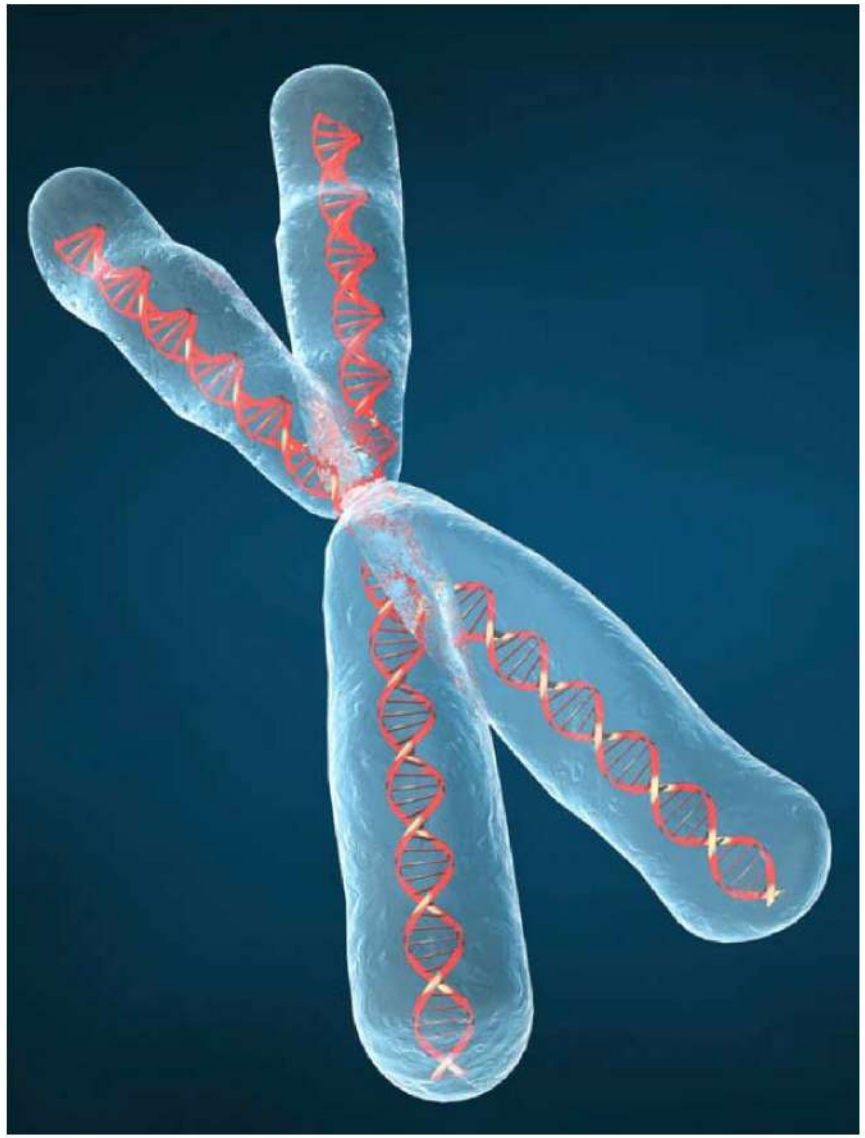
- ❖ Where is the largest and smallest in plant?
- ❖ Some important chromosome numbers of organism.

Structure of a Chromosome

Parts of a chromosome

- ❑ Chromatin
- ❑ Chromatid
- ❑ Centromere
- ❑ Arms
- ❑ Kinetochore
- ❑ Chromomere
- ❑ Secondary Constriction
- ❑ Satellite
- ❑ Telomere
- ❑ Matrix
- ❑ Pellicle

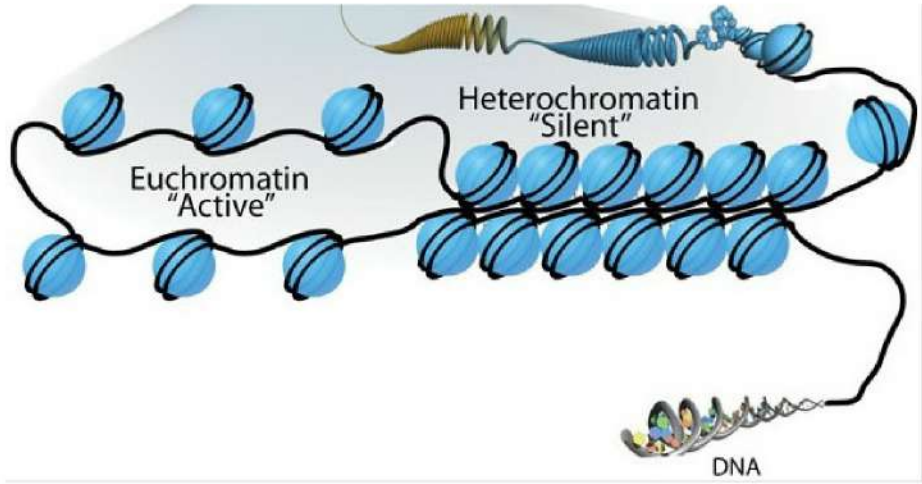




Structure of a Chromosome

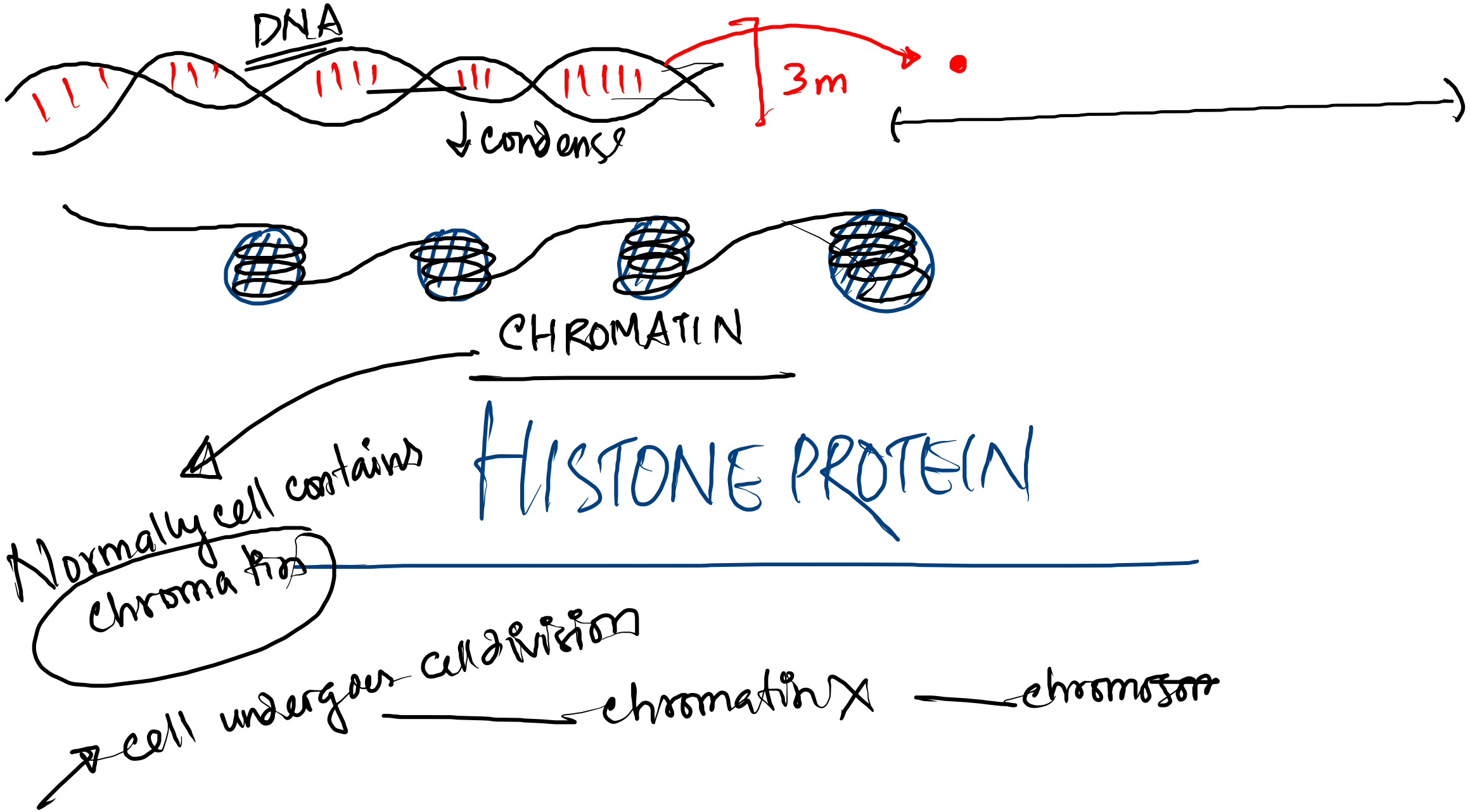
Chromatin:

- Heterochromatin → More coiled, contains inactive DNA.
- Euchromatin → Less coiled, contains active DNA.



Chromatid:

- In metaphase stage, the chromosome is seen longitudinally divided into two segments.
- Each segment is formed of single DNA molecule.


DNA
3m
condense
CHROMATIN
HISTONE PROTEIN
Normally cell contains
chromatin
cell undergoes cell division
chromatin
chromosome

Structure of a Chromosome

Info Reading

Centromere:

An ideal chromosome contains only one centromere.

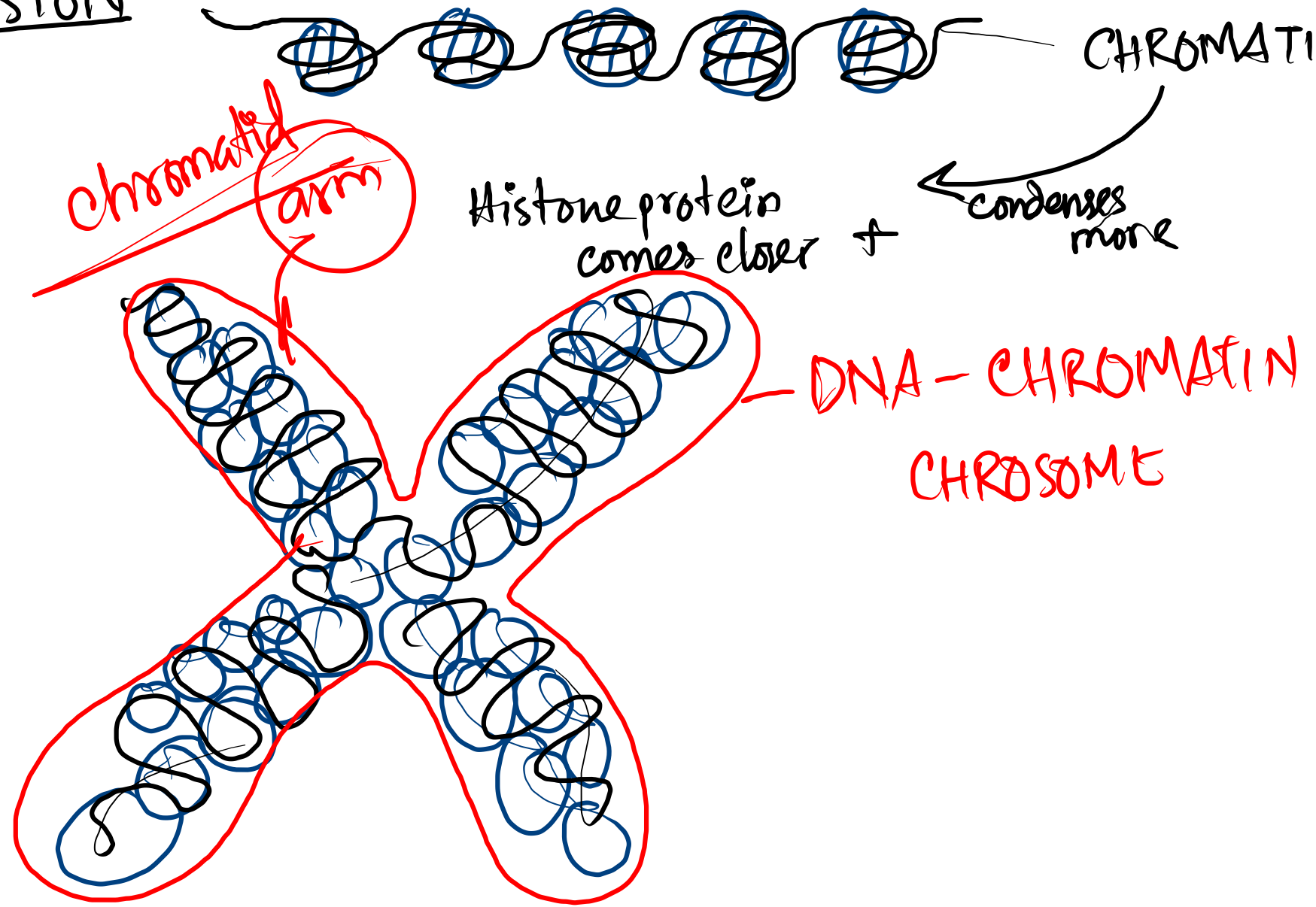
Secondary Constriction

Another name → Nucleolus reformation area

Satellite

- ❑ The chromosome where satellite is present/Nucleolus containing chromosome is called → SAT chromosome .
- ❑ Cotton, jute, pea etc. plants has some chromosomes containing satellite.
- ❑ 1st chromosome of chickpea contains satellite.
- ❑ Secondary constriction called SAT helps in formation of nucleolus.

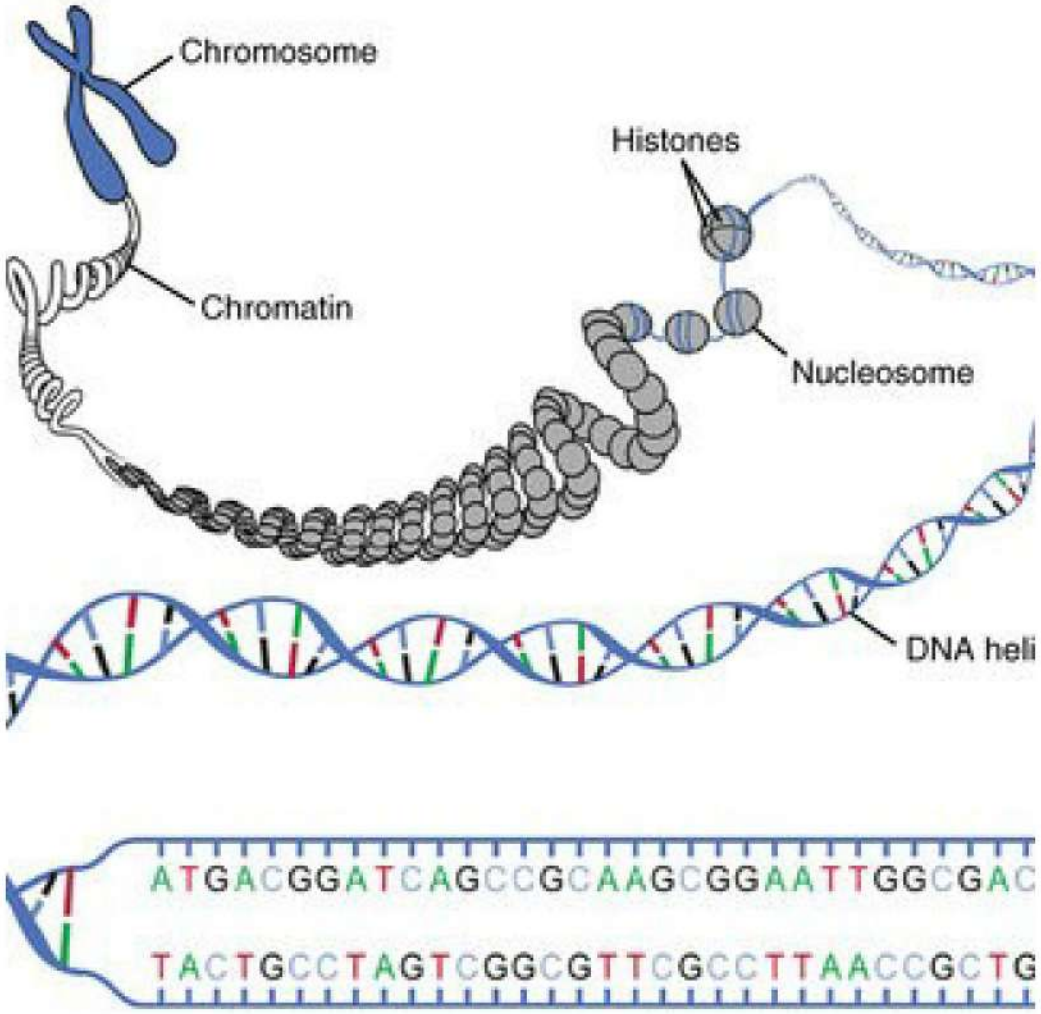
CELL DIVISION

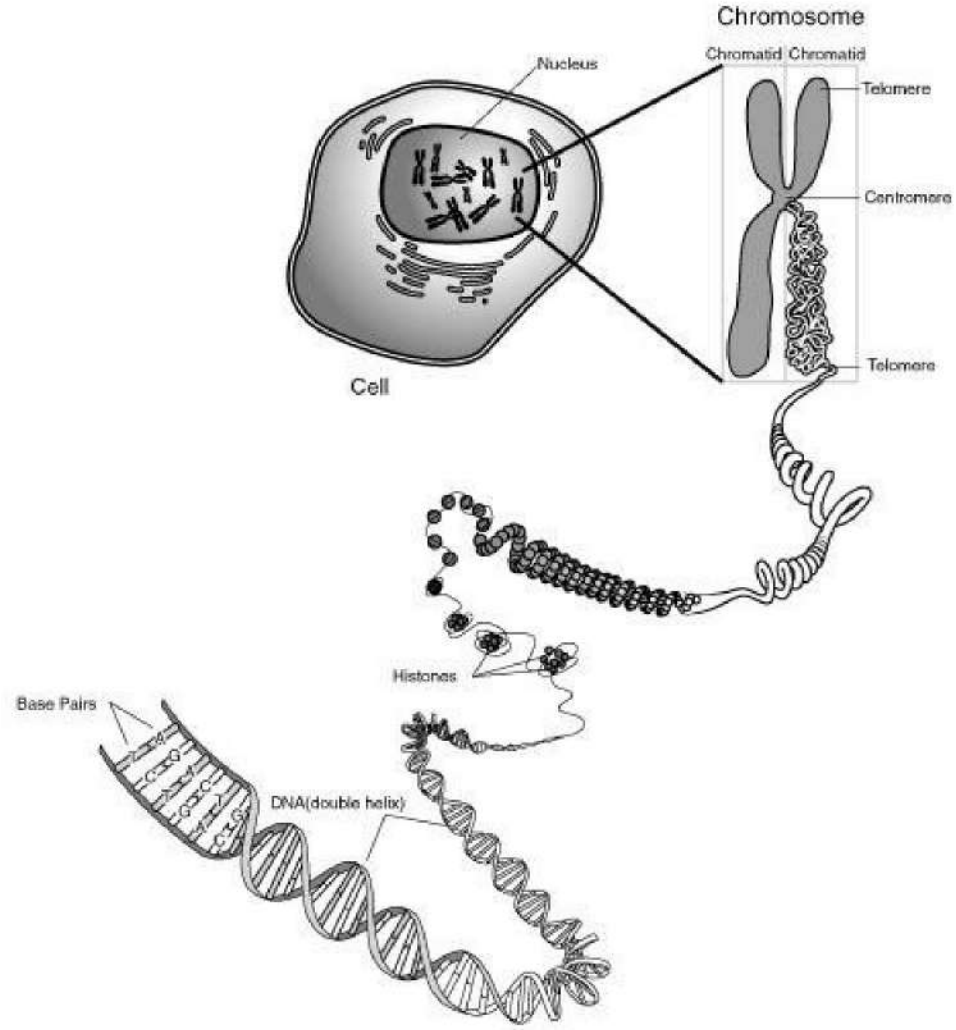


Telomere

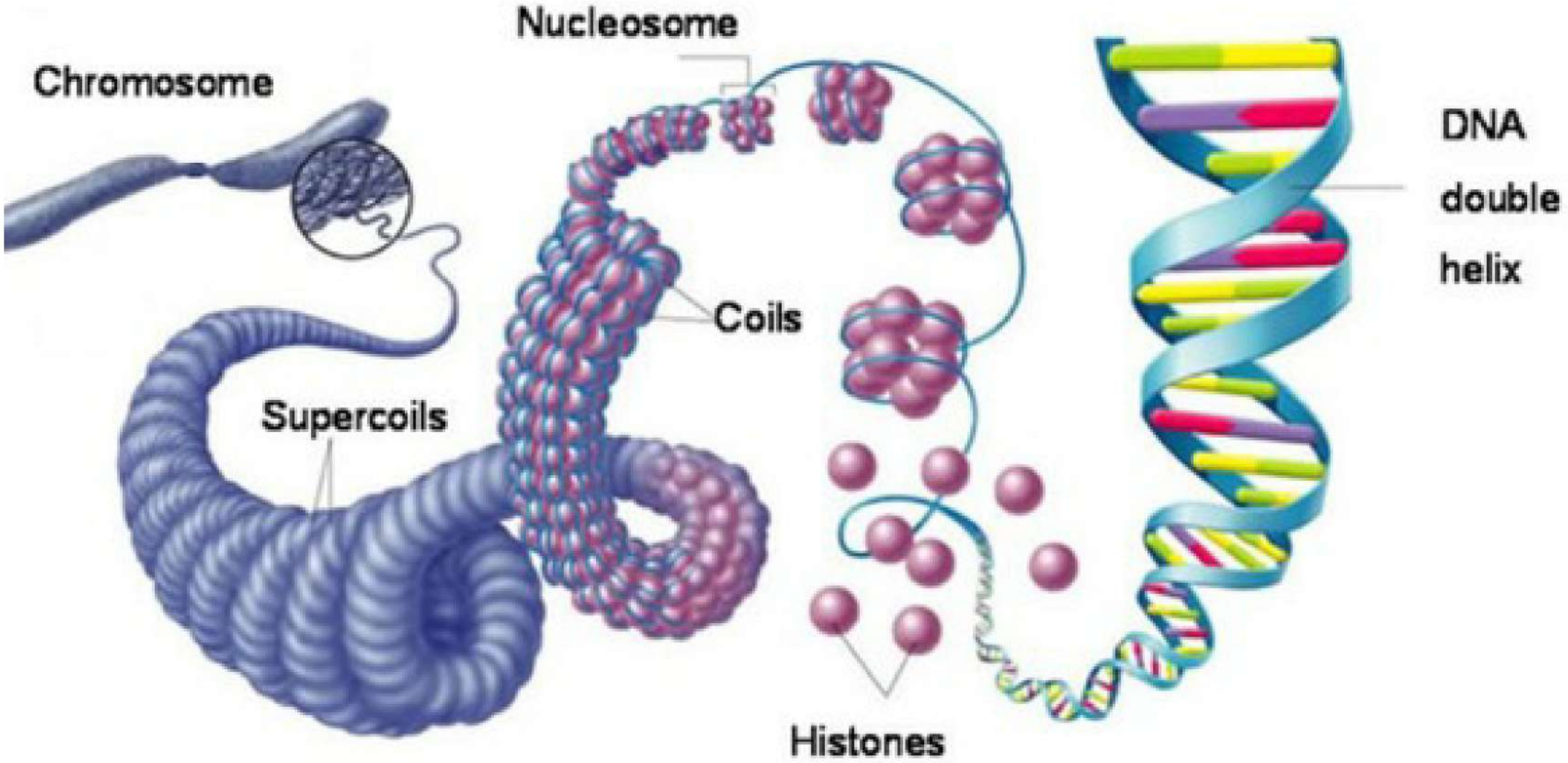
- Repeated sequence of DNA in the head of chromosome is telomere.
- Protects the coding region of DNA from destruction during cell division.
- According to H. J. Muller- the specially characterized area of both ends of the chromosomes is called telomere.
- Telomerase enzyme helps to prevent aging process in human.

Chromosome


Chromosome
Histones
Chromatin
Nucleosome
DNA heli
ATGACGGATCAGCCGCAAGCGGAATTGGCGAC
TACTGCCTAGTCGGCGTTCGCCTTAACCGCTG


Chromosome
Nucleus
Chromatid
Chromatid
Telomere
Centromere
Telomere
Cell
Histones
Base Pairs
DNA(double helix)

Chromosome


Nucleosome
Chromosome
DNA
double
helix
Coils
Supercoils
Histones

Classification

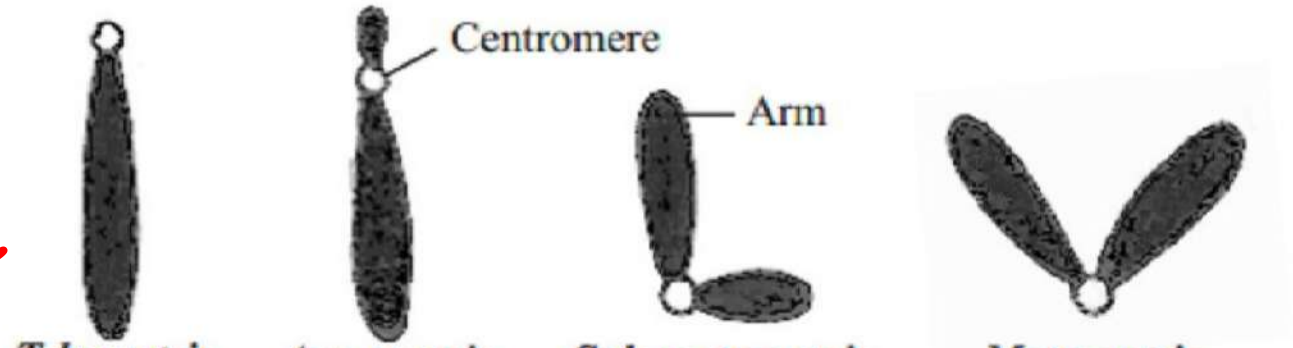


Fig. Four morphogenic types of chromosomes

INFO ***

According to the position of centromere

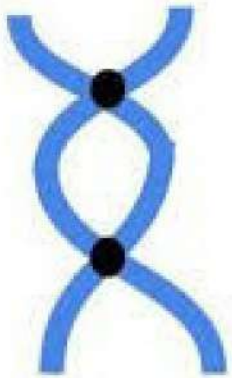
(i) Metacentric → V shaped.
(ii) Sub-metacentric → L shaped.
(iii) Acrocentric → J shaped.
(iv) Telocentric → I shaped.

Classification

According to the number of centromere

(i) Monocentric → In most of the plant species.
(ii) Dicentric → In some species of wheat.
(iii) Polycentric → In some species of banana (Musa sp.).
(iv) Diffused → No centromere is distinctly visible.

Normal Chromosome



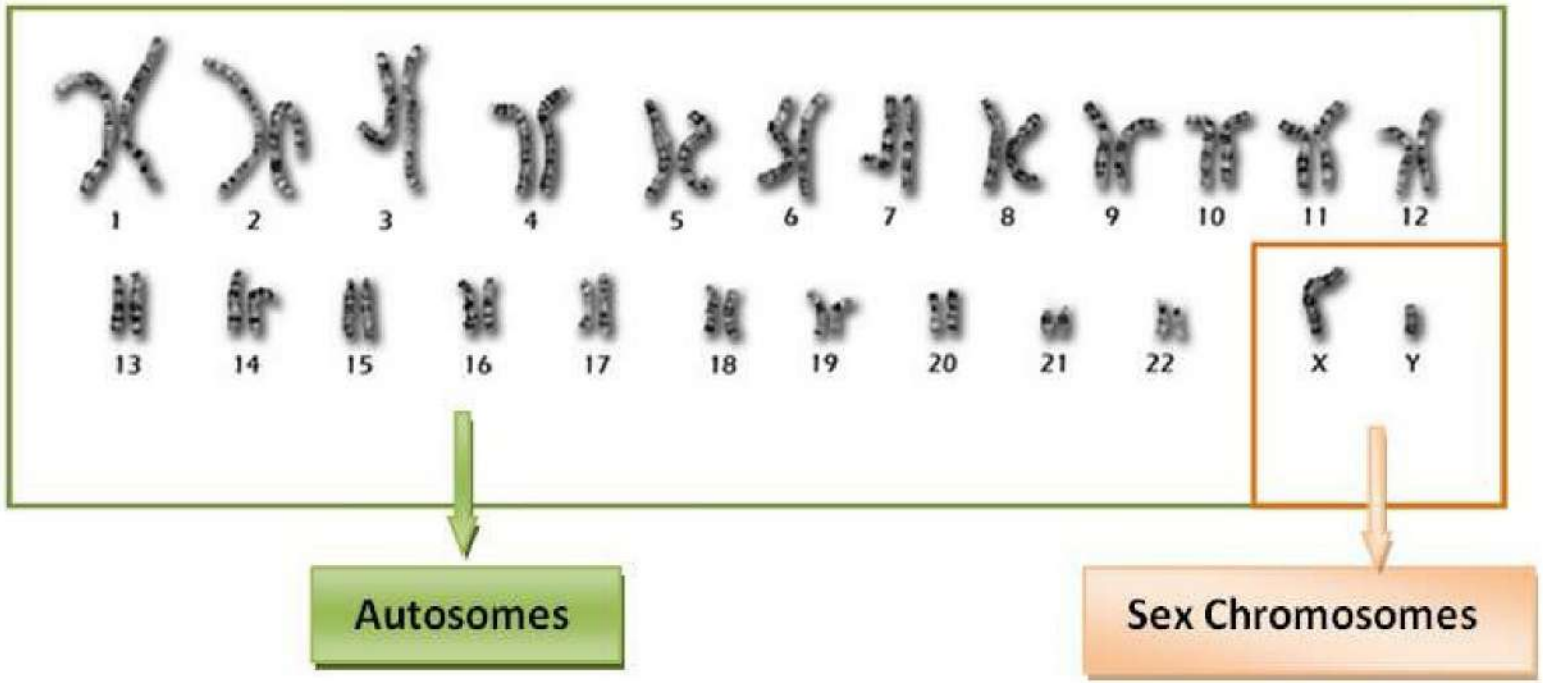
Dicentric Chromosome

Classifications

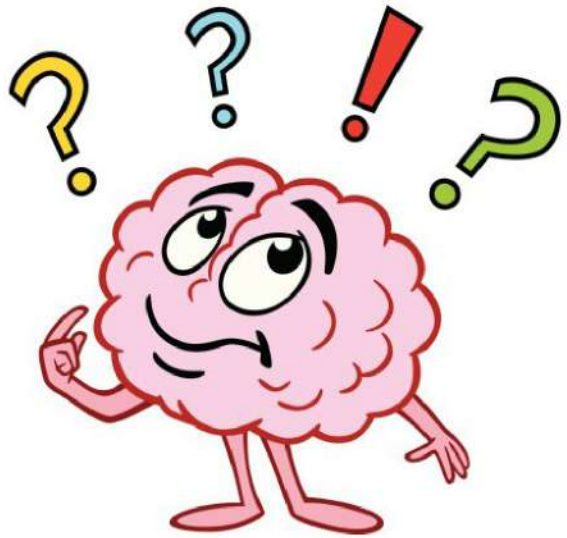
According to Gender determination and size:

(i) Autosome

(ii) Sex Chromosome



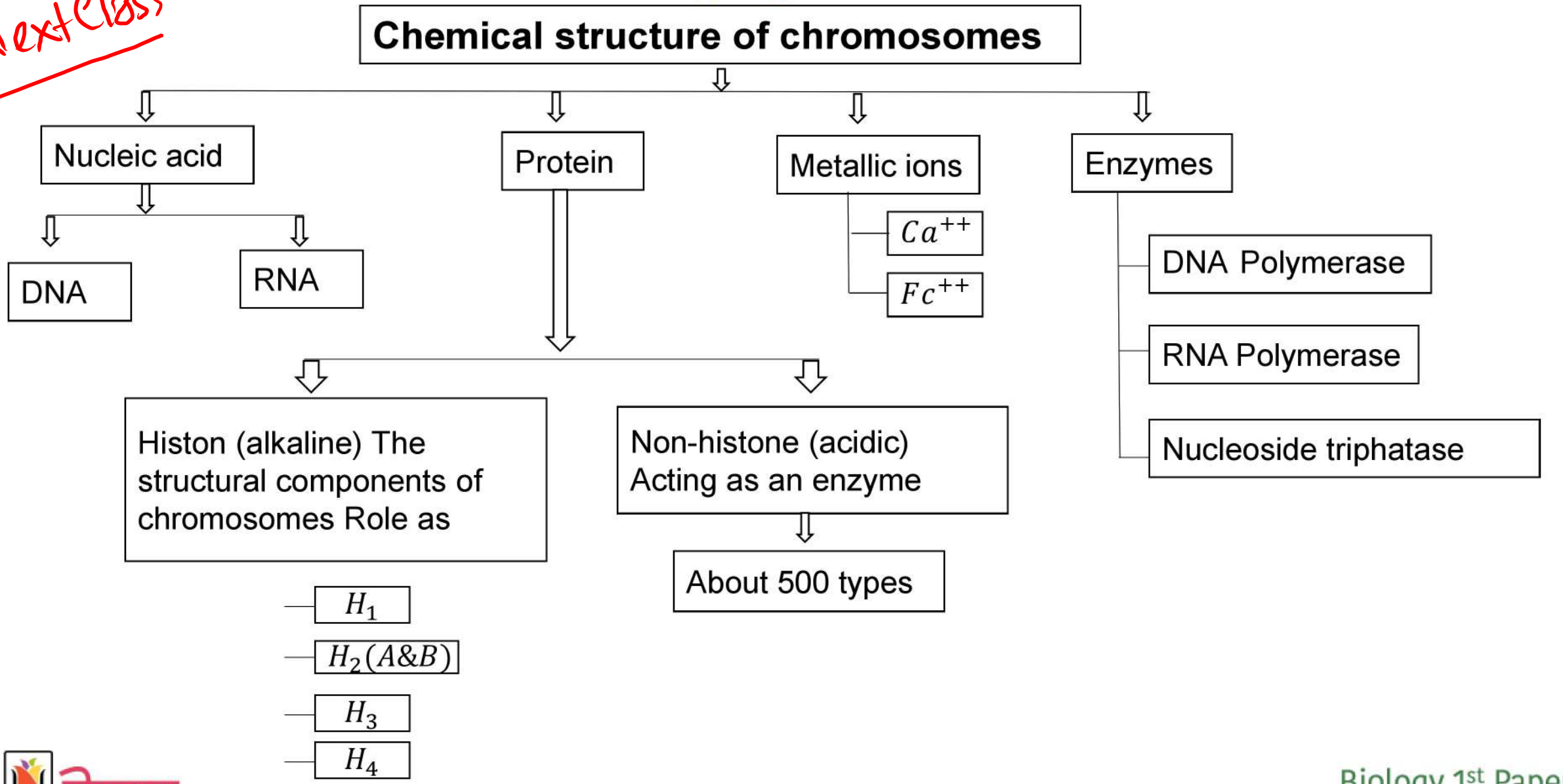
Chromosome



?? So which are the largest and smallest chromosome of human cell?

Chemical structure of Chromosome

Next Class



Chemical Components of Chromosome

MCQ ***

- The proportion of DNA and histone protein in chromosomes is 1:1.
- The amount of DNA in various components of chromosomes is about 45 percent. Protein accounts for 55 percent.
- The amount of RNA in a chromosome is 0.2-1.4 percent.
- Almost 90% chromosome of organisms are present in DNA.

10% cytoplasm
MITOCHONDRIA
CHLOROPLAST
Ribosome 70S ✓
circular DNA ✓

Functions of Chromosome

1. Contains DNA or gene molecule.
2. Chromosome is the carrier of heredity. / characters
3. Chromosome plays a special role in cell division by dividing itself.
4. Protein synthesis by mRNA produced according to the template of DNA.
5. Sex chromosome plays special role to determine sex of organisms.
6. Carrier gene of inheritance works as a blueprint of life of organism

mainplan

Previous years questions

➢ **Amount of DNA and Histone in the chromosome is respectively-**

(a) 35% and 55%

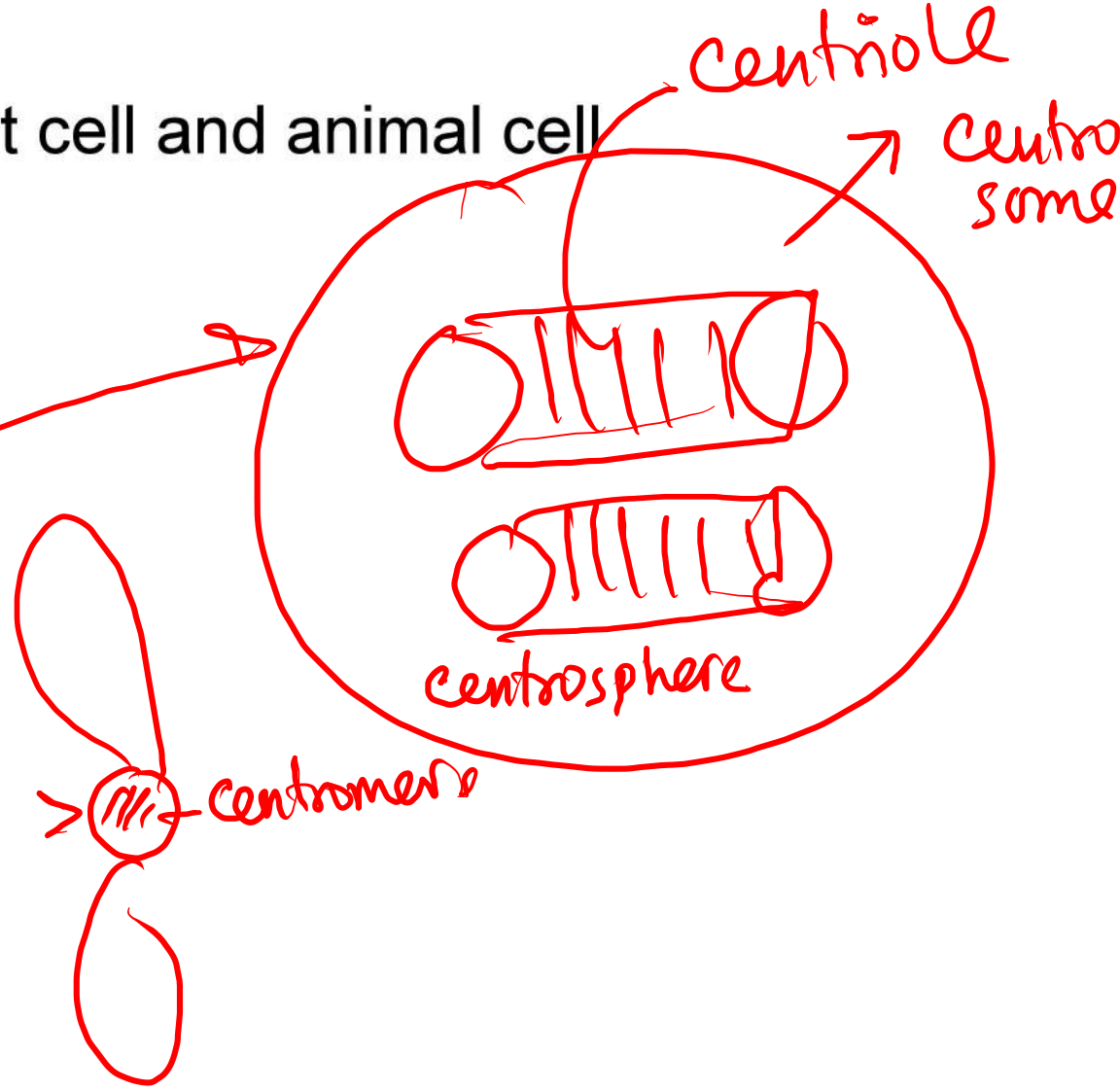
(b) 45% and 50%

(c) 50% and 40%

(d) 25% and 65%

Major differences

- Prokaryotic and Eukaryotic cell / Plant cell and animal cell
- Cell wall and Cell membrane
- Ribosome and Lysosome
- Smooth and Rough ER
- All 3 plastids
- Nucleus and Nucleolus
- Centrosome and Centromere



All special names

Name	Also known as-
Cell membrane	Plasma membrane / plasmalemma/Cytomembrane
Golgi Body	Golgi filed /Dictayosome / lypochondria/idiosome / Traffic police of cell/Carbohydrate factory/PACKING house
Mitochondria	Biological Powerhouse
Ribosome	Protein factory
ER	Road of a Cell
Protoplasm	Base line of life
Secondary Constriction	Nucleolus reformation area

All special names-

Name	Also known as-
Matrix of Cytoplasm	Hyaloplasm / Cytosol
Lysosome	Bag of hydrolytic enzymes/ Stomach of a cell/Suicidal squad or bag
Chloroplast	Kitchen of cell / Factory of synthesis of sugar
Chromosome	Base of heredity , Carrier of heredity
Microtubules	Skeleton of a cell
Proteasome	Main switch of a cell
Nucleus	Cell brain/ Center of a cell /Cell center

লেগে থাকো সৎ ভাবে,
স্বপ্ন জয় তোমারই হবে।