ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

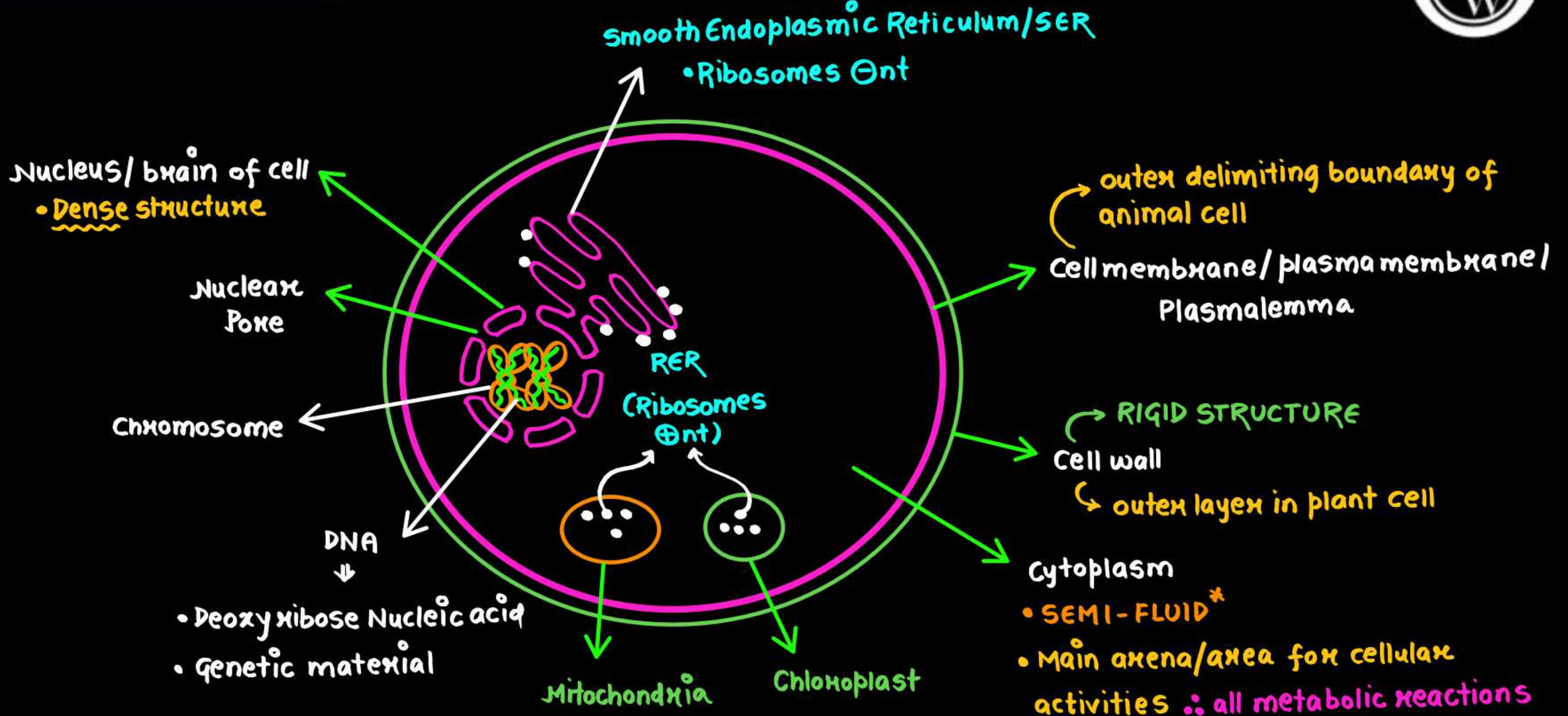
Lecture: 02

By: Vipin Sharma Sir

Topics *to be covered*

1.) **Overview of a Cell**

OVERVIEW OF A CELL



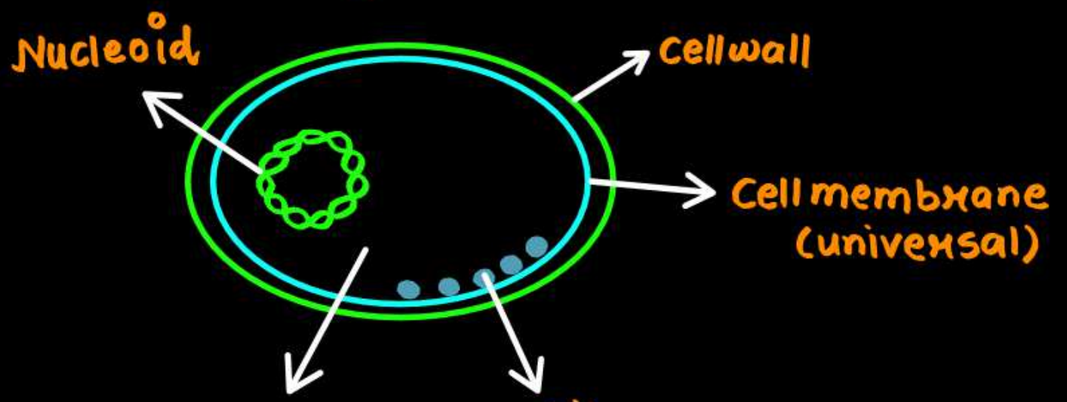
PROKARYOTIC CELL VS EUKARYOTIC CELL

- Pro, Karyon → Nucleus
  - Primitive / not well developed
- well defined nucleus is absent
  - In prok. cell, nuclear membranes/envelope are absent
- Membrane bound organelles are absent
- Cell membrane present
- Usually smaller
- Ribosome = 70s
  - = Svedberg unit

Eu, Karyon → Nucleus
- True / well defined

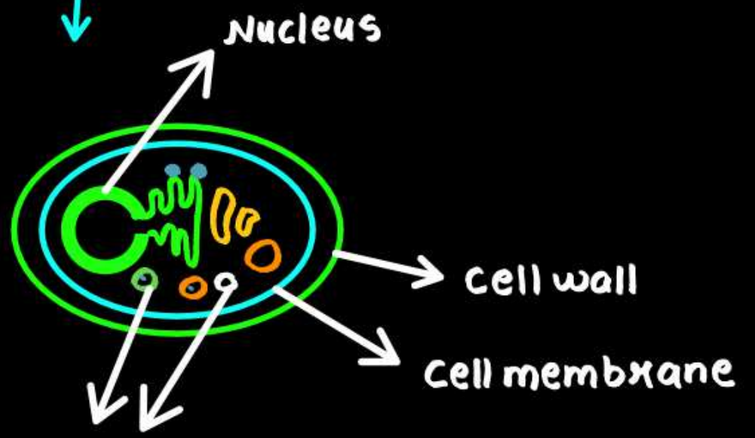
- In eukaryotic nucleus, nuclear envelope/membranes are present
- Membrane bound organelles are present
- Cell membrane present
- Usually bigger
- Ribosome = 80s, 70s → Mitochondria & chloroplast
  - 80s → cytoplasm/RER

PROKARYOTIC CELL VS EUKARYOTIC CELL



- associated with cell membrane
- 70s

- Smaller in size
- Divides faster



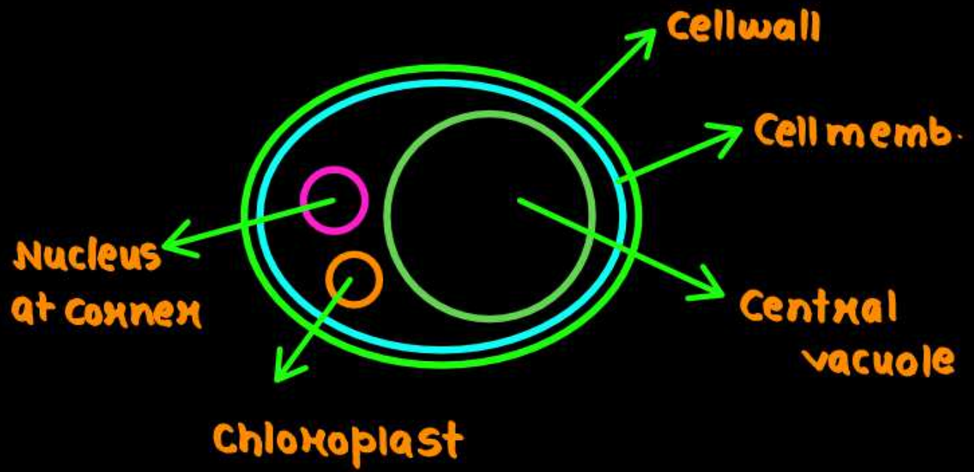
Membrane bound organelles

e.g., Nucles, Endoplasmic reticulum (ER), Golgi Body (GB), mitochondria, chloroplast, vacuole, peroxisome etc.

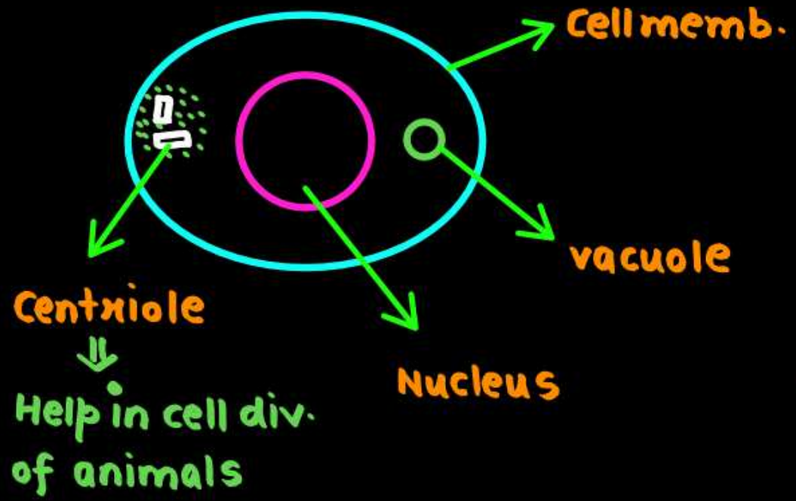
- Bigger in size
- Divides slowly

PLANT CELL VS ANIMAL CELL

- Cell wall present
- Chloroplast present
- Central vacuole present
- Absent



- Absent
- Absent
- Absent
- Centrioles & Centrosome present



Centriole ⇓ Help in cell div. of animals

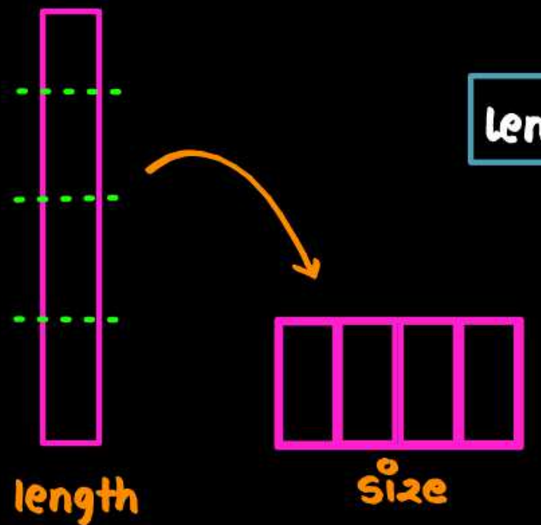
TRICK

Cellwall
Chloroplast
Central vacuole
Centriole

- A Typical plant cell: onion peel cell
- A typical human cell: human cheek cell

CELLS VARY GREATLY IN SHAPE, SIZE AND ACTIVITY

LENGTH AND SIZE



length > size

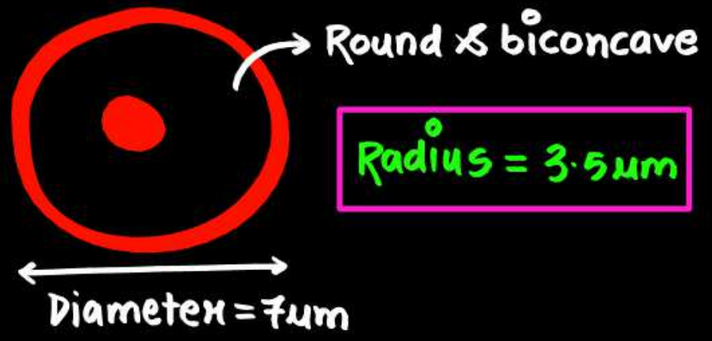
- Length of bacteria : 3-5 µm
- size of typical prokaryotic cell : 1-2 µm

Euk. cell is 10x bigger
∴ 10-20 µm

- Length of mycoplasma : 0.3 µm (prokaryotic)
  - Smallest living cell
- Size of PPLO : Pleuropneumonia Like organism : 0.1 µm
  - Type of mycoplasma
- Virus size : 0.02 - 0.2 µm (NOT LIVING)

RED BLOOD CELL

Erythrocyte



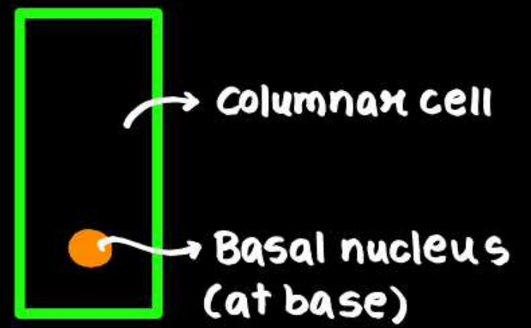
WHITE BLOOD CELL

Leucocyte (white)

Amoeboid/ Irregular

COLUMNAR EPITHELIA

स्तंभ : Pillar like



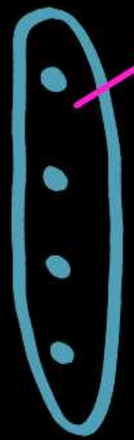
NERVE CELL

- Long, branched
- Longest cell

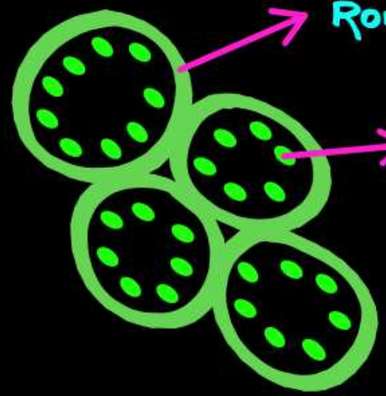
- Largest cell: ostrich egg

TRACHEID

Transports water/ dead cell



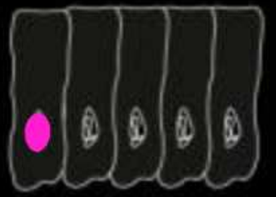
MESOPHYLL CELL



CELLS VARY GREATLY IN SHAPE, SIZE AND ACTIVITY

Red blood cells
(round and biconcave)

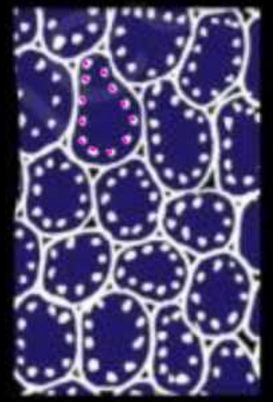
White blood cells
(amoeboid)



Columnar epithelial cells
(long and narrow)

Nerve cell
(Branched and long)

A tracheid
(elongated)



Mesophyll cells
(round and oval)

NCERT MAIYAAAA KI READING!!

8.3 An Overview of Cell

You have earlier observed cells in an onion peel and/or human cheek cells under the microscope. Let us recollect their structure. The onion cell which is a typical plant cell, has a distinct cell wall as its outer boundary and just within it is the cell membrane. The cells of the human cheek have an outer membrane as the delimiting structure of the cell. Inside each cell is a dense membrane bound structure called nucleus. This nucleus contains the chromosomes which in turn contain the genetic material, DNA. Cells that have membrane bound nuclei are called eukaryotic whereas cells that lack a membrane bound nucleus are prokaryotic. In both prokaryotic and eukaryotic cells, a semi-fluid matrix called cytoplasm occupies the volume of the cell. The cytoplasm is the main arena of cellular activities in both the plant and animal cells. Various chemical reactions occur in it to keep the cell in the 'living state'.

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NEET-2015

Besides the nucleus, the eukaryotic cells have other membrane bound distinct structures called **organelles** like the endoplasmic reticulum (ER), the golgi complex, lysosomes, mitochondria, microbodies and vacuoles.

NEET-2015

The prokaryotic cells lack such membrane bound organelles.

NEET-2015

Ribosomes are non-membrane bound organelles found in all cells – both eukaryotic as well as prokaryotic. Within the cell, ribosomes are found not only in the cytoplasm but also within the two organelles – chloroplasts (in plants) and mitochondria and on rough ER.

Animal cells contain another non-membrane bound organelle called centrosome which helps in cell division.

NEET-2022

Cells differ greatly in size, shape and activities (Figure 8.1). For example, Mycoplasmas, the smallest cells, are only 0.3 µm in length while bacteria

NCERT MAIYAAAA KI READING!!

could be 3 to 5 µm. The largest isolated single cell is the egg of an ostrich. Among multicellular organisms, human red blood cells are about 7.0 µm in diameter. Nerve cells are some of the longest cells. Cells also vary greatly in their shape. They may be disc-like, polygonal, columnar, cuboid, thread like, or even irregular. The shape of the cell may vary with the function they perform.

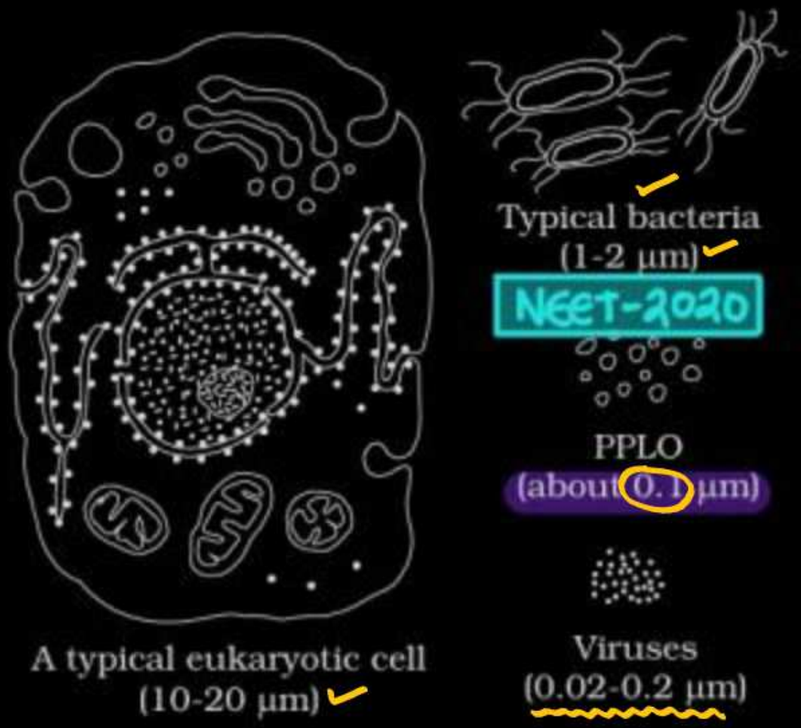
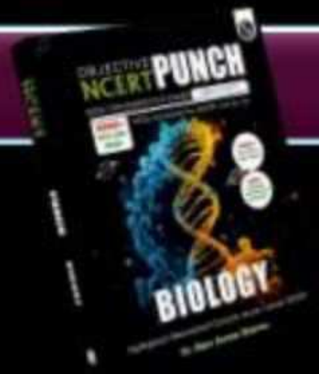


Figure 8.2 Diagram showing comparison of eukaryotic cell with other organisms

Punchayat

with Vipu Sir



QUESTIONS AND PYQs

1 Plant cell differs from animal cell in the:

(1) presence of centriole.
(2) presence of cell wall and chloroplast.
(3) absence of cell wall.
(4) absence of chloroplast.

2 Which of the following cell has a diameter of 7 micrometre?

(1) Erythrocyte
(2) Monocyte
(3) Neuron
(4) Blood platelets

3 The main arena of cellular activities in plant and animal cells is:

(1) Cell membrane
(2) Mitochondria
(3) Cytoplasm
(4) Ribosome

4 Ribosomes are found in;

(1) Prokaryotic cells only
(2) Prokaryotic cells, chloroplasts, mitochondria and eukaryotic cell cytoplasm.
(3) Prokaryotic cells, chloroplasts and vacuole
(4) Lysosome, mitochondria

5 Which of the following is present in both prokaryotes and eukaryotes?

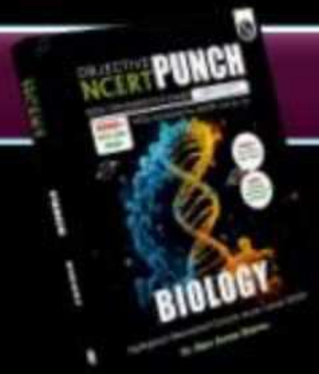
(1) Golgi complex
(2) Mitochondria
(3) Chloroplast
(4) Plasma membrane

6 Which of the following is the largest isolated single cell?

(1) Nerve cell
(2) Mycoplasma
(3) Ostrich egg
(4) RBCs

7 The shape of human red blood cell is:

(1) round and biconcave.
(2) flat and thread like.
(3) irregular.
(4) round and oval.



8 Different cells have different sizes. Arrange the following cells in an ascending order of their size. Choose the **correct** option among the followings.

I. Mycoplasma (1)
II. Ostrich eggs (4)
III. Human RBC (3)
IV. Bacteria (2)

(1) I, IV, III, II
(2) I, II, III, IV
(3) II, I, III, IV
(4) III, II, I, IV

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarabh: 11
Exercise-1: 1, 3, 4, 7, 8, 11, 12, 14
Exercise-2: 1, 2


THANK
YOU

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BOTANY

CELL: THE UNIT OF LIFE

Lecture: 03

By: Vipin Sharma Sir

Topics to be covered

1) Prokaryotic Cell
2) Mesosomes
3) Inclusion Bodies
4) Flagella
5) Surface Structures
6) PUNCH Questions and PYQs

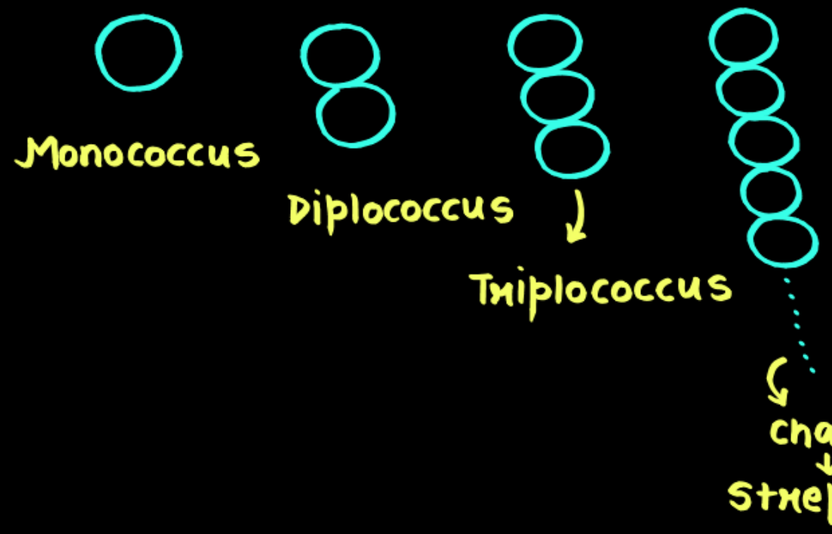
PROKARYOTIC ORGANISMS

- Pro : Primitive / less developed
  Karyon : Nucleus
  ∴ donot have a well defined nucleus
- e.g., All bacteria, mycoplasma, Pleuro pneumonia like organism (PPLO)
  - Cyanobacteria or Blue-Green Algae (BGA)
    - Blue
    - Photosyntnetic
- Prokaryotic cells are smaller than eukaryotic cell & they divide faster
  - Size = 1-2 µm → 10X → Size = 10-20 µm
  - E. coli = 20 minutes
    Human cheek cell = 24 hours

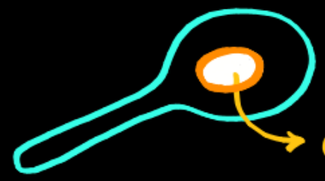
PROKARYOTIC ORGANISMS

→ Bacteria has 4-shapes:

① coccus/round



② Bacillus/rod-shaped

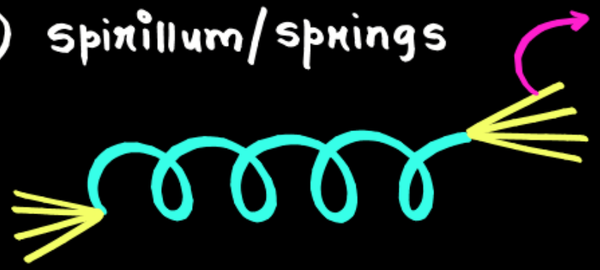


NOTE: Endo means inside
Exo means outside

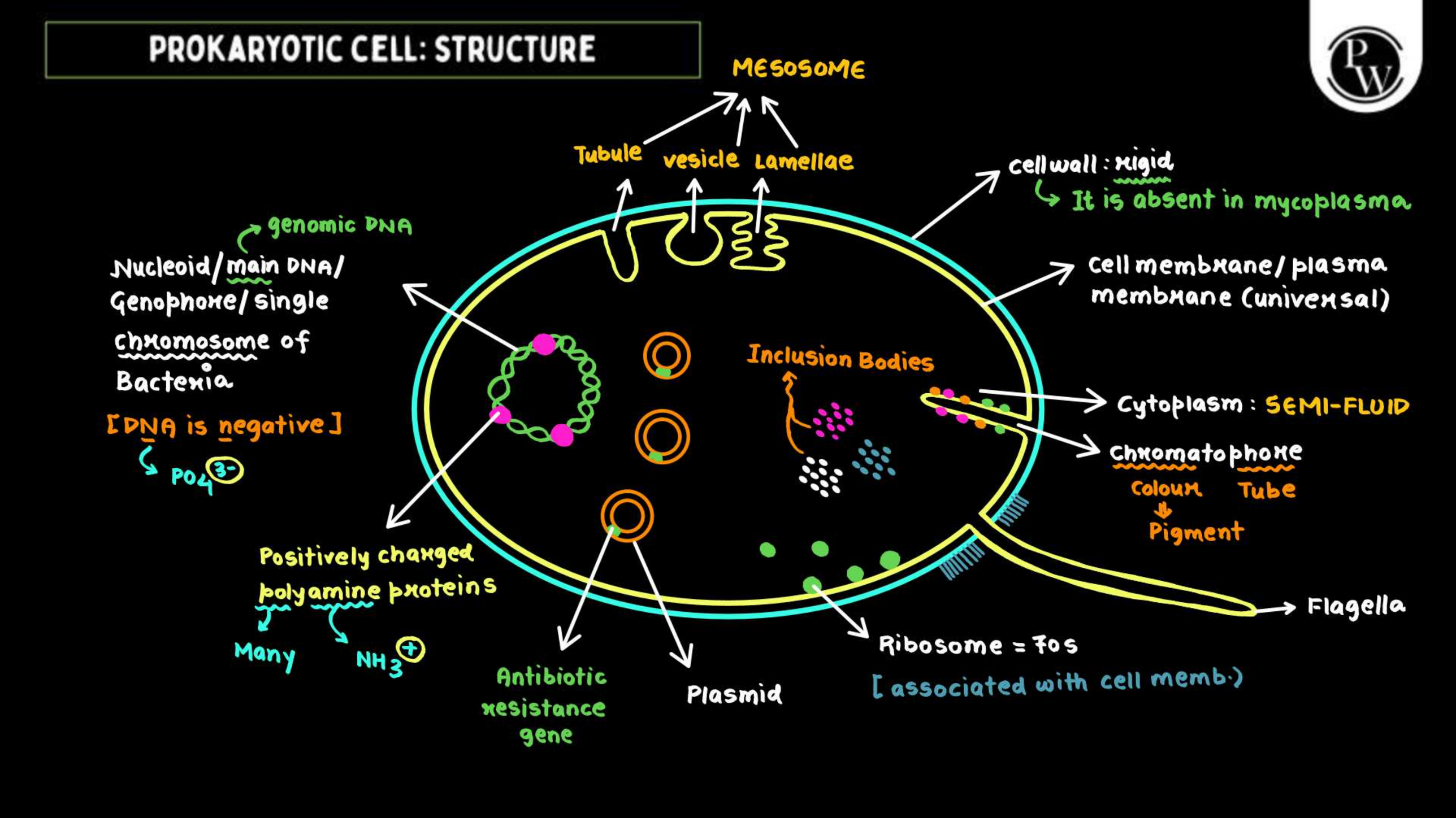
Endospore
(calcium-dipicolinic acid)*
⇓
Provide resistance to bacteria

③ Vibrio/comma-shaped

④ Spirillum/springs



PROKARYOTIC CELL: STRUCTURE



PROKARYOTIC CELL: FEATURES

CELL WALL & CELL MEMBRANE

- Rigid
- Mycoplasma: cellwall was Ont
  - Pleumoxphic / Jokex change morphology / Shape

- Flexible
- Foxmed up of Lipid & protein

NOTE:
Eubactexia = Peptidoglycan
Anchaebactexia → Pseudomuxein

NUCLEOID AND PLASMIDS

- double stxanded cixculax DNA
- Main genetic matexial

Acts as a gene-taxi & helps to txansfex any gene (DNA) in bactexia

- cixculax
- double stxanded DNA
- Extxachxomosomal
- Replicate independently → donot need pexmission of NUCLEOID
- Pxovides some phenotypic → stxuctuxe xelated chaxactexs to bactexia like antibiotic xesistance*

NCERT MAIYAAAA KI READING!!

8.4 Prokaryotic Cells

The prokaryotic cells are represented by bacteria, blue-green algae, mycoplasma and PPLO (Pleuro Pneumonia Like Organisms). They are generally smaller and multiply more rapidly than the eukaryotic cells (Figure 8.2). They may vary greatly in shape and size. The four basic shapes of bacteria are bacillus (rod like), coccus (spherical), vibrio (comma shaped) and spirillum (spiral).

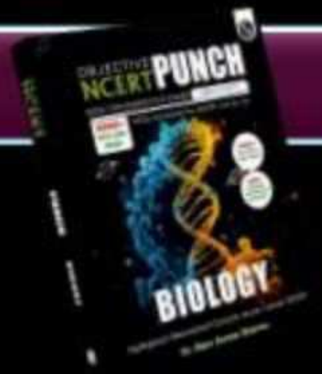
The organisation of the prokaryotic cell is fundamentally similar even though prokaryotes exhibit a wide variety of shapes and functions. All

NCERT MAIYAAAA KI READING!!

prokaryotes have a cell wall surrounding the cell membrane except in mycoplasma. The fluid matrix filling the cell is the cytoplasm. There is no well-defined nucleus. The genetic material is basically naked, not enveloped by a nuclear membrane. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular DNA outside the genomic DNA. These smaller DNA are called plasmids. The plasmid DNA confers certain unique phenotypic characters to such bacteria. One such character is resistance to antibiotics. In higher classes you will learn that this plasmid DNA is used to monitor bacterial transformation with foreign DNA. Nuclear membrane is found in eukaryotes. No organelles, like the ones in eukaryotes, are found in prokaryotic cells except for ribosomes. Prokaryotes have something unique in the form of inclusions. A specialised differentiated form of cell membrane called mesosome is the characteristic of prokaryotes. They are essentially infoldings of cell membrane.

Punchayat

with Vipu Sir



QUESTIONS AND PYQs

1 Which of the following is **NOT** a function of mesosomes?

(1) Respiration
(2) DNA replication
(3) Increases enzymatic content
(4) Reproduction

2 The genetic material of prokaryotic cells is called:

(1) Nucleus
(2) Nucleolus → found in nucleus
(3) Nucleoid
(4) Centrosome

3 Which of the following structures is **NOT** found in a prokaryotic cell?

(1) Nuclear envelope
(2) Ribosome
(3) Mesosome
(4) Plasma membrane

4 Prokaryotic cell does not have:

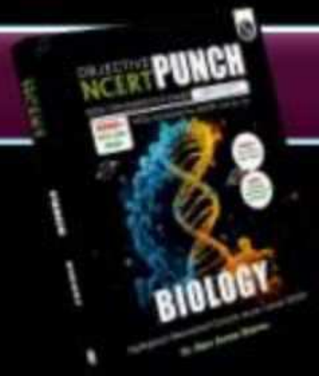
(1) Nucleolus
(2) Membrane bound organelles
(3) Centrioles
(4) All of these

5 The longest portion of the bacterial flagellum that extends from the cell surface to the outside is called:

(1) Filament
(2) Hook
(3) Basal body
(4) Shaft

6 Bacteria show a range in the number of arrangement of flagella. Bacterial flagellum is composed of

(1) Two parts – pili and fimbriae
(2) Three parts – filament, hook and basement membrane
(3) Three parts – filament, shaft and basal body
(4) Three parts – filament, hook and basal body



7 Given below are two statements: **(2023 manipur)**

Statement-I: In bacteria, the mesosomes are formed by the extensions of plasma membrane.

Statement-II: The mesosomes, in bacteria, help in DNA replication and cell wall formation.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) **Statement-I** is correct but **Statement-II** is incorrect.

(2) **Statement-I** is incorrect but **Statement-II** is correct.

(3) Both **Statement-I** and **Statement-II** are correct.

(4) Both **Statement-I** and **Statement-II** are incorrect.

8 Which of the following statements about inclusion bodies is **incorrect**? **(2020)**

(1) These are involved in ingestion of food particles.

(2) They lie free in the cytoplasm

(3) These represent reserve material in cytoplasm

(4) They are not bound by any membrane

9 Inclusion bodies of blue-green, purple and green photosynthetic bacteria are: **(2020 Covid)**

(1) Gas vacuoles

(2) Centrioles

(3) Microtubules

(4) Contractile vacuoles

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 4, 5, 10, 11
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 34, 35, 36, 39
Exercise-2: 2, 3, 4


THANK
YOU

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BOTANY

CELL: THE UNIT OF LIFE

Lecture: 05

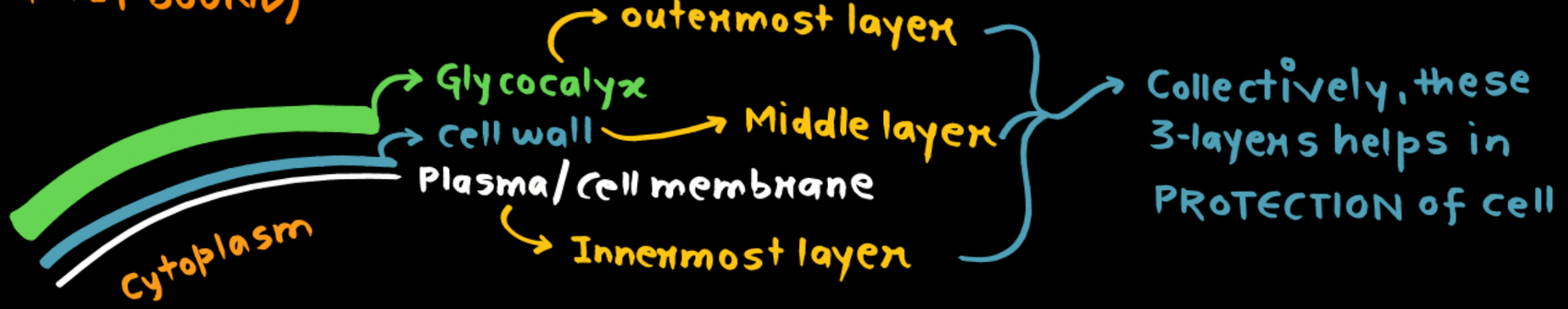
By: Vipin Sharma Sir

Topics to be covered

1) Cell Envelope *
2) Modifications of Cell Envelope *
3) Ribosomes
4) Eukaryotic Cell
5) Plant Cell vs Animal Cell
6) PUNCH Questions and PYQs

CELL ENVELOPE

- Present in most prokaryotic cells; specifically bacteria
- Chemically complex
  - ⇓
  - Formed up of 3-layers (TIGHTLY BOUND)



① Glycocalyx: Main function is in protection or defense of bacterial cell
- Sugar/Carbohydrate
- → Covers (Coat)

CELL ENVELOPE

- Present in most prokaryotic cells; specifically bacteria
- Chemically complex

② Cell wall: RIGID
- Maintaintains structure & shape of bacterial cell
- Prevents the bursting & collapsing of bacterial cell

③ Plasma membrane: It is "selectively permeable"
- it allows only selected molecules to come in & out of the cell

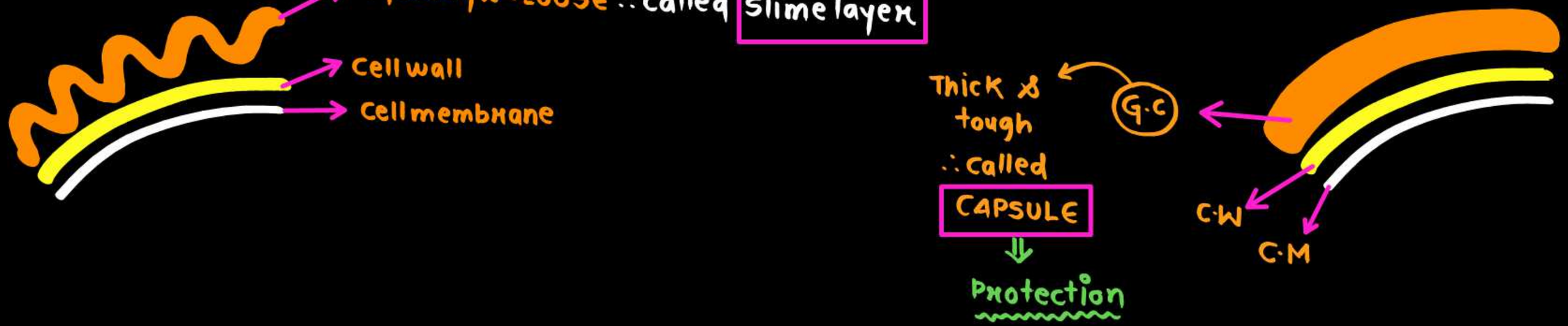
⇓

It INTERACTS with the outside world

* Cell wall is highly permeable
  Cell wall stops only heavy macromolecules

MODIFICATIONS OF CELL ENVELOPE

- Slime layer / Loose sheath
  - Retain water ∴ Prevent dessication (drying)
  - Glycocalyx : Loose ∴ called Slime layer
  - Cell wall
  - Cell membrane
- Capsule / Thick tough sheath
  - Thick & tough ∴ called CAPSULE (G.C)
  - ⇓
  - Protection
  - C.W
  - C.M



GRAM STAINING

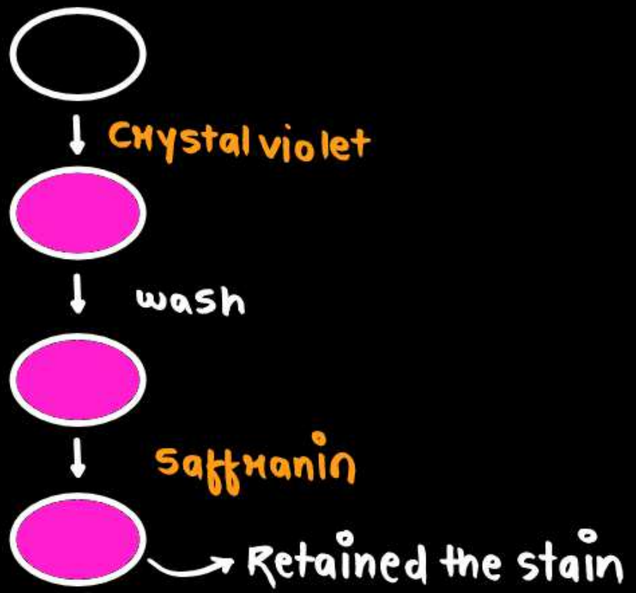
- Technique was discovered by 'Christian Gram'
- On the basis of CELL ENVELOPE, cells are of 2-types → Gram ⊕ve, Gram ⊖ve

Gram positive

Streptococcus

⇓

Retains the stain

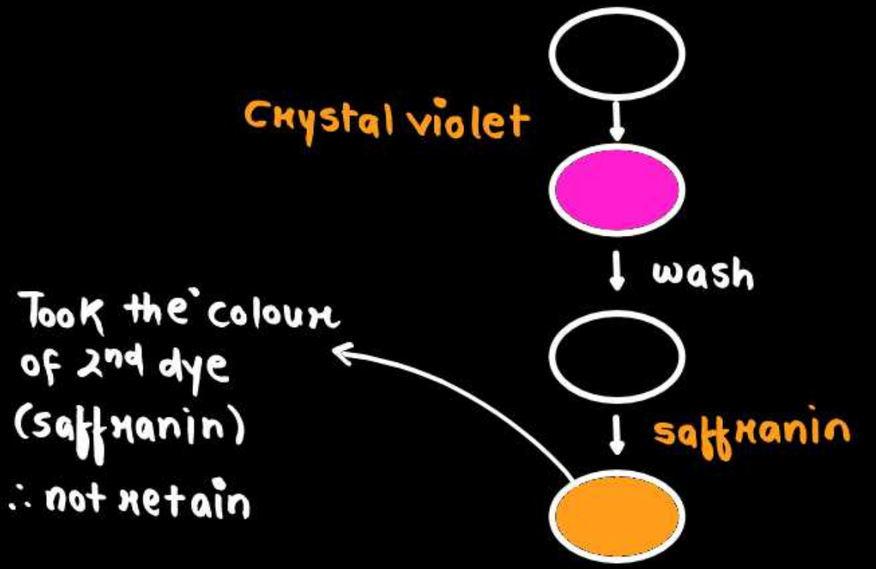


Gram negative

E.coli

⇓

Donot retain the stain



RIBOSOMES

⇝ Universal organelle ; membrane-less organelle

⇝ Smallest cell organelle

↳ 15-20 nanometer (nm)

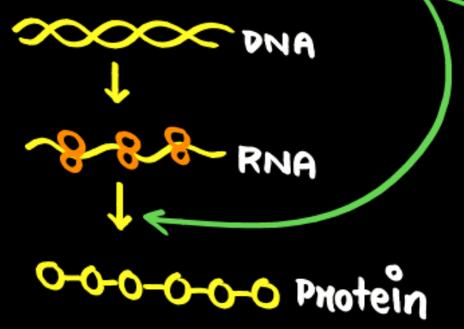
⇓

10^{-9} m

⇝ also called as palade particle

↳ discovered by George Palade in 1953 → after advancement of electron microscopy

⇝ also called 'PROTEIN FACTORY'



→ Ribosomes helps in Translation process

RIBOSOMES

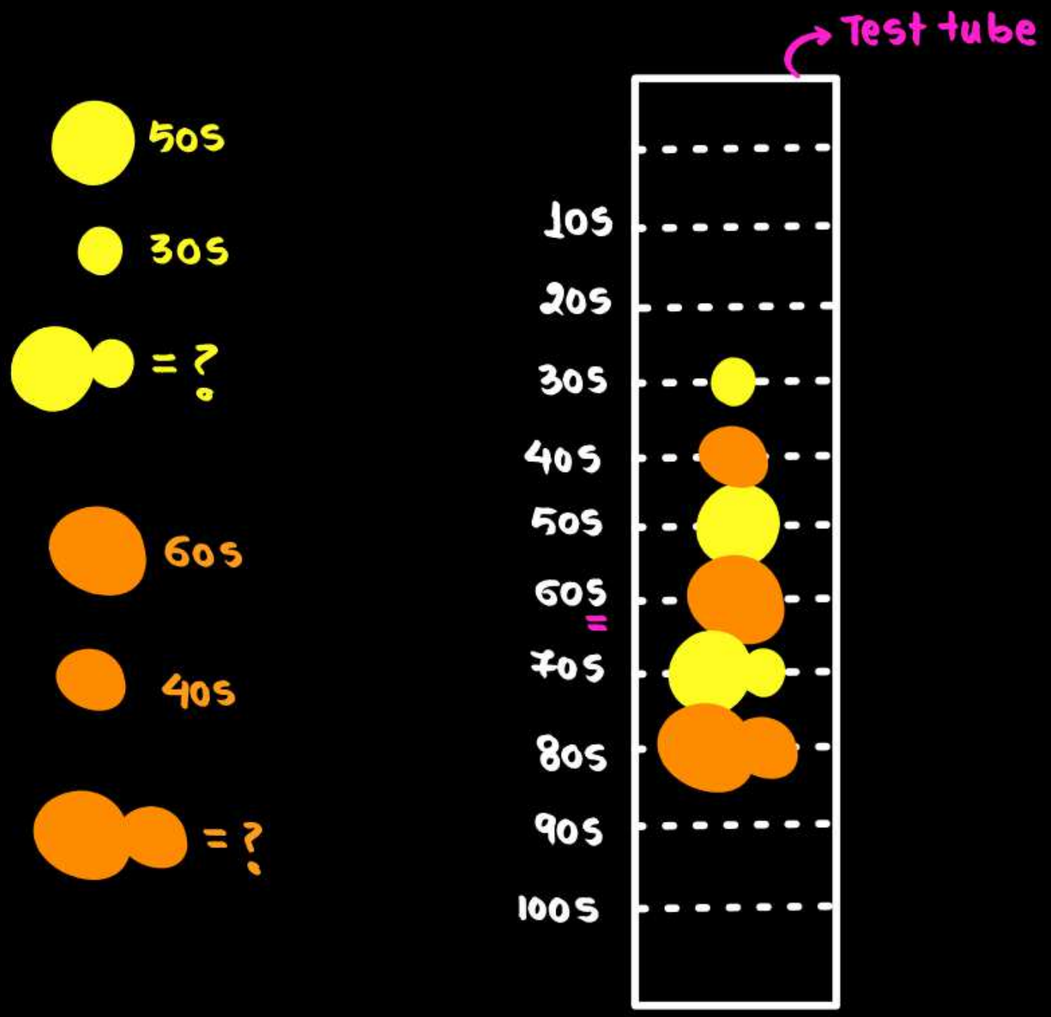
- Structure : Granular
- Formed of : Protein + rRNA
  - rRNA = ribosomal RNA
- 2 Types
  - 70S (prok., mito., chloroplast)
    - Large → 50S
      - 50S + 30S → 70S
    - Small → 30S
  - 80S (euk. cell, RER)
    - Large → 60S
      - 60S + 40S → 80S
    - Small → 40S

S = Svedberg unit
OR
S = Sedimentation cofficient

- Measure of density or size
- NOT WEIGHT

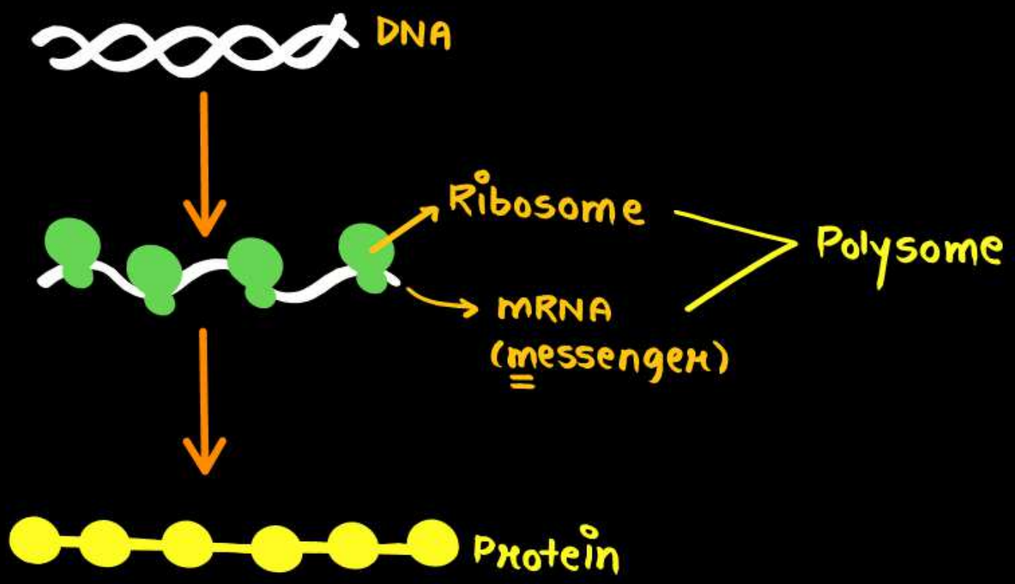
50S + 30S ≠ 80S
60S + 40S ≠ 100S

RIBOSOMES


50S
30S
= ?
60S
40S
= ?
Test tube
10S
20S
30S
40S
50S
60S
=
70S
80S
90S
100S

POLYSOME

↳ also called as POLY-RIBOSOME
⇓
many



NCERT MAIYAAAA KI READING!!

8.4.1 Cell Envelope and its Modifications

Most prokaryotic cells, particularly the bacterial cells, have a chemically complex cell envelope. The cell envelope consists of a tightly bound three layered structure i.e., the outermost glycocalyx followed by the cell wall and then the plasma membrane. Although each layer of the envelope performs distinct function, they act together as a single protective unit. Bacteria can be classified into two groups on the basis of the differences in the cell envelopes and the manner in which they respond to the staining procedure developed by Gram viz., those that take up the gram stain are **Gram positive** and the others that do not are called **Gram negative** bacteria.

Glycocalyx differs in composition and thickness among different bacteria. It could be a loose sheath called the **slime layer** in some, while in others it may be thick and tough, called the **capsule**. The **cell wall** determines the shape of the cell and provides a strong structural support to prevent the bacterium from bursting or collapsing.

The plasma membrane is selectively permeable in nature and interacts with the outside world. This membrane is similar structurally to that of the eukaryotes.

* Cell membrane is Universal & it is always formed of LIPID & PROTEIN

* All membranes are generally similar
  - bacteria
  - animal cell
  - plant cell
  - E.R, G.C, nuclei memb.

NCERT MAIYAAAA KI READING!!

8.4.2 Ribosomes and Inclusion Bodies

In prokaryotes, ribosomes are associated with the plasma membrane of the cell. They are about 15 nm by 20 nm in size and are made of two subunits - 50S and 30S units which when present together form 70S prokaryotic ribosomes. Ribosomes are the site of protein synthesis. Several ribosomes may attach to a single mRNA and form a chain called **polyribosomes** or **polysome**. The ribosomes of a polysome translate the mRNA into proteins.

NEET-2018,16

NCERT MAIYAAAA KI READING!!

8.5.6 Ribosomes

Ribosomes are the granular structures first observed under the electron microscope as dense particles by George Palade (1953). They are composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane.

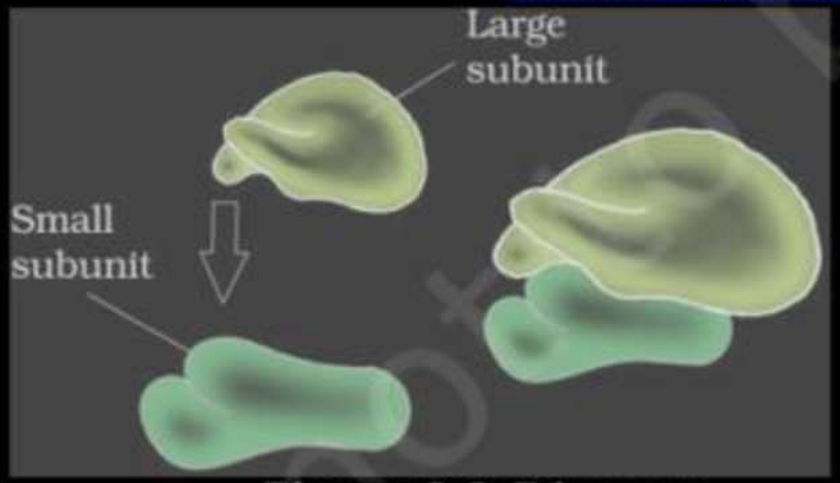
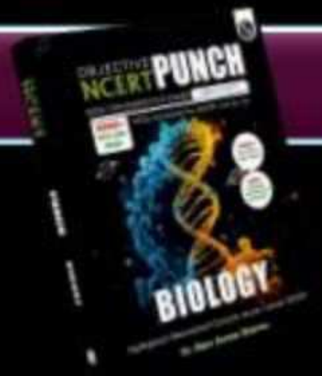


Figure 8.9 Ribosome

The eukaryotic ribosomes are 80S while the prokaryotic ribosomes are 70S. Each ribosome has two subunits, larger and smaller subunits (Fig 8.9). The two subunits of 80S ribosomes are 60S and 40S while that of 70S ribosomes are 50S and 30S. Here 'S' (Svedberg's Unit) stands for the sedimentation coefficient; it is indirectly a measure of density and size. Both 70S and 80S ribosomes are composed of two subunits.

Punchayat

with Vipu Sir



QUESTIONS AND PYQs

GC
CW
CM

1 The term "Glycocalyx" is used for:

(1) a layer surrounding the cell wall of bacteria.

(2) a layer present between cell wall and plasma membrane of bacteria.

(3) cell wall of bacteria.

(4) bacterial cell genetically engineered to possess N-glycosylated proteins.

2 A capsule in bacteria is related to

(1) Glycocalyx (2) Cell wall

(3) Plasma membrane (4) None of these

3 Which of the following is **incorrect** for ribosomes?

(1) Made up of two sub-units

(2) Form polysome

(3) May attach to mRNA

(4) Have no role in protein synthesis

4 The function of polysome in prokaryotic cell is to:

(1) translate m-RNA into protein.

(2) store reserve food materials.

(3) synthesize pigments.

(4) help in lipid synthesis.

5 Which of the following is present in both prokaryotic and plant cells?

(1) Lysosome (2) Golgi bodies

(3) Cell wall (4) Mitochondrion

6 Organelles which are regarded as 'power house' of the cell is:

(1) Chloroplast

(2) Ribosomes

(3) Endoplasmic reticulum

(4) Mitochondria

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 4, 5, 10, 11
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 33, 34, 35, 36, 37, 38, 39
Exercise-2: 2, 3, 4, 5


THANK
YOU

ARJUNA

NEET 2026

BOTANY

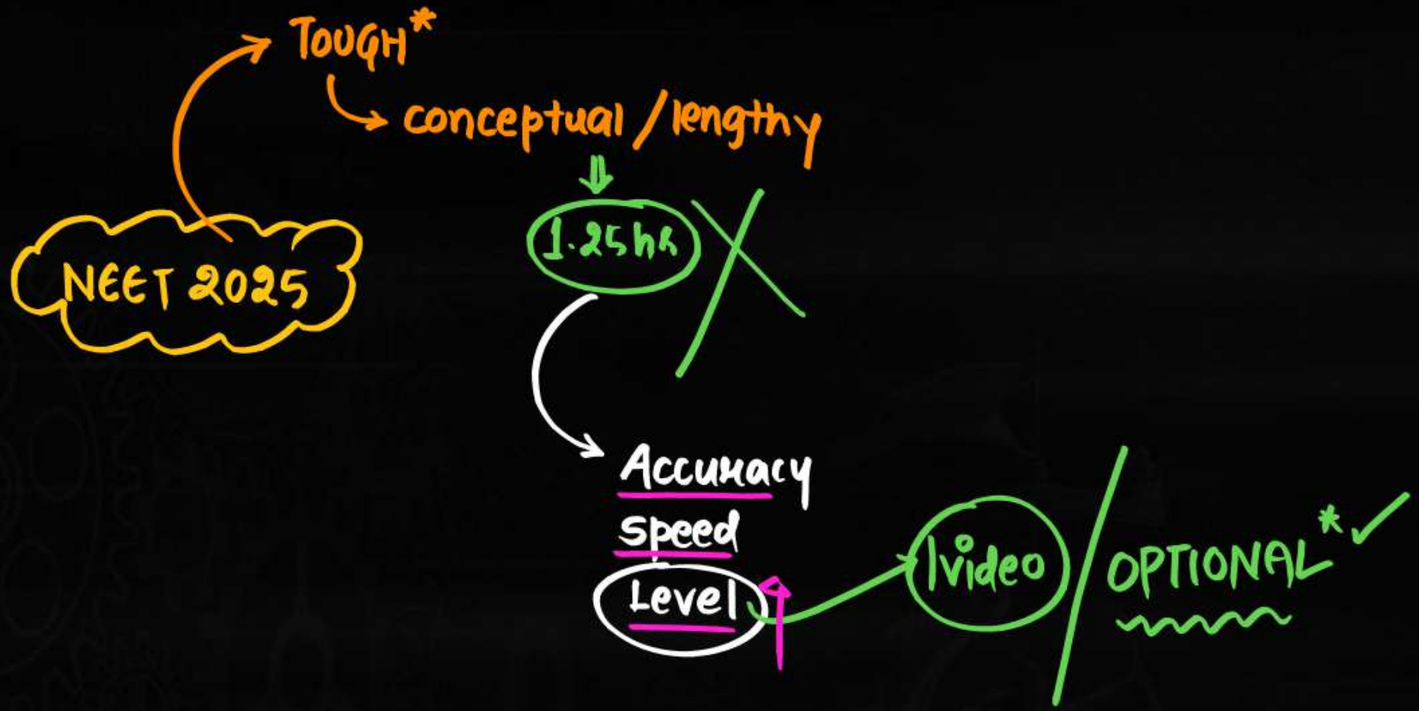
CELL: THE UNIT OF LIFE

Lecture: 06

By: Vipin Sharma Sir

Topics to be covered

1) Introduction to Eukaryotic Cell
2) Plant Cell vs Animal Cell
3) Cell membrane
4) Lipid in Membrane
5) Different Proteins in Membrane
6) PUNCH Questions and PYQs


TOUGH*
conceptual / lengthy
NEET 2025
1.25 hr
Accuracy
Speed
Level
Video
OPTIONAL*

NEET 2025 QUESTIONS

1 From the statements given below choose the **correct** option:

A. The eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S.

B. Each ribosome has two sub-units.

C. The two sub-units of 80S ribosome are 60S and 40S while that of 70S are 50S and 30S.

D. The two sub-units of 80S ribosome are 60S and 20S and that of 70S are 50S and 20S.

E. The two sub-units of 80S are 60S and 30S and that of 70S are 50S and 30S

(1) A, B, C are true

(2) A, B, D are true

(3) A, B, E are true

(4) B, D, E are true

2 A specialized membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration is:

(1) Mesosome

(2) Chromatophores

(3) Cristae

(4) Endoplasmic Reticulum

EUKARYOTIC CELL

↝ Eu: True/well defined / well organised

Karyon: Nucleus

↓

It means the nucleus will have nuclear membrane or nuclear envelope

- Nucleus have 2 membranes

↝ Membrane bound organelles are present ∴ compartmentalisation occur

↝ e.g., eukaryotes includes: Protista, Fungi, Plants, Animals

↝* Eukaryotes have complex locomotory & cytoskeletal structures

⇓

Prok- flagella: Flagellin protein → lower

Euk- flagella: Tubulin protein → Higher/complex

Cyto: cell

Skeletal: Frame

⇓

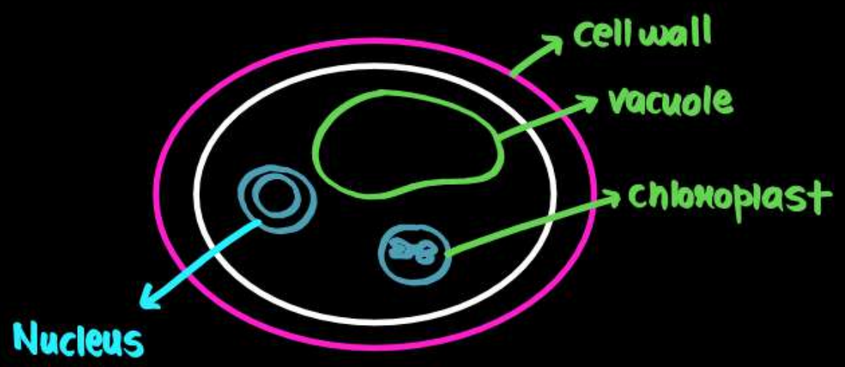
Prok- = MreB protein → Simple

Euk- = Actin & more → complex

PLANT CELL VS ANIMAL CELL

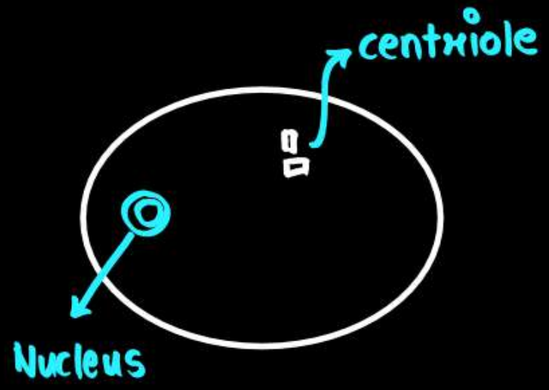
Plant cell

- Cell wall ⊕nt
- Plastids ⊕nt ; Chloroplast ⊕nt
- Central vacuole ⊕nt
- ⊖nt



Animal cell

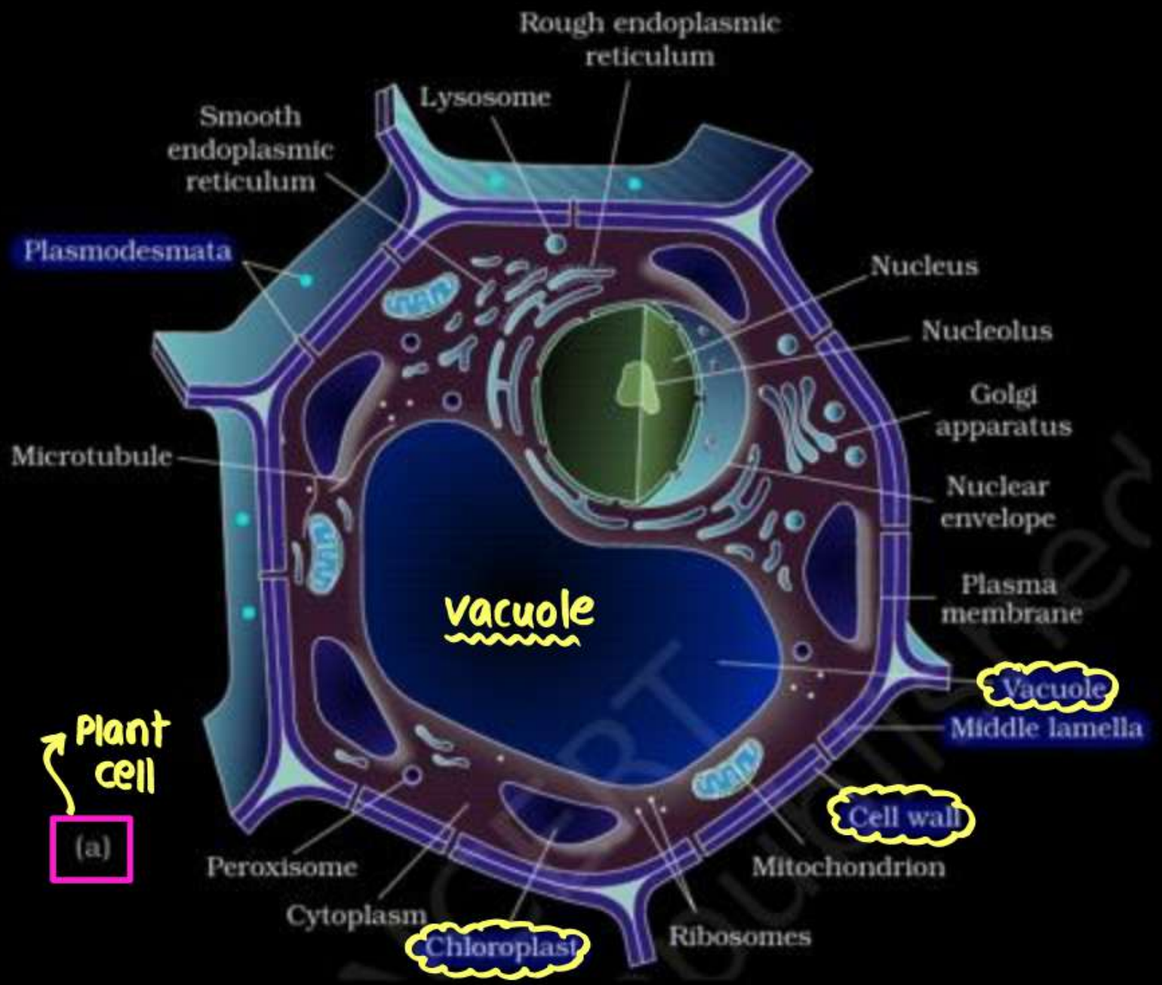
- ⊖nt
- ⊖nt
- ⊖nt
- Centrioles ⊕nt

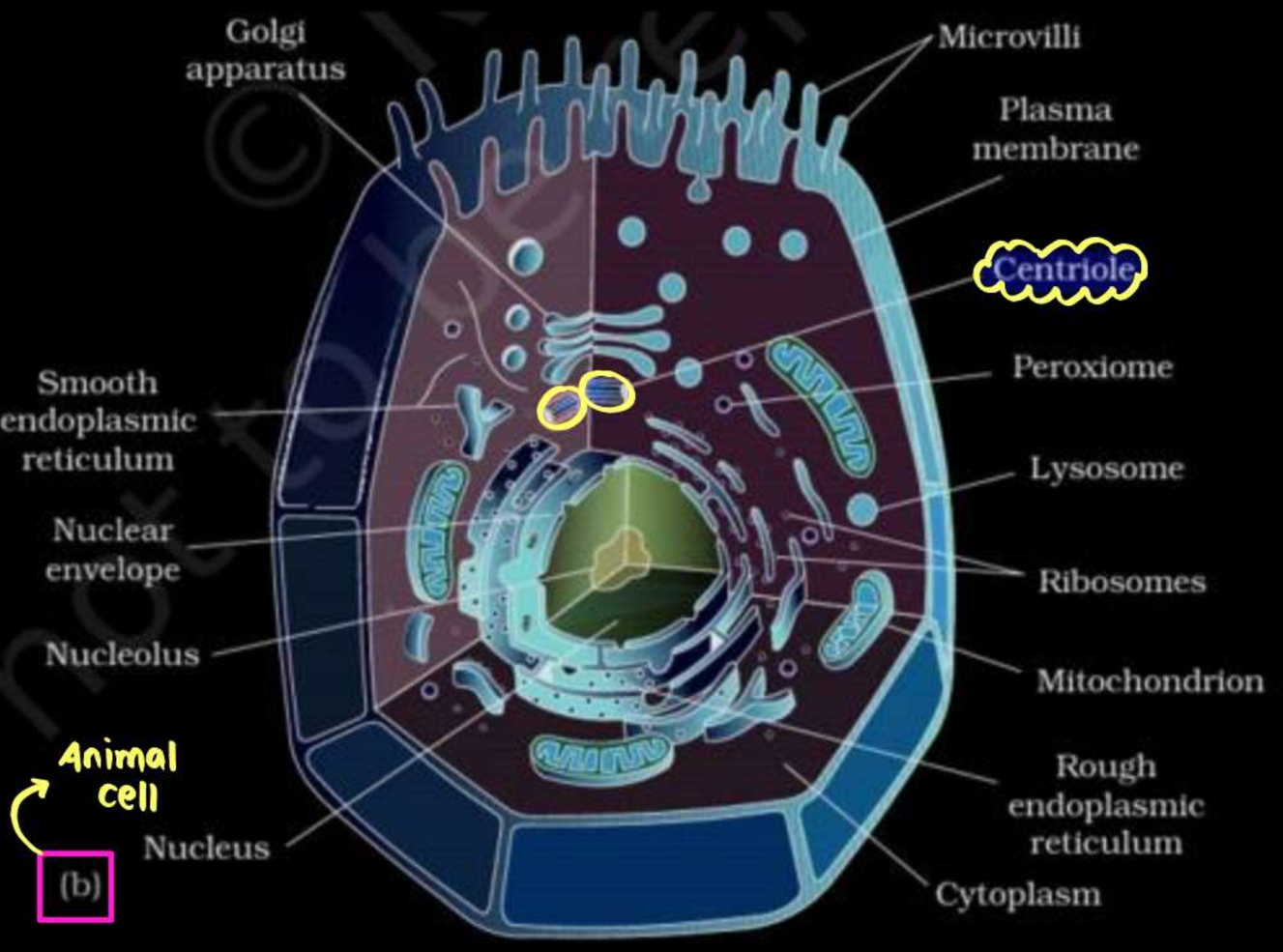


⇓

1. Membraneless
2. ⊕nt in animal cell is helps in cell division

PLANT CELL AND ANIMAL CELL





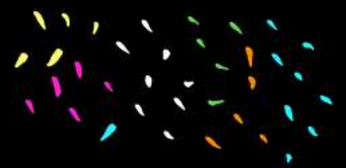
CELL MEMBRANE

- Universal structure found in all cells
- also called plasma membrane or plasmolemma
  - plasmolemma ⇓ Membrane
- Selectively permeable
- Due to advancement of electron microscopy, the structure of cell membrane was elaborated well after 1950s.
- Flexible
- Largely formed of Lipid & Protein
- Membranes of all kinds are largely lipid & proteins
  - largely ⇓ carbohydrates & cholesterol may also be present

CELL MEMBRANE

↳ Studies of cell membrane were done on Human RBC or Red Blood cell or Erythrocyte (Red cell)

Break

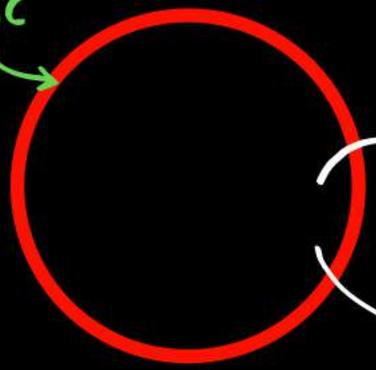


Different membrane parts are here

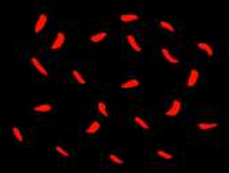
∴ contamination ↑

RBC

Ghost cell



Break



No contamination

∴ Studied easily

- Contains no nucleus or memb. bound organelles
- It only stores 'Haemo-globin'

⇓

no RIBOSOMES

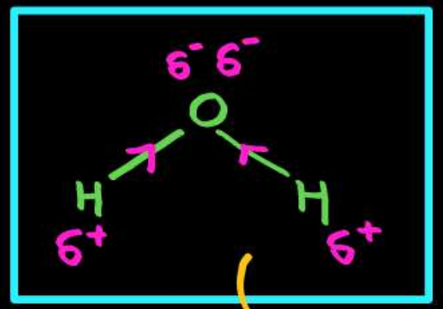
⇓

∴ It can't make its own proteins

∴ Die in 120 days

LIPID

- In RBC: Ratio of protein & Lipid is 52:40
  - 52% → protein
  - 40% → Lipid
- Rest 8% is carbohydrate & cholesterol
- Ratio of protein & lipid vary in different membranes
  - e.g.; Myeline sheath has 70-80% lipid
- Lipid: Main lipid that makes membrane is phospholipid
  - ⇓
  - Hydrophobic
    - H_2O
    - Fear



→ Polar

→ Hydrophillic as it can interact with H_2O

Polar Head ⇓ due to phosphate

PO_4^{3-}

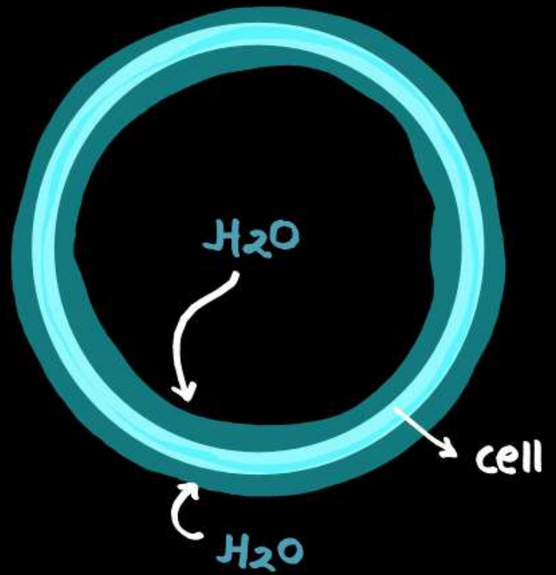
Hydrocarbon Tail
- Hydrogen
- Carbon

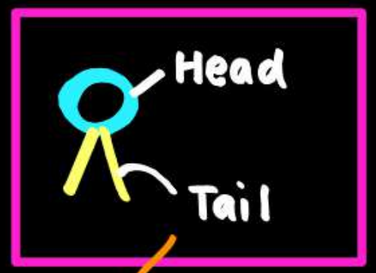
Saturated or unsaturated*
- Single bond → NCERT
- double bond

Non-polar → H—C

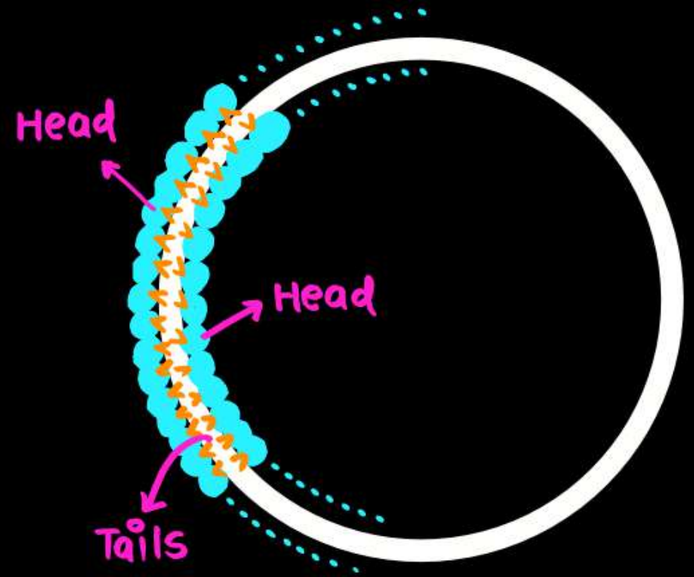
Can't interact with H_2O ∴ Hydrophobic

LIPID





Lipids forms a bilayer to make a membrane



NCERT MAIYAAAA KI READING!!

8.5 Eukaryotic Cells

Monera को छोड़के सब

The eukaryotes include all the protists, plants, animals and fungi. In eukaryotic cells there is an extensive compartmentalisation of cytoplasm through the presence of membrane bound organelles. Eukaryotic cells possess an organised nucleus with a nuclear envelope. In addition, eukaryotic cells have a variety of "complex" locomotory and cytoskeletal structures. Their genetic material is organised into chromosomes.

All eukaryotic cells are not identical. Plant and animal cells are different as the former possess cell walls, plastids and a large central vacuole which are absent in animal cells. On the other hand, animal cells have centrioles which are absent in almost all plant cells (Figure 8.3).

NCERT MAIYAAAA KI READING!!

8.5.1 Cell Membrane

The detailed structure of the membrane was studied only after the advent of the electron microscope in the 1950s. Meanwhile, chemical studies on the cell membrane, especially in human red blood cells (RBCs), enabled the scientists to deduce the possible structure of plasma membrane.

These studies showed that the cell membrane is mainly composed of lipids and proteins. The major lipids are phospholipids that are arranged in a bilayer. Also, the lipids are arranged within the membrane with the polar head towards the outer sides and the hydrophobic tails towards the inner part.This ensures that the nonpolar tail of saturated hydrocarbons is protected from the aqueous environment (Figure 8.4). In addition to phospholipids membrane also contains cholesterol.

NEET-2012

NCERT MAIYAAAA KI READING!!

Later, biochemical investigation clearly revealed that the cell membranes also possess protein and carbohydrate. The ratio of protein and lipid varies considerably in different cell types. In human beings, the membrane of the erythrocyte has approximately 52 per cent protein and 40 per cent lipids.

NEET-2012

Depending on the ease of extraction, membrane proteins can be classified as integral and peripheral. Peripheral proteins lie on the surface of membrane while the integral proteins are partially or totally buried in the membrane.

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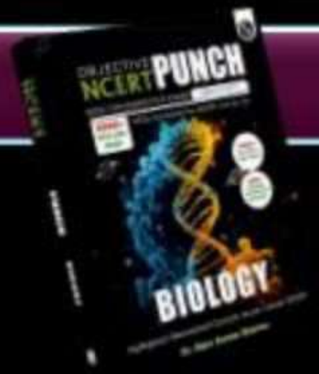
with Vipu Sir



1 Cell membranes posses lipid, protein and carbohydrate. The ratio of protein and lipid varies considerably in different cell types. In human beings, the membrane of the RBCs has approximately

(1) 40 percent lipids and 52 percent carbohydrates
(2) 40 percent protein and 52 percent lipids
(3) 40 percent lipids and 52 percent proteins
(4) 40 percent protein and 52 percent carbohydrates

2 Which of the following is present in both prokaryotic and plant cells?

(1) Lysosome
(2) Golgi bodies
(3) Cell wall
(4) Mitochondrion

3 A plant cell has:

(1) a large central vacuole and rigid cell wall.
(2) a centriole for cell division.
(3) a centrosome inactive in non-dividing cells.
(4) absence of cell membrane.

4 Depending on the ease of extraction, membrane proteins can be classified as:

(1) saturated and unsaturated.
(2) hydrophilic and hydrophobic.
(3) integral and peripheral.
(4) acidic, basic and neutral.

5 Phospholipid molecules of cell membrane possess:

(1) Polar head and polar tail
(2) Non-polar head and non-polar tail
(3) Polar head and non-polar tail
(4) Non-polar head and polar tail

6 A complex of ribosomes attached to a single strand of RNA is known: **(2016 - I)**

(1) Polysome
(2) Polymer
(3) Polypeptide
(4) Okazaki fragment

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 4, 5, 10, 11, 12, 13
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 33, 34, 35, 36, 37, 38, 39, 40, 42, 47, 48
Exercise-2: 2, 3, 4, 5, 12, 13


THANK
YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 09

By: Vipin Sharma Sir

Topics to be covered

1) Endomembrane System *

~~2)~~ Endoplasmic Reticulum

~~3)~~ Golgi Complex

~~4)~~ Lysosome

~~5)~~ Vacuole

6) PUNCH Questions and PYQs

ENDOMEMBRANE SYSTEM

- Endo: Inside cell
  Membrane: vesicles
  System: coordination

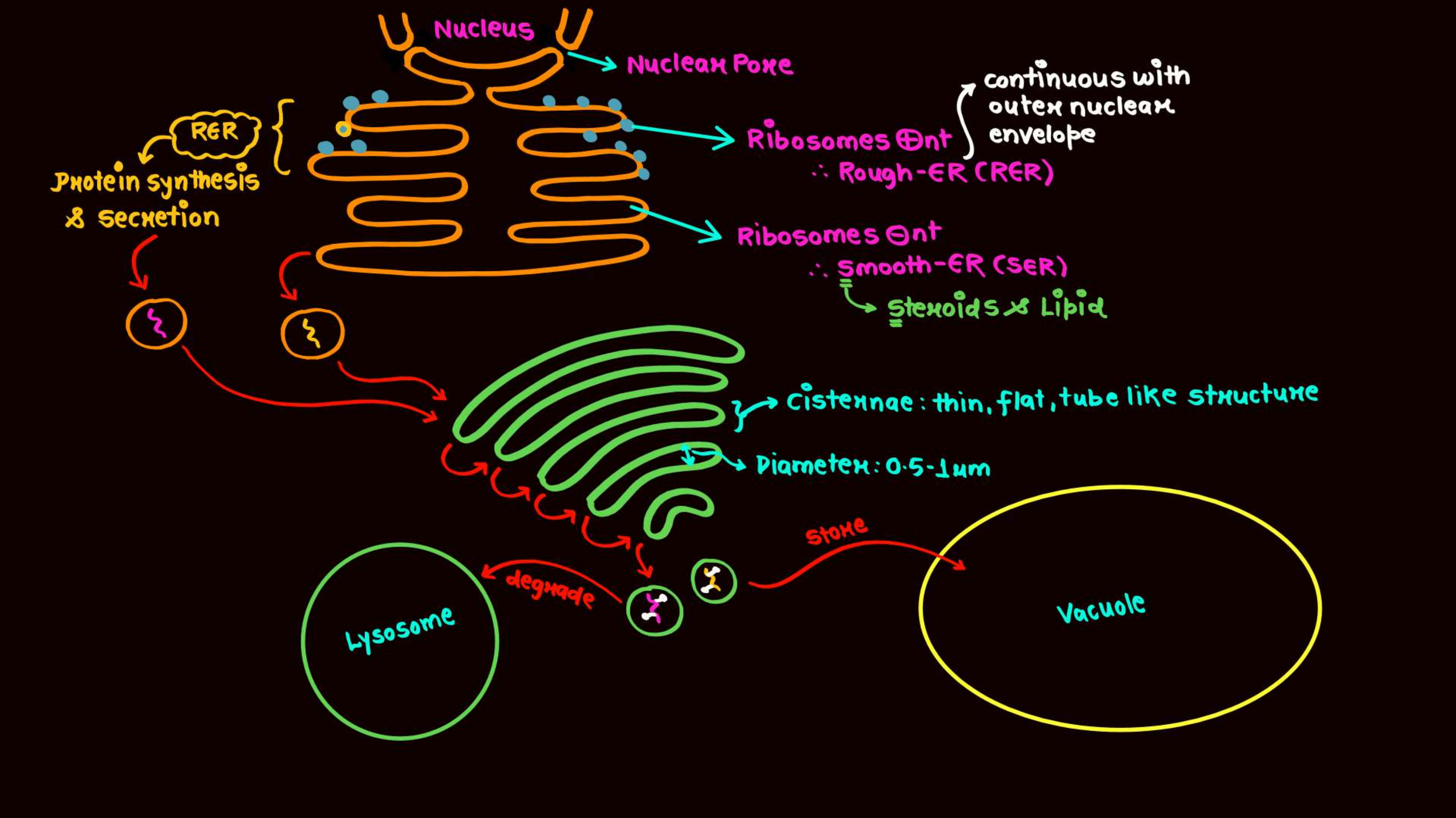
- All organelles in a cell have distinct/ different structure & functions

  BUT

  Some organelles function are coordinated ∵ they are connected by VESICLES

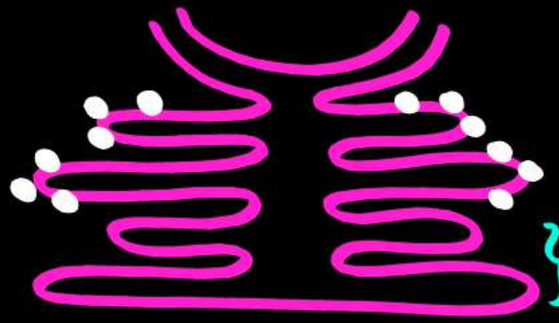
- Endomembrane system includes:
  1. Endoplasmic reticulum (ER)
  2. Golgi complex (GC)
  3. Lysosomes
  4. Vacuole

- NOTE: Mitochondria, chloroplast, peroxisome are 'NOT' parts of Endomemb. system


Nucleus
Nuclear Pore
RER
Protein synthesis & secretion
Ribosomes ⊕nt
continuous with outer nuclear envelope
∴ Rough-ER (RER)
Ribosomes ⊖nt
∴ Smooth-ER (SER)
Steroids & Lipid
Cisternae : thin, flat, tube like structure
Diameter : 0.5-1 μm
store
degrade
Lysosome
Vacuole

ENDOPLASMIC RETICULUM

- Reticulum or network of tiny tubules which are interconnected to each other
- Seen scattered in the cell after advancement of $e^{\ominus}$-microscopy



RER ⇓

Synthesise & secrete PROTEIN ⇓

⇓ Towards Golgi

SER : makes LIPID

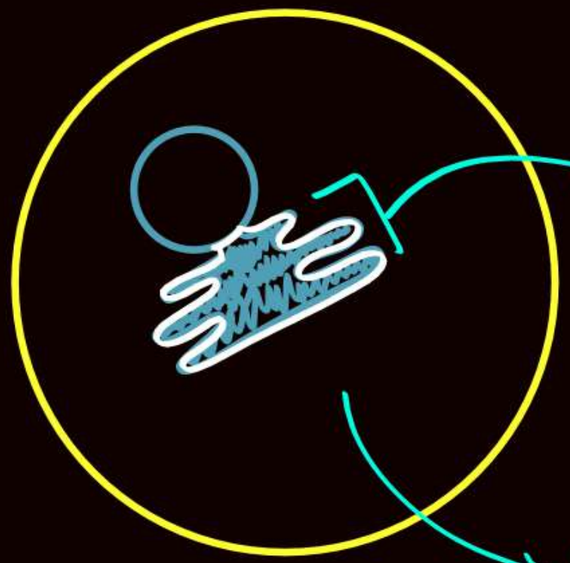
→ Towards Golgi

In animals, it makes STEROID hormones ⇓

Sex Hormones

e.g., Testosterone
Estrogen etc.

Also makes **GLYCOGEN**



Luminal space of ER

Extra Luminal space

Cell – Luminal space = Extra luminal space

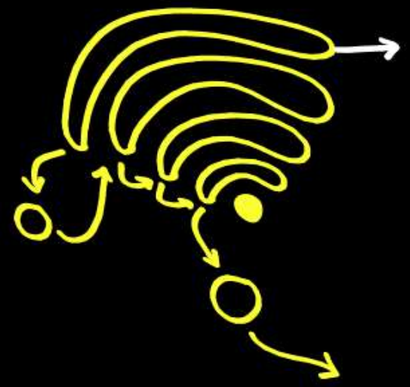
GOLGI BODY

↝ Named after camillo Golgi (1898) → discovered

↝ Densely stained reticular structure
⇓
Golgi stain

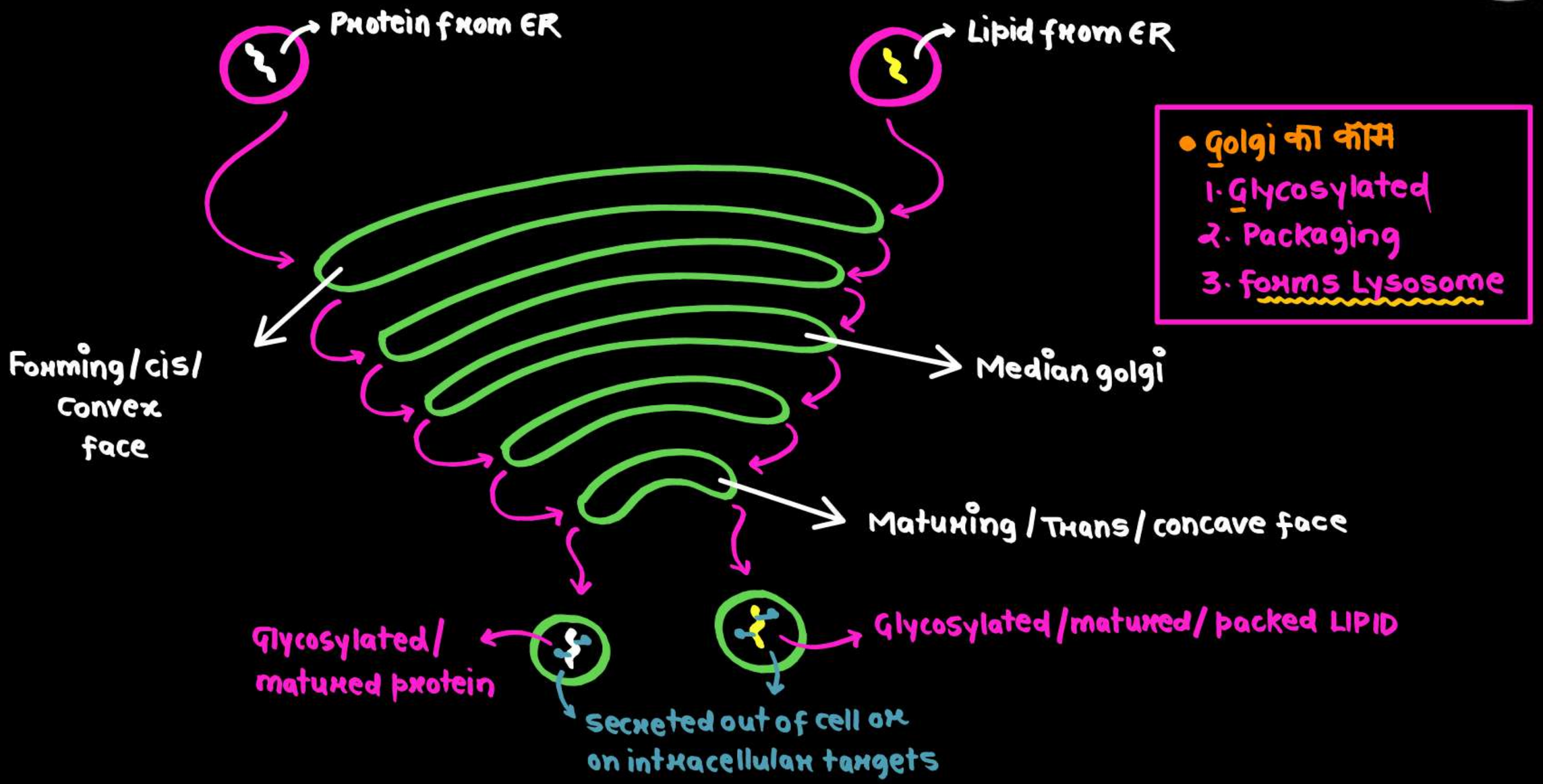
↝ Parallely arranged flat, disc like str. are found called 'CISTERNAE'

↝ These cisternae are concentrically arranged



→ All cisternae are separate but interconnected via vesicles
(4-8)

GOLGI BODY


Protein from ER
Lipid from ER
Golgi का काम
1. Glycosylated
2. Packaging
3. forms Lysosome
Forming / cis / Convex face
Median golgi
Maturing / Trans / concave face
Glycosylated / matured protein
Glycosylated / matured / packed LIPID
Secreted out of cell or on intracellular targets

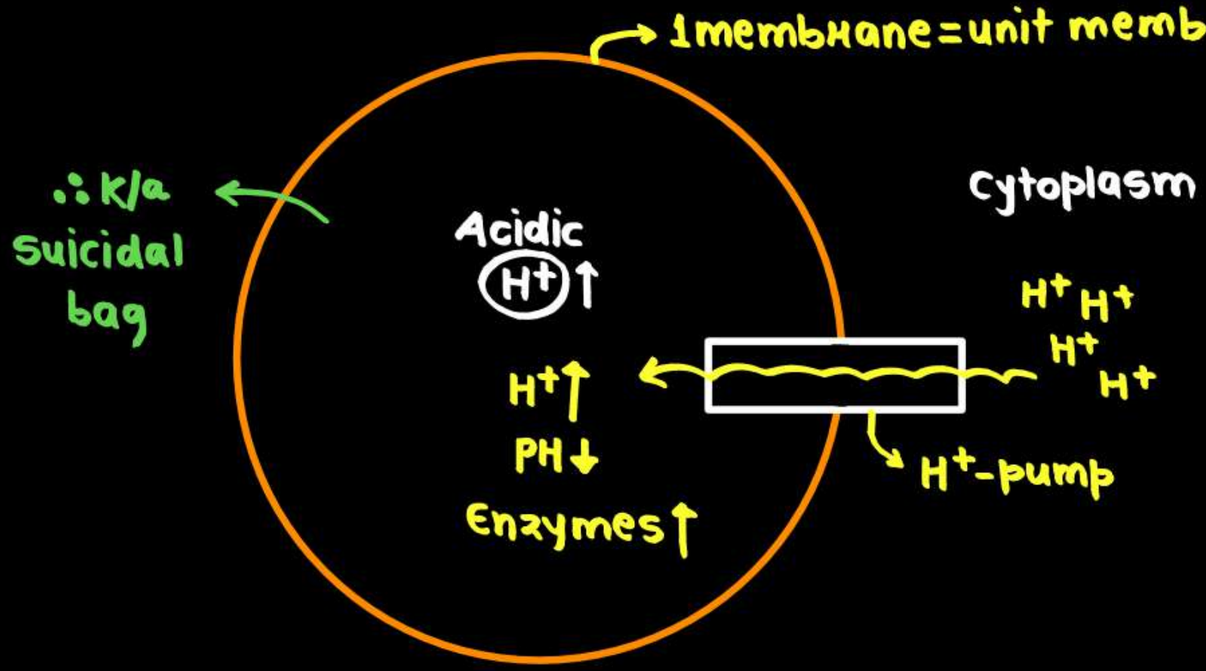
LYSOSOME

↝ Lyso : to Lyse or to breakdown

⬇

digests different biomolecules with the help of hydrolytic enzymes

↝ Hydrolytic enzymes are active at low pH / acidic pH / 4-5 pH



Enzymes:

1. Nuclease : breaks nucleic acid
2. Amylase : breaks starch
3. Lipase : breaks Lipid
4. Protease : breaks protein

- It is a polymorphic organelle

many forms

NCERT MAIYAAAA KI READING!!

8.5.3 Endomembrane System

While each of the membranous organelles is distinct in terms of its structure and function, many of these are considered together as an endomembrane system because their functions are coordinated. The endomembrane system include 1. endoplasmic reticulum (ER), 2. golgi complex, 3. lysosomes and 4. vacuoles. Since the functions of the mitochondria, chloroplast and peroxisomes are not coordinated with the above components, these are not considered as part of the endomembrane system.

NEET-2021

NEET-2023

NCERT MAIYAAAA KI READING!!

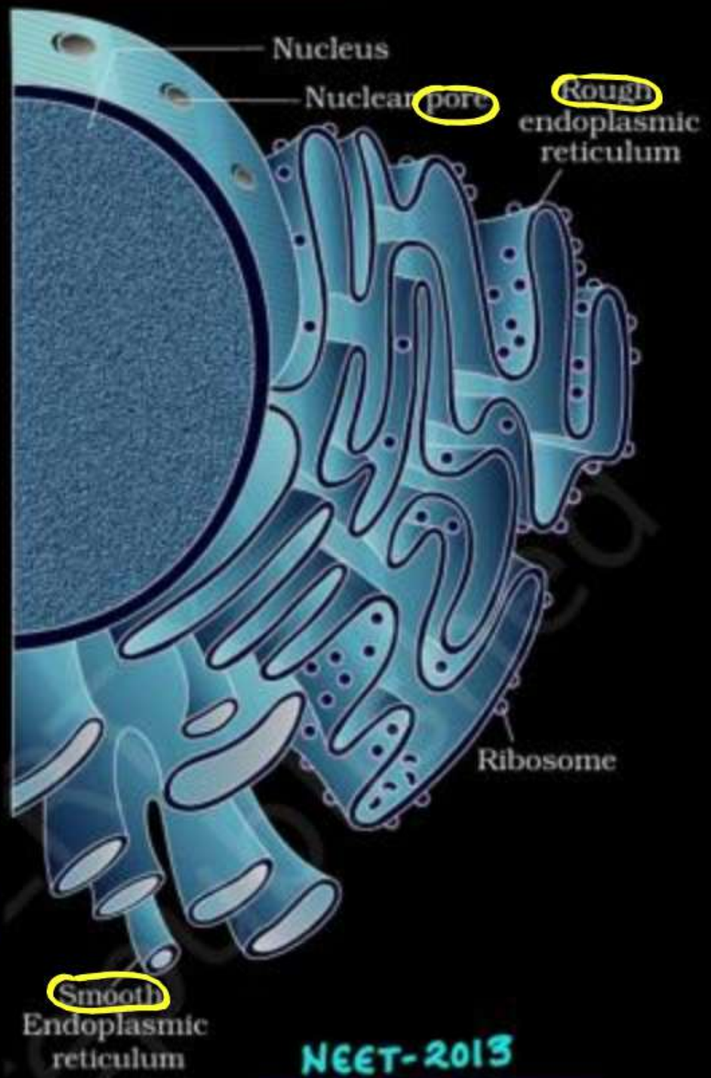
8.5.3.1 The Endoplasmic Reticulum (ER)

Electron microscopic studies of eukaryotic cells reveal the presence of a network or reticulum of tiny tubular structures scattered in the cytoplasm that is called the endoplasmic reticulum (ER) (Figure 8.5). Hence, ER divides the intracellular space into two distinct compartments, i.e., luminal (inside ER) and extra luminal (cytoplasm) compartments.

The ER often shows ribosomes attached to their outer surface. The endoplasmic reticulun bearing ribosomes on their surface is called rough endoplasmic reticulum (RER). In the absence of ribosomes they appear smooth and are called smooth endoplasmic reticulum (SER).

RER is frequently observed in the cells actively involved in protein synthesis and secretion. They are extensive and continuous with the outer membrane of the nucleus.

The smooth endoplasmic reticulum is the major site for synthesis of lipid. In animal cells lipid-like steroidal hormones are synthesised in SER.



NEET-2013

Figure 8.5 Endoplasmic reticulum

NCERT MAIYAAAA KI READING!!

8.5.3.2 *Golgi apparatus*

NEET-2021

Camillo Golgi (1898) first observed densely stained reticular structures near the nucleus. These were later named Golgi bodies after him. They consist of many flat, disc-shaped sacs or cisternae of 0.5µm to 1.0µm diameter (Figure 8.6). These are stacked parallel to each other. Varied number of cisternae are present in a Golgi complex. The Golgi cisternae are concentrically arranged near the nucleus with distinct convex *cis* or the forming

Figure 8.6 Golgi apparatus

NCERT MAIYAAAA KI READING!!

face and concave *trans* or the maturing face. The *cis* and the *trans* faces of the organelle are entirely different, but interconnected.

The golgi apparatus principally performs the function of packaging materials, to be delivered either to the intra-cellular targets or secreted outside the cell. Materials to be packaged in the form of vesicles from the ER fuse with the *cis* face of the golgi apparatus and move towards the maturing face. This explains, why the golgi apparatus remains in close association with the endoplasmic reticulum. A number of proteins synthesised by ribosomes on the endoplasmic reticulum are modified in the cisternae of the golgi apparatus before they are released from its *trans* face. Golgi apparatus is the important site of formation of glycoproteins and glycolipids.

NEET-2023

NEET-2024, 2020

NCERT MAIYAAAA KI READING!!

8.5.3.3 *Lysosomes*

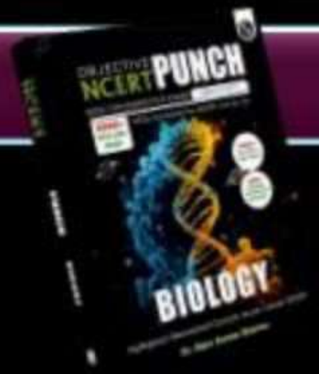
NEET-2019

NEET-2022, 2016

These are membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes (hydrolases – lipases, proteases, carbohydrases) optimally active at the acidic pH. These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.

Punchayat

with Vipu Sir



QUESTIONS AND PYQs

1 From the given options choose the two organelles that look most alike structurally:

(1) Nucleus and vesicle
(2) ER and mitochondrion
(3) Golgi apparatus and smooth ER
(4) Vacuole and cytoskeleton

2 Which structures are responsible for synthesis of lipid like-steroidal hormones in animal cells?

(1) Smooth ER
(2) Smooth and rough ER
(3) Sphaerosomes
(4) Golgi bodies

oleosome : stone lipid in plants

3 Rough E.R is mainly responsible for

(1) Protein synthesis
(2) Cell wall formation
(3) Lipid synthesis
(4) Cholesterol synthesis

4 Golgi body is associated with:

(1) packaging of material.
(2) protein synthesis.
(3) secretion of different substance.
(4) Both (1) and (3).

5 Hydrolytic enzymes are abundantly found in;

(1) Ribosome.
(2) Lysosome.
(3) Oxysome.
(4) Endoplasmic reticulum.

6 Which face of Golgi complex is associated with ER?

(1) Forming face, i.e., *Trans*-face
(2) Maturing face, i.e., *Trans*-face
(3) Both forming and maturing face
(4) Forming face or *Cis*-face

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 2, 4, 5, 10, 11, 12, 13
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48, 49, 50
Exercise-2: 2, 3, 4, 5, 12, 13

THANK YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 10

By: Vipin Sharma Sir

Topics to be covered

1) Endomembrane System

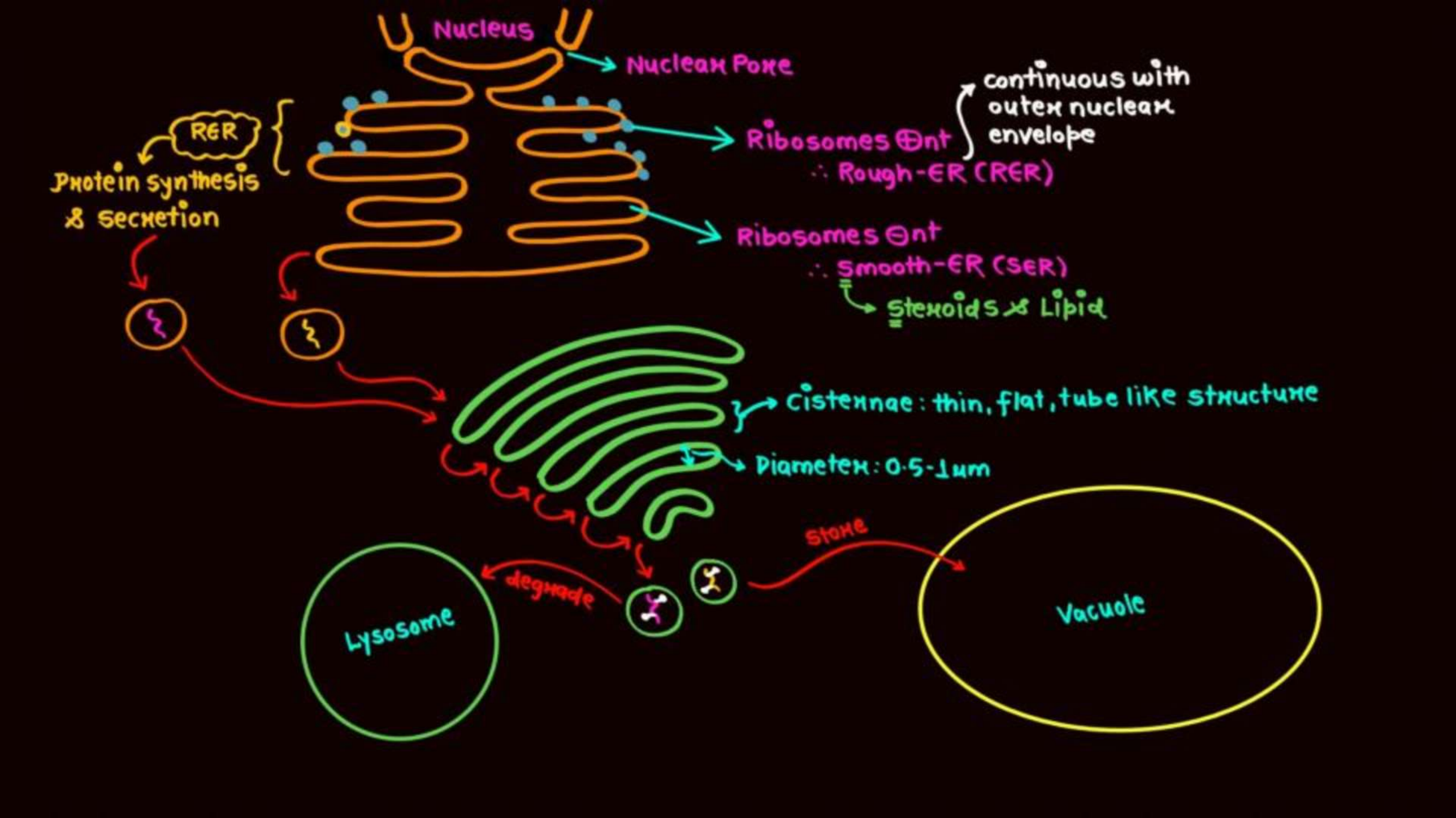
2) Vacuole*

3) Semiautonomous Organelles

4) Mitochondria

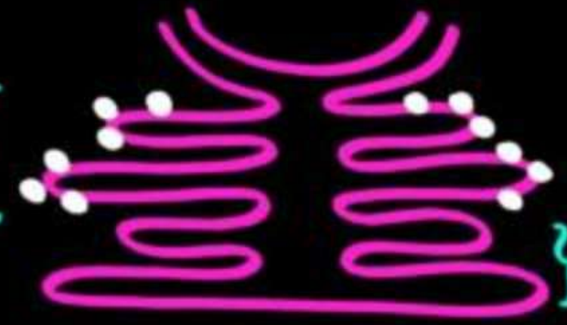
5) Plastids

6) PUNCH Questions and PYQs


Nucleus
Nuclear Pore
RER
Protein synthesis & secretion
Ribosomes ⊕nt
continuous with outer nuclear envelope
∴ Rough-ER (RER)
Ribosomes ⊖nt
∴ Smooth-ER (SER)
Steroids & Lipid
Cisternae : thin, flat, tube like structure
Diameter : 0.5-1 μm
Store
degrade
Lysosome
Vacuole

ENDOPLASMIC RETICULUM

- Reticulum or network of tiny tubules which are interconnected to each other
- Seen scattered in the cell after advancement of $e^{\ominus}$-microscopy



RER ⇓

Synthesise & secrete PROTEIN ⇓

⇓ Towards Golgi

SER : makes LIPID

→ Towards Golgi

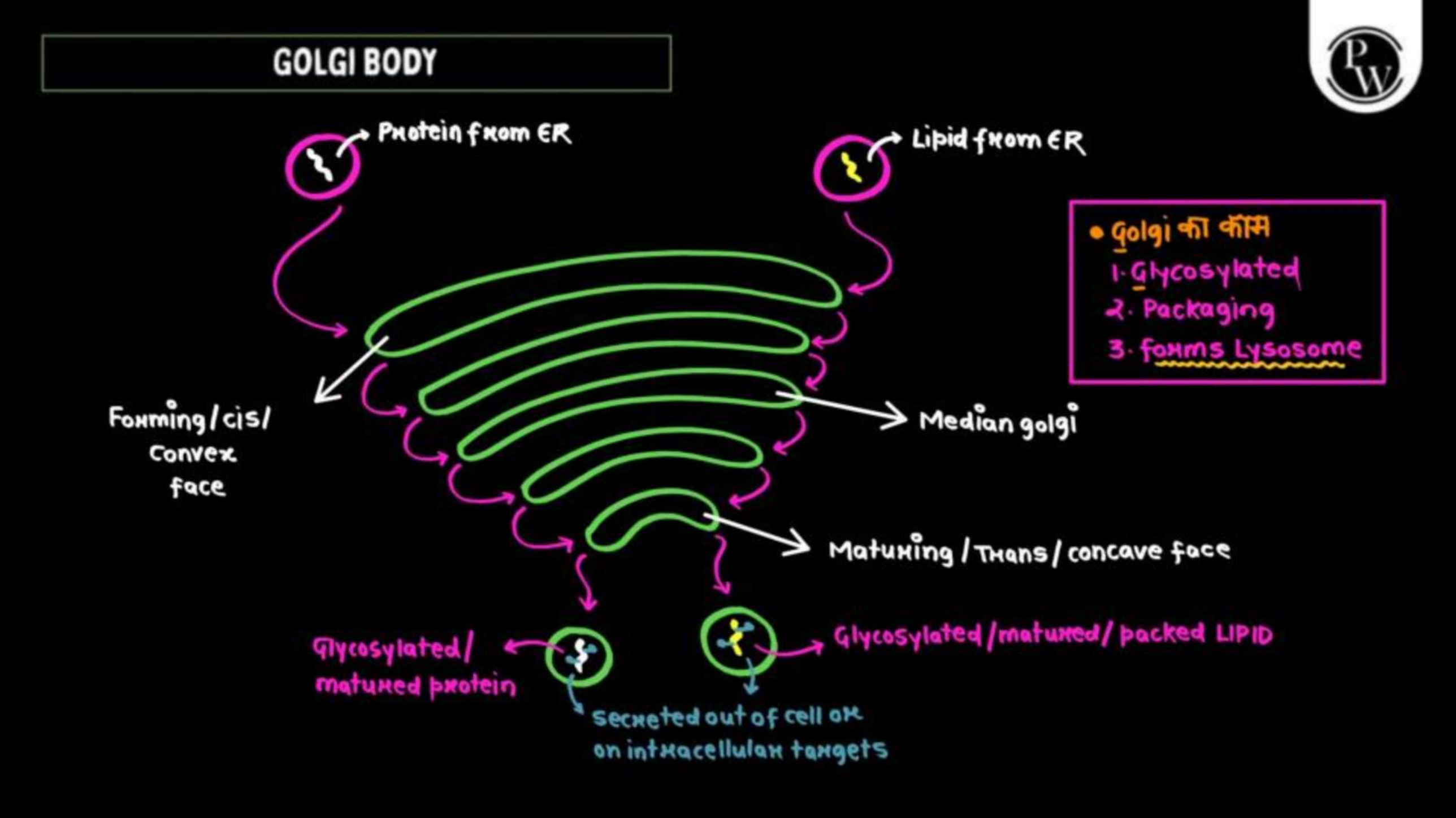
In animals, it makes STEROID hormones ⇓

Sex Hormones

e.g., Testosterone
Estrogen etc.

Also makes **GLYCOGEN**

GOLGI BODY


Protein from ER
Lipid from ER
• Golgi का काम
1. Glycosylated
2. Packaging
3. forms Lysosome
Forming / cis / Convex face
Median golgi
Maturing / Trans / concave face
Glycosylated / matured protein
Glycosylated / matured / packed LIPID
Secreted out of cell or on intracellular targets

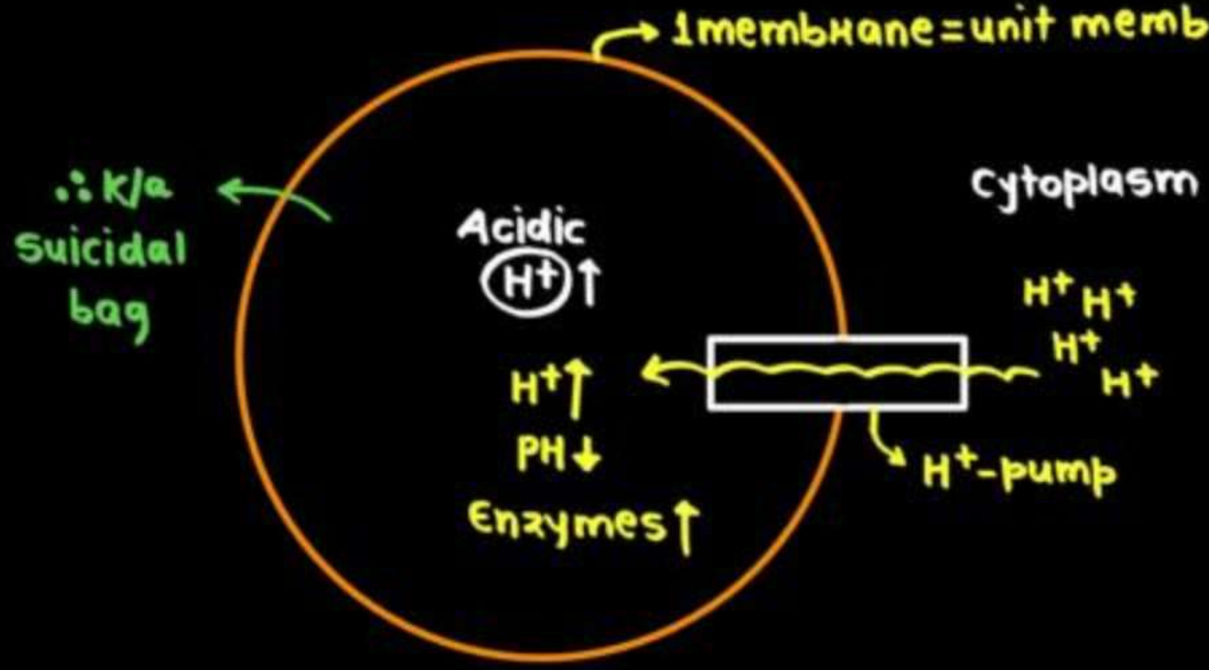
LYSOSOME

↝ Lyso : to Lyse or to breakdown

↓

digests different biomolecules with the help of hydrolytic enzymes

↝ Hydrolytic enzymes are active at low pH / acidic pH / 4-5 pH



Enzymes:

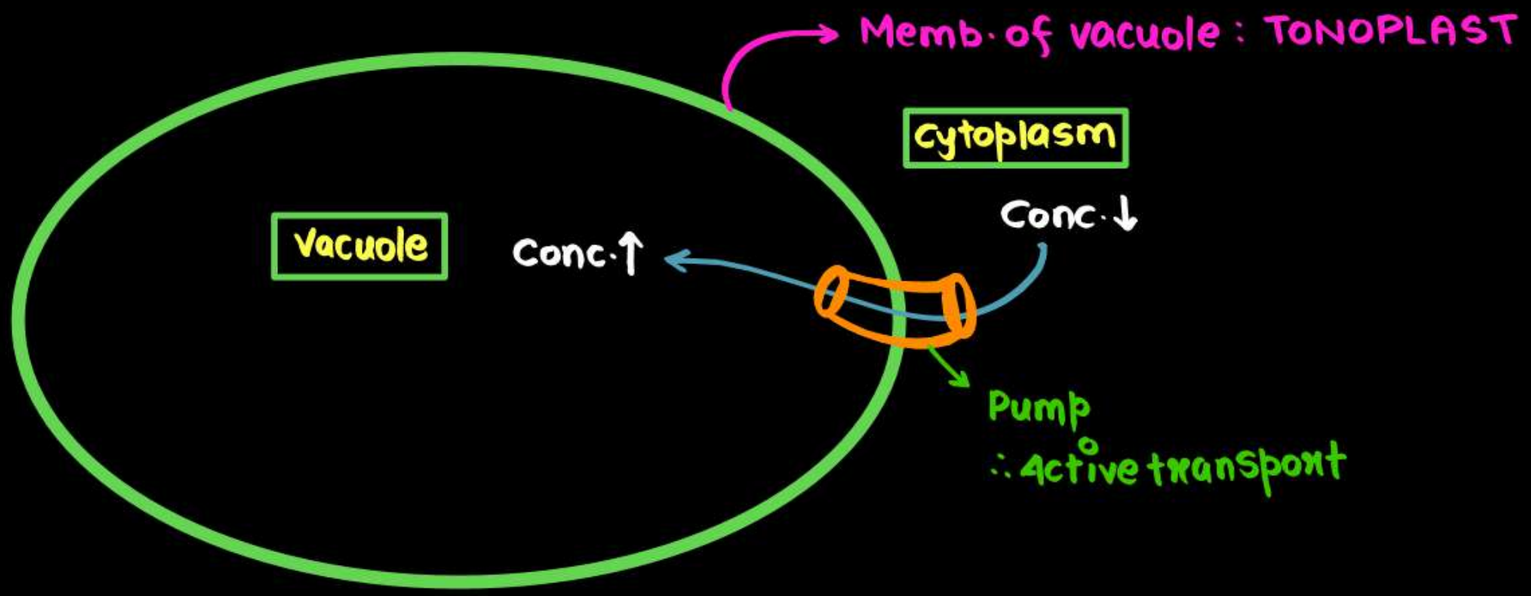
1. Nuclease : breaks nucleic acid
2. Amylase : breaks starch
3. Lipase : breaks Lipid
4. Protease : breaks protein

- It is a polymorphic organelle

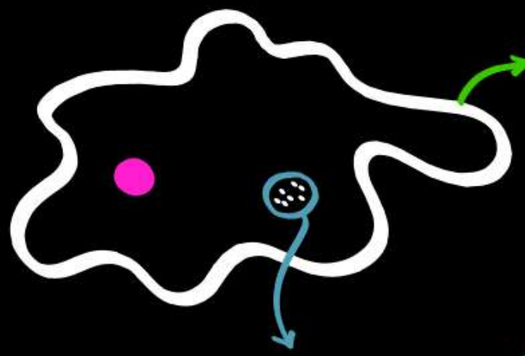
many forms

VACUOLE

- just like a storehouse of the cell
- In plant cells, the vacuole can occupy upto 90% of volume of cell
- can store: H_2O, sap, pigments, excretory waste
  - sap → H_2O, salts, sugars, org. acids
  - pigments → Anthocyanin (flowers)



CONTRACTILE VACUOLE



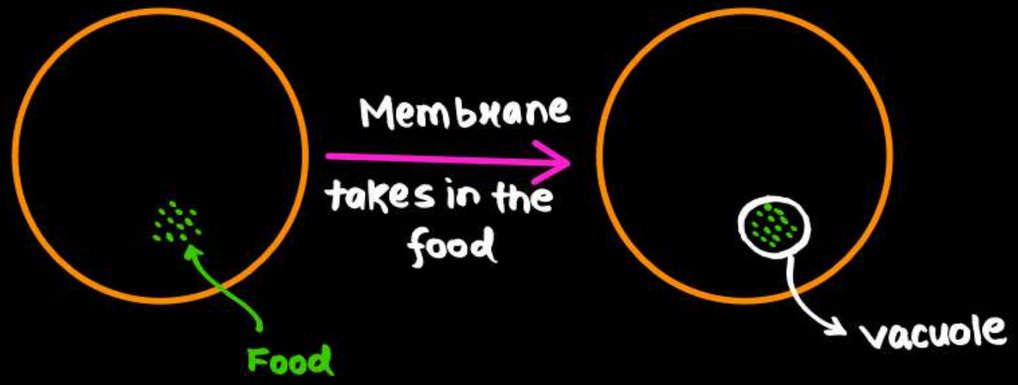
vacuole contracts & helps in excretion & osmoregulation control

osmolarity ⇓ H_2O & salt conc.

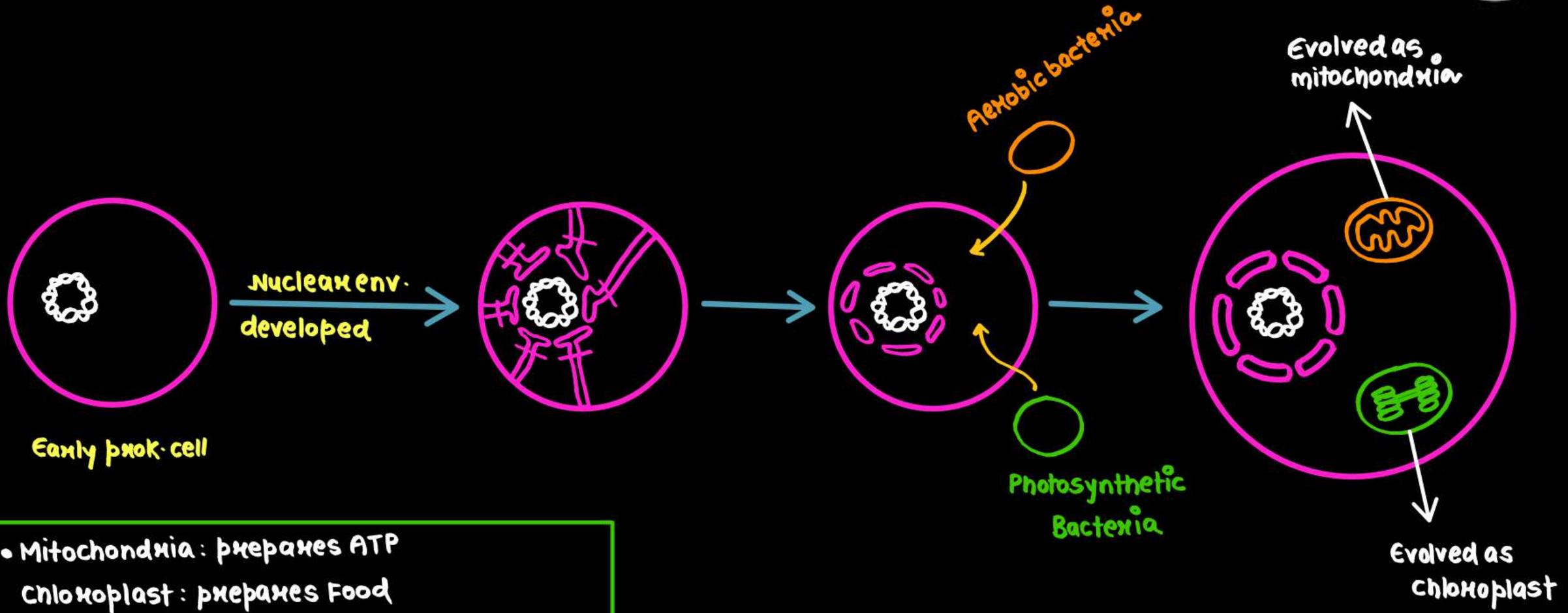
* osmoregulation & excretion occur simultaneously

FOOD VACUOLE

- In Protista, food vacuole is formed by engulfing food particles

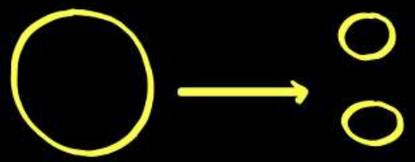
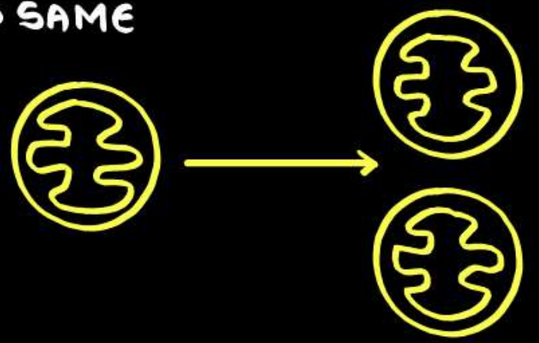


ENDOSYMBIOTIC THEORY



- Mitochondria : prepares ATP
  Chloroplast : prepares Food
  Nucleus : controls major activities of mitochondria & chloroplasm

ENDOSYMBIOTIC THEORY

Bacteria	Mitochondria & Chloroplast
• 70S ribosomes	• SAME
• double stranded circular DNA 	• SAME
• size almost same to mitoc. & chloroplast	• SAME
• Divide by fission 	• SAME 

They both are SEMI-AUTONOMOUS ORGANELLE
50% Independent

Their major functions are still regulated by nuclear DNA

MITOCHONDRIA

↝ Also called as powerhouse of the cell

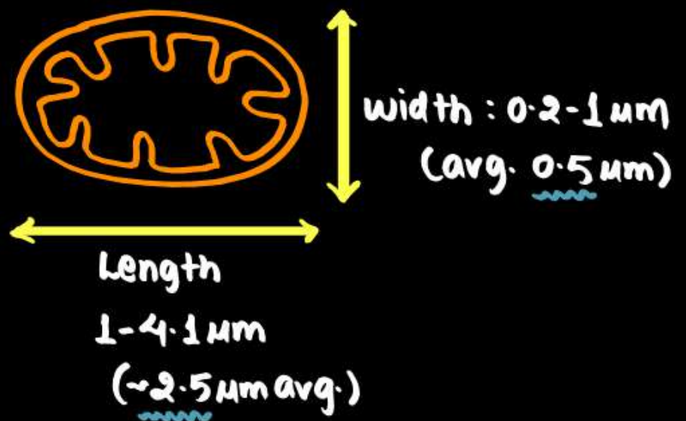
⇓

∵ ATP are formed here

↳ Adenosine-Tri-phosphate

↝ It is small in size ∴ to visualise it, a dye is needed to stain it

↳ Janus Green-B



No. of mitochondria varies in diff. cells & it depends upon physio-logical activities of the cell

e.g., Flight muscle of Birds : ↑↑ mito.

↝ Shape is also variable but it is usually cylindrical or sausage shape

NCERT MAIYAAAA KI READING!!

8.5.3.4 Vacuoles

The vacuole is the membrane-bound space found in the cytoplasm. It contains water, sap, excretory product and other materials not useful for the cell. The vacuole is bound by a single membrane called tonoplast. In plant cells the vacuoles can occupy up to 90 per cent of the volume of the cell.

In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradients into the vacuole, hence their concentration is significantly higher in the vacuole than in the cytoplasm.

NEET 2014

In *Amoeba* the **contractile vacuole** is important for osmoregulation and excretion. In many cells, as in protists, **food vacuoles** are formed by engulfing the food particles.

NCERT MAIYAAAA KI READING!!

8.5.4 Mitochondria

Mitochondria (sing.: mitochondrion), unless specifically stained, are not easily visible under the microscope. The number of mitochondria per cell is variable depending on the physiological activity of the cells. In terms of shape and size also, considerable degree of variability is observed. Typically it is sausage-shaped or cylindrical having a diameter of 0.2-1.0µm (average 0.5µm) and length 1.0-4.1µm. Each mitochondrion is a double

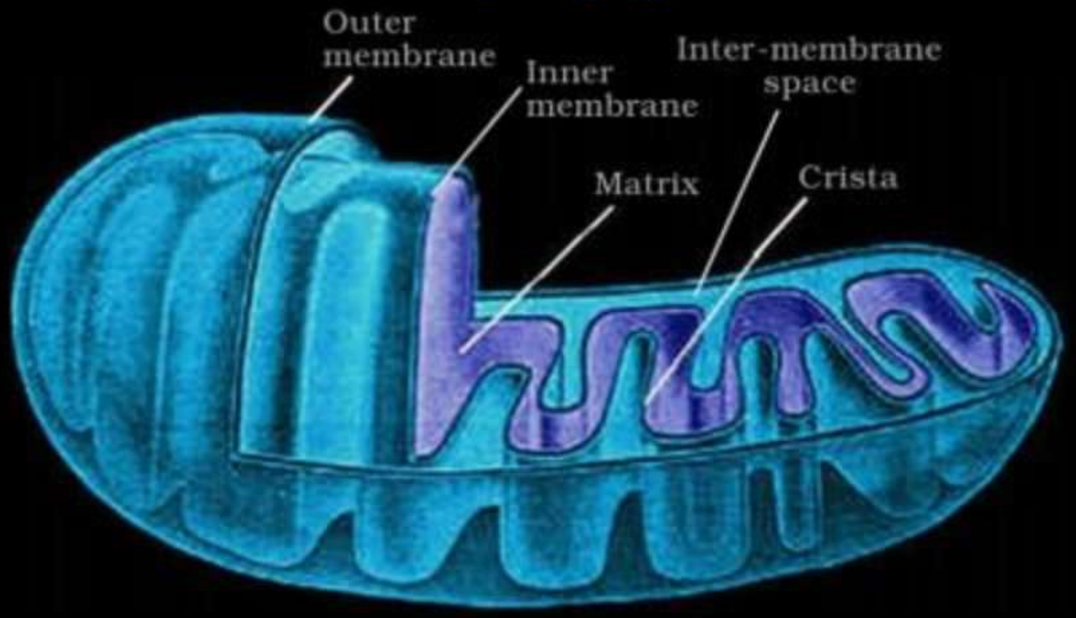
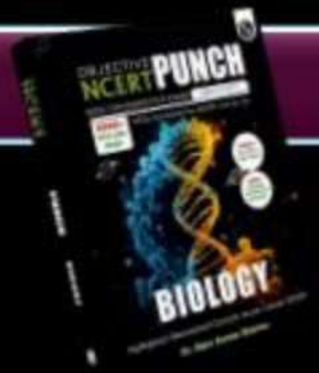


Figure 8.7 Structure of mitochondrion (Longitudinal section)

Punchayat

with Vipu Sir



QUESTIONS AND PYQs

1 Cristae are found in:

(1) surface of grana.
(2) surface of plasma membrane.
(3) inner membrane of mitochondria.
(4) nuclear membrane.

2 Which of the following organelles are double membrane-bound?

(1) Nucleus
(2) Chloroplast
(3) Mitochondria
(4) All of these

3 Membrane covering the vacuole is termed as:

(1) Cell wall
(2) Plasmalemma
(3) Cell membrane
(4) Tonoplast

4 Both chloroplasts and mitochondria:

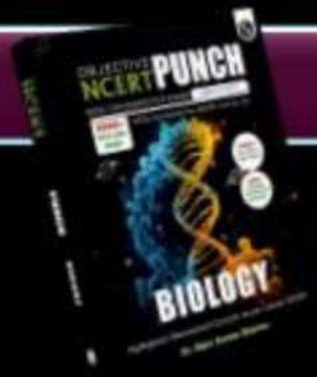
(1) have more than one membranes.
(2) have 70S ribosomes.
(3) are found in eukaryotic cells.
(4) All of these.

5 DNA is not present in:

(1) Nucleus
(2) Mitochondria
(3) Chloroplast
(4) Ribosomes

6 Which of the following cell organelles is present in the highest number in secretory cells? **(2019 odisha)**

(1) Mitochondria
(2) Golgi complex
(3) Endoplasmic reticulum
(4) Lysosomes



7 Match the List-I with List-II. **(2019 odisha)**

List-I		List-II	
A.	Golgi apparatus	P.	Synthesis of protein
B.	Lysosomes	Q.	Trap waste and excretory products
C.	Vacuoles	R.	Formation of glycoproteins and glycolipids
D.	Ribosomes	S.	Digesting biomolecules

Choose the **right** match from options given below:

(1) A-R, B-S, C-Q, D-P (2) A-S, B-R, C-P, D-Q

(3) A-R, B-Q, C-S, D-P (4) A-P, B-Q, C-S, D-R

8 Mitochondria and chloroplast are

(1) semi-autonomous organelles

(2) formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery

Which one of the following options is correct? **(2016 - I)**

(1) both (1) and (2) are correct

(2) (2) is true but (1) is false

(3) (1) is true but (2) is false

(4) both (1) and (2) are false

9 Match the following Lists and select the **correct** option; **(2020 Covid)**

List-I		List-II	
A.	Smooth Endoplasmic Reticulum	I.	Protein synthesis
B.	Rough endoplasmic reticulum	II.	Lipid synthesis
C.	Golgi complex	III.	Glycosylation
D.	Centriole	IV.	Spindle formation

	(A)	(B)	(C)	(D)
(1)	(III)	(I)	(II)	(IV)
(2)	(IV)	(II)	(I)	(III)
(3)	(I)	(II)	(III)	(IV)
(4)	(II)	(I)	(III)	(IV)

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

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Exercise-2: 2, 3, 4, 5, 12, 13


THANK
YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 11

By: Vipin Sharma Sir

Topics to be covered

1. Structure of Mitochondria
2. Plastids
3. Chloroplast
4. Cytoskeletal Elements
5. PUNCHayat

MITOCHONDRIA

↝ Also called as powerhouse of the cell → performs aerobic respiration
- in presence of O_2

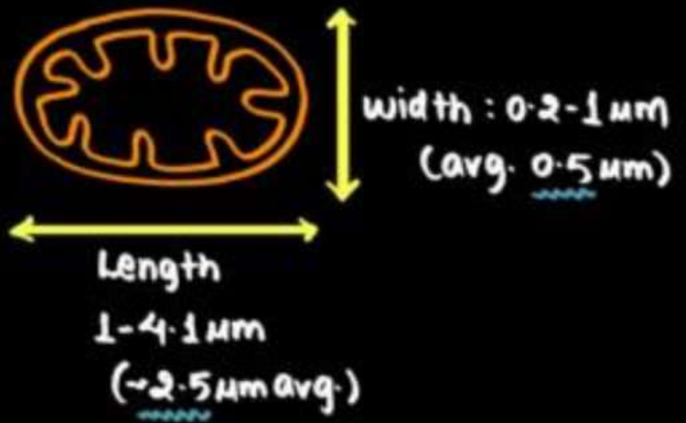
⇓

∵ ATP are formed here

↳ Adenosine-Tri-phosphate

↝ It is small in size ∴ to visualise it, a dye is needed to stain it

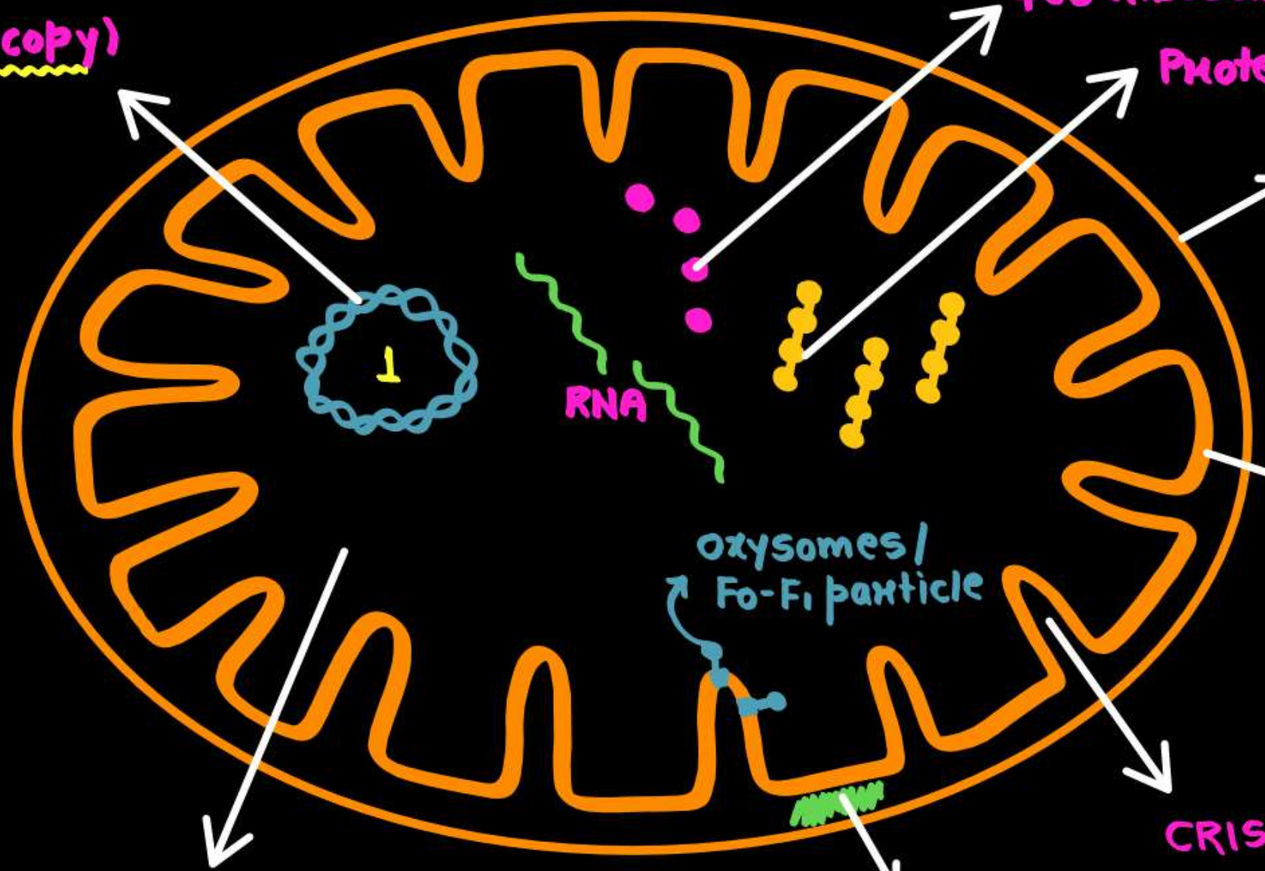
↳ Janus Green-B



No. of mitochondria varies in diff. cells & it depends upon physio-logical activities of the cell

e.g., Flight muscle of Birds : ↑↑ mito.

↝ Shape is also variable but it is usually cylindrical or sausage shape



cristae↑ ; F0-F1↑
ATP production↑

Outer memb. of mitochondria (OMM)
↳ comparatively more permeable
⇓
due to PORIN proteins

↳ less permeable as compared to OMM
Inner memb. of mitochondria (IMM)
⇓
has infoldings to increase surface
area called CRISTAE

MATRIX
- Inner aqueous compartment
- Dense homogeneous fluid filled
⇓
uniform

Intermembranous space
- outer aqueous compartment
⇓
Contains H_2O

* outer & inner memb. have different enzymes
∴ different functions

PLASTIDS

- Found mainly in plants & euglenoids
  - connecting link b/w plants & animals
    - If sunlight ⊕nt
      - photosynthesis is DONE
    - If sunlight ⊖nt
      - predation of smaller organisms is done
- Largest in size (no staining needed)

PLASTIDS

on the basis of PIGMENTS

Chloroplast

- Chlorophyll + Carotenoids ⊕nt
- Green colour

Chromoplast

- Fat soluble pigments called Carotenoids
  - Carotene & Xanthophyll
- Colour: yellow, orange, pink, red

Leucoplast

white/colourless (PIGMENTS ⊖nt)

∴ It stores food

PLASTIDS

- Found mainly in plants & euglenoids
  - connecting link b/w plants & animals
    - plants → If sunlight ⊕nt
      - photosynthesis is DONE
    - animals → If sunlight ⊖nt
      - predation of smaller organisms is done
- Largest in size (no staining needed)

PLASTIDS

on the basis of PIGMENTS

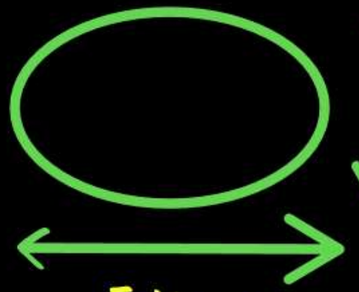
- Chloroplast
- Chromoplast

NOTE: Anthocyanin is a H_2O soluble pigments

- Leucoplast
  1. Amyloplast: stores starch
  2. Aleuroplast: stores protein
  3. Elaioplast: oil & Fat storage

CHLOROPLAST

- Chlorophyll ↑
- Largest than mitochondria (4-5x ↑)



→ 6x bigger than mitochondria

⇓

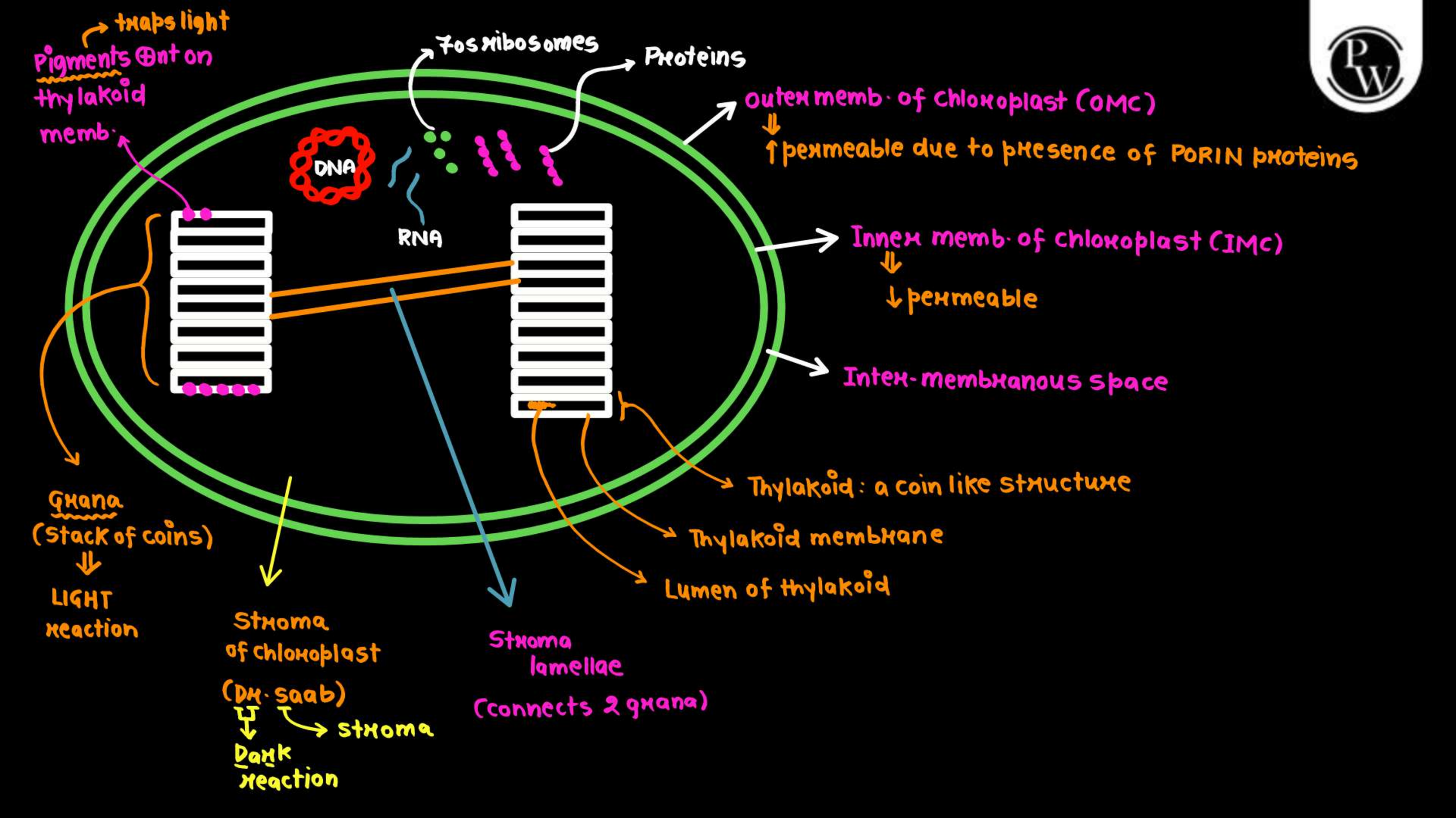
3x bigger than mitochondria

- Shapes: most commonly: disc like, oval, mound, lens....
  - Ribbon like / spiral: Spirogyra
  - Cup shape: Chlamydomonas → only '1' chloroplast / cell

- Found in: mesophyll cells

→ Chloroplast present at boundary / margin to trap ↑ light

→ 1 mesophyll cell contains 20-40 chloroplasts


traps light
Pigments present on thylakoid memb.
70s ribosomes
Proteins
DNA
RNA
Outer memb. of chloroplast (OMC)
↑ permeable due to presence of PORIN proteins
Inner memb. of chloroplast (IMC)
↓ permeable
Inter-membranous space
Thylakoid : a coin like structure
Thylakoid membrane
Lumen of thylakoid
Grana
(Stack of coins)
LIGHT reaction
Stroma of chloroplast
(DM. saab)
stroma
Dark reaction
Stroma lamellae
(connects 2 grana)

CYTOSKELETAL ELEMENTS

NCERT LINE by LINE

Each mitochondrion is a double membrane-bound structure with the outer membrane and the inner membrane dividing its lumen distinctly into two aqueous compartments, i.e., the outer compartment and the inner compartment. The inner compartment is filled with a dense homogeneous substance called the **matrix**. The outer membrane forms the continuous limiting boundary of the organelle. The inner membrane forms a number of infoldings called the cristae (sing.: crista) towards the matrix (Figure 8.7). The cristae increase the surface area. The two membranes have their own specific enzymes associated with the mitochondrial function. Mitochondria are the sites of aerobic respiration. They produce cellular energy in the form of ATP, hence they are called 'power houses' of the cell. The matrix also possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the components required for the synthesis of proteins. The mitochondria divide by fission.

CRITICAL POINTS

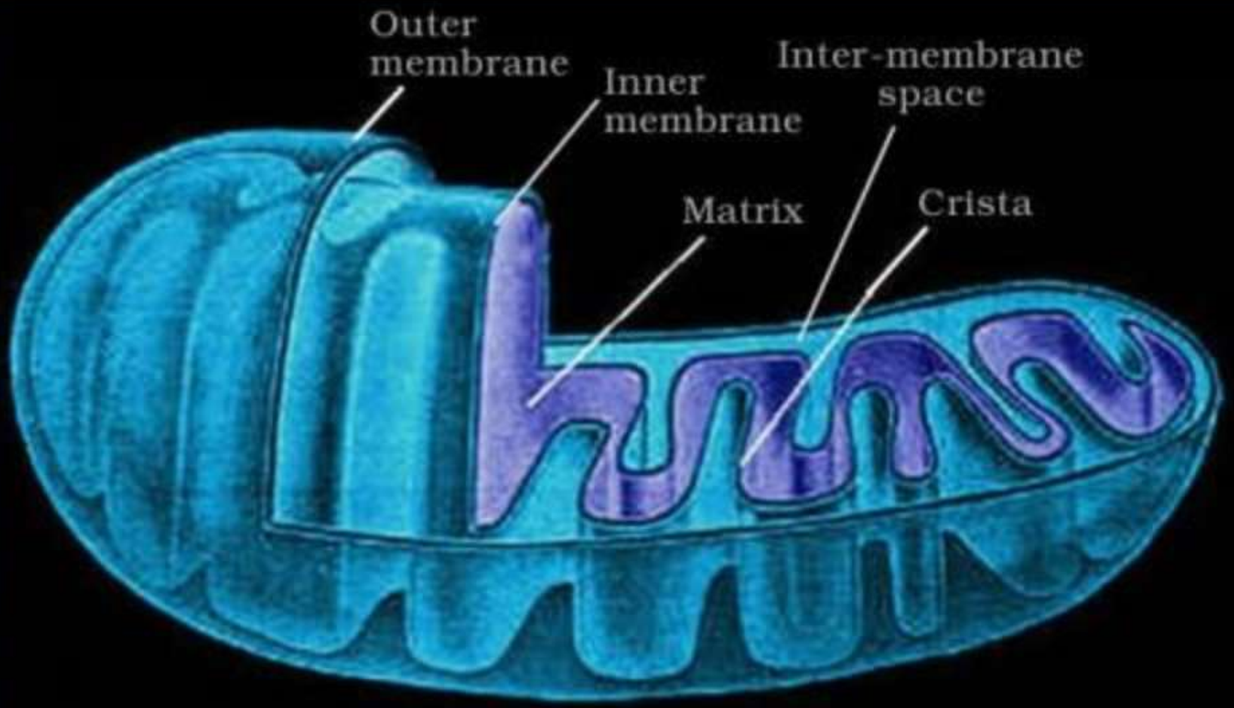


Figure 8.7 Structure of mitochondrion (Longitudinal section)

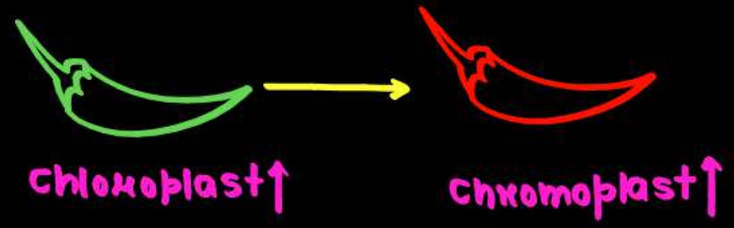
NCERT LINE by LINE

8.5.5 Plastids

Plastids are found in all plant cells and in euglenoides. These are easily observed under the microscope as they are large. They bear some specific pigments, thus imparting specific colours to the plants. Based on the type of pigments plastids can be classified into **chloroplasts**, **chromoplasts** and **leucoplasts.**

The chloroplasts contain **chlorophyll** and carotenoid pigments which are responsible for trapping light energy essential for photosynthesis. In the chromoplasts fat soluble **carotenoid** pigments like carotene, xanthophylls and others are present. This gives the part of the plant a yellow, orange or red colour. The leucoplasts are the colourless plastids of varied shapes and sizes with stored nutrients: **Amyloplasts** store carbohydrates (starch), e.g., potato; **elaioplasts** store oils and fats whereas

- Plastids can also divide by binary fission
- They can be converted into each other based on needs



CRITICAL POINTS

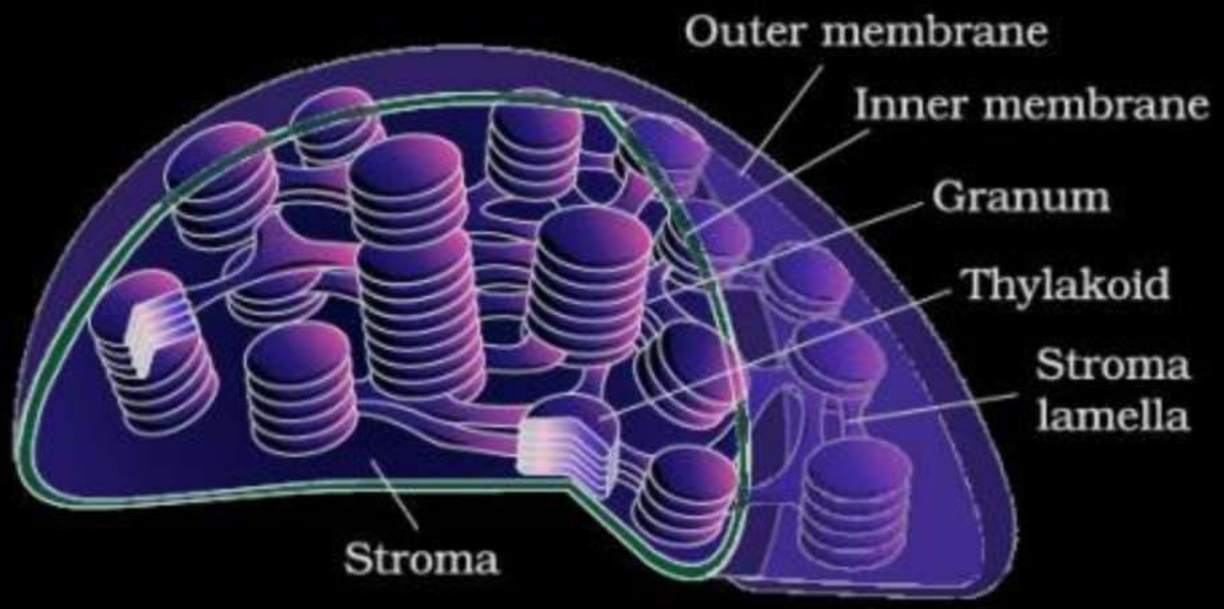


Figure 8.8 Sectional view of chloroplast

NCERT LINE by LINE

the **aleuroplasts** store proteins.

Majority of the chloroplasts of the green plants are found in the mesophyll cells of the leaves. These are lens-shaped, oval, spherical, discoid or even ribbon-like organelles having variable length (5-10µm) and width (2-4µm). Their number varies from 1 per cell of the *Chlamydomonas*, a green alga to 20-40 per cell in the mesophyll.

Like mitochondria, the chloroplasts are also double membrane bound. Of the two, the inner chloroplast membrane is relatively less permeable. The space limited by the

CRITICAL POINTS

1 Mitochondria and chloroplast are

(1) semi-autonomous organelles

(2) formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery

Which one of the following options is correct? **(2016 - I)**

(1) both (1) and (2) are correct

(2) (2) is true but (1) is false

(3) (1) is true but (2) is false

(4) both (1) and (2) are false

2 Which of the following pair of organelles does **not** contain DNA? **(2019)**

(1) Mitochondria and Lysosomes

(2) Chloroplast and Vacuoles

(3) Lysosomes and Vacuoles

(4) Nuclear envelope and Mitochondria

NCERT LINE by LINE

inner membrane of the chloroplast is called the stroma. A number of organised flattened membranous sacs called the **thylakoids**, are present in the stroma (Figure 8.8). Thylakoids are arranged in stacks like the piles of coins called grana (singular: granum) or the intergranal thylakoids. In addition, there are flat membranous tubules called the stroma lamellae connecting the thylakoids of the different grana. The membrane of the thylakoids enclose a space called a lumen. The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. It also contains small, double-stranded circular DNA molecules and ribosomes. Chlorophyll pigments are present in the thylakoids. The ribosomes of the chloroplasts are smaller (70S) than the cytoplasmic ribosomes (80S).

* Permeability
OMM > IMM
OMC > IMC
IMM > IMC *

CRITICAL POINTS

3 Match the List-I with List-II. **(2021)**

List-I		List-II	
A.	Cristae	I.	Primary constriction in chromosome
B.	Thylakoids	II.	Disc-shaped sacs in Golgi apparatus
C.	Centromere	III.	Infoldings in mitochondria
D.	Cisternae	IV.	Flattened membranous sacs in stroma of plastids

Choose the **correct** answer from the options given below.

(1) (A)-(I); (B)-(IV); (C)-(III); (D)-(II)

(2) (A)-(III); (B)-(IV); (C)-(I); (D)-(II)

(3) (A)-(II); (B)-(III); (C)-(IV); (D)-(I)

(4) (A)-(IV); (B)-(III); (C)-(II); (D)-(I)

Punchayat

with Vipu Sir

Question-4

Organelle 'X' is the major centre of release of energy in aerobic respiration, but is absent in prokaryotes and anaerobic eukaryotes. It can be stained differentially with Janus Green. Identify the organelle X.

A Nucleus

B Mitochondria ✓

C Lysosome

D Rough endoplasmic reticulum

Question-5

Extranuclear inheritance is due to the presence of genes in DNA

A mitochondria and chloroplasts ✓

B nucleus and mitochondria ✗

C nucleus and chloroplasts ✗

D endoplasmic reticulum and mitochondria. ✗

Question-6

Assertion: Mitochondria are called power house of the cell.

Reason: They produce cellular energy in the form of ATP.

A Assertion and reason both are true and the reason is correct explanation of assertion.

B Assertion and reason both are true but reason is not correct explanation of assertion.

C Assertion is true but reason is wrong.

D Assertion and reason both are wrong.

Question-7

Assertion: Mitochondria is an important cell organelle of both eukaryotes and prokaryotes.

Reason: They are called power houses and involve in anaerobic respiration.

A Assertion and reason both are true and the reason is correct explanation of assertion.

B Assertion and reason both are true but reason is not correct explanation of assertion.

C Assertion is true but reason is wrong.

D Assertion and reason both are wrong.

Question-8

Statement I: Mitochondria is a double membrane bound structure.

Statement II: The inner membrane of mitochondria forms a number of infoldings called cristae which increase the surface area.

A. Both statements are correct.

B. Statement I is correct and II is incorrect.

C. Statement I is incorrect and II is correct.

D. Both statements are incorrect.

Question-9

Statement I: Aleuroplasts stores oils and fats.

Statement II: Elaioplasts stores proteins.

A. Both statements are correct

B. Statement I is correct and II is incorrect

C. Statement I is incorrect and II is correct

D. Both statements are incorrect

Question-10

Match column-I (cell organelle) with column-II (membrane) and select the correct option from the codes given below.

Column-I	Column-II
A. Mitochondria	I. Without membrane
B. Lysosomes	II. Single membrane
C. Ribosomes	III. Double membrane

(A) A-I; B-II; C-III ✗

(B) A-III; B-I; C-II ✗

(C) A-III; B-II; C-I ✓

(D) A-II; B-III; C-I ✗

Question-11

Which one of the following statements are correct?

(i) Mitochondria and Chloroplast are double membrane-bound structures.

(ii) The inner compartment of mitochondria is called matrix and possesses linear DNA molecules.

(iii) Mitochondria organelle is site of aerobic respiration, and it divide by fragmentation.

(iv) Plastid are classified based on pigment into chloroplasts, chromoplast and leucoplast.

(v) Amyloplast type of leucoplast stores carbohydrates, elaioplasts store proteins whereas aleuroplasts store oils and fats.

(vi) *Chlamydomonas*, a green algae has one chloroplast per cell.

(vii) The space limited by inner membrane of chloroplast is called stroma.

(viii) Thylakoids are arranged in stacks like the piles of coin called grana and are connected to other thylakoid of different stacks by membranous tubules called stroma lamellae.

(ix) The ribosome of chloroplast and mitochondria are of 80S unit.

(x) Ribosome are composed of ribonucleic acid and protein.

(xi) Eukaryotic ribosome are 80S. Here 'S' is svedberg's unit which stands for the sedimentation coefficient.

(xii) The core of flagella is called axoneme which consist of nine triplets of radially arranged peripheral microtubules and one pair of centrally located microtubules.

Choose the correct option given below:

A (i), (iii), (vi), (vii), (ix), (x), (xii)

B (ii), (iv), (v), (vi), (viii), (ix), (xi)

C (i), (iv), (vi), (vii), (viii), (x), (xi)

D All of these

Active Recall

Home Work

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarabh: 4, 11
Prarambh: 2, 4, 5, 6, 7, 9, 10, 11, 12, 13
Prabal: 1, 2
Parikshit: 6, 19, 20
PYQs: 24, 28


THANK
YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 12

By: Vipin Sharma Sir

Topics to be covered

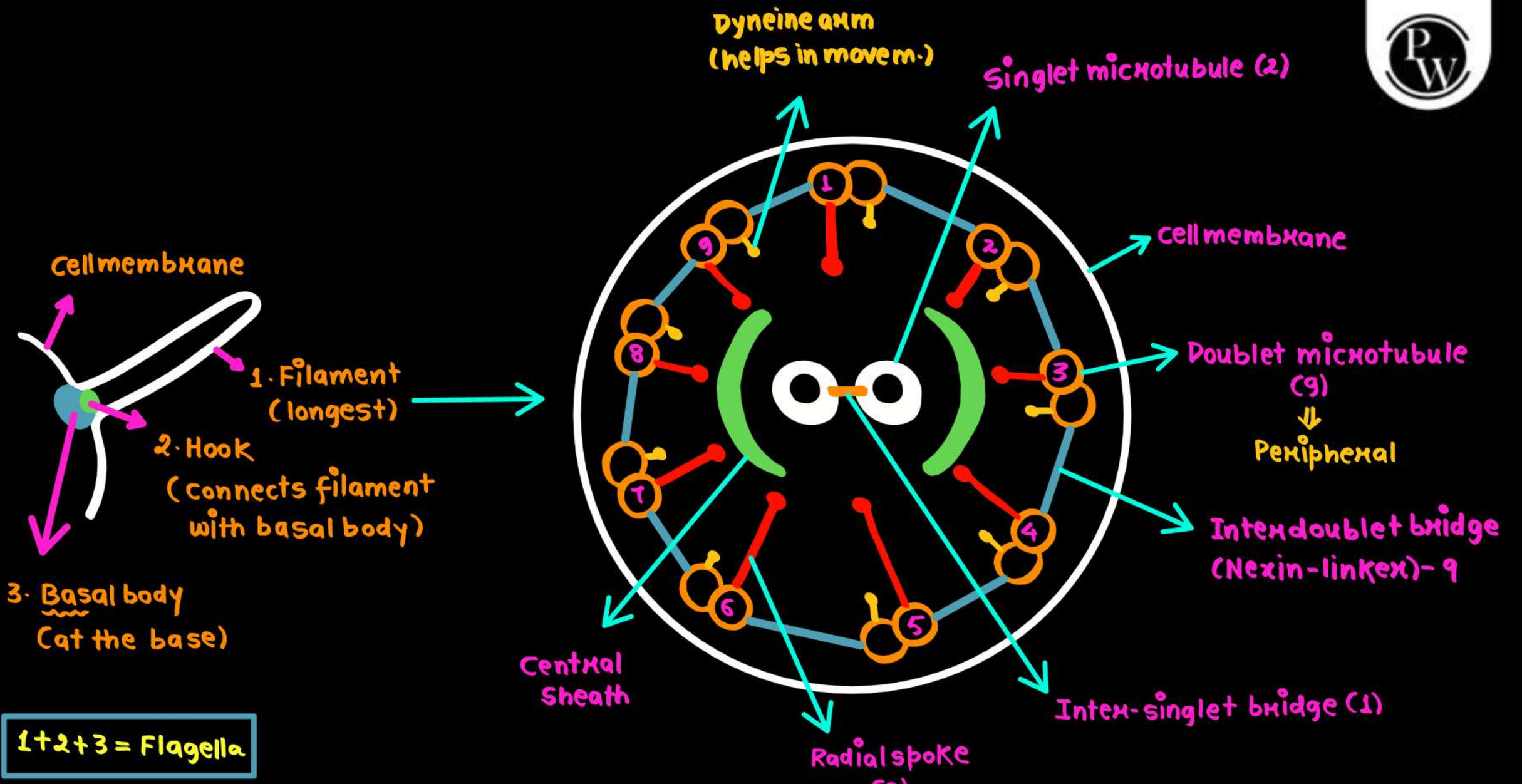
1. Cillia and Flagella
2. Centriole
3. Centrosome
4. Cytoskeletal Elements
5. PUNCHayat

CILIA AND FLAGELLA

- Extension of cell membrane
- Small in size ∴ they are numerous
  ⇓
  no. ↑
- They works like oars
  ⇓
  They move either the surrounding fluid or they move the cell itself by their COORDINATED MOVEMENT
- NOT FOUND in prokaryotes

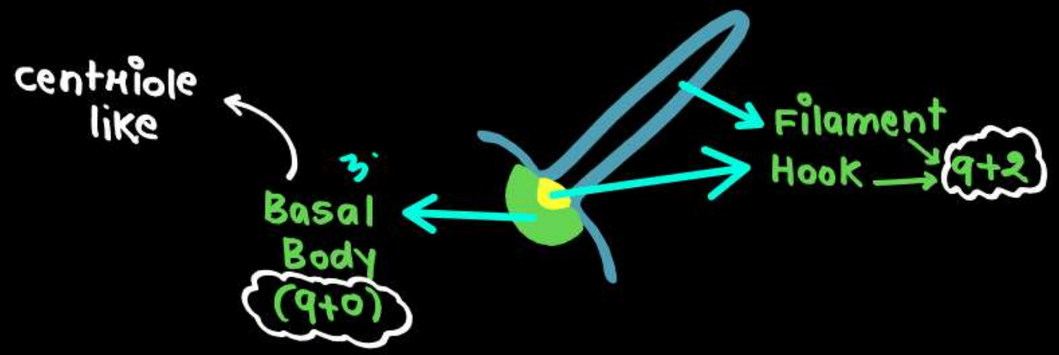
- Extension of cell membrane
- size is largen ∵ they are less in no.
  ⇓
  they are directly involved in cell movement (mainly)
- Prokaryotic & Eukaryotic flagella are different
  - Flagellin protein
  - Tubulin protein
    ⇓
    ∴ It is a type of Microtubule

NOTE : Core of Cilia & Flagella is called AXONEME


Dyneine arm
(helps in movem.)
Singlet microtubule (2)
Cell membrane
Cell membrane
1. Filament
(longest)
2. Hook
(connects filament
with basal body)
3. Basal body
(at the base)
Doublet microtubule
(9)
Peripheral
Inter doublet bridge
(Nexin-linker)- 9
Central
Sheath
Inter-singlet bridge (1)
Radial spoke
(9)
(connects doublets with central sheath)
1+2+3 = Flagella

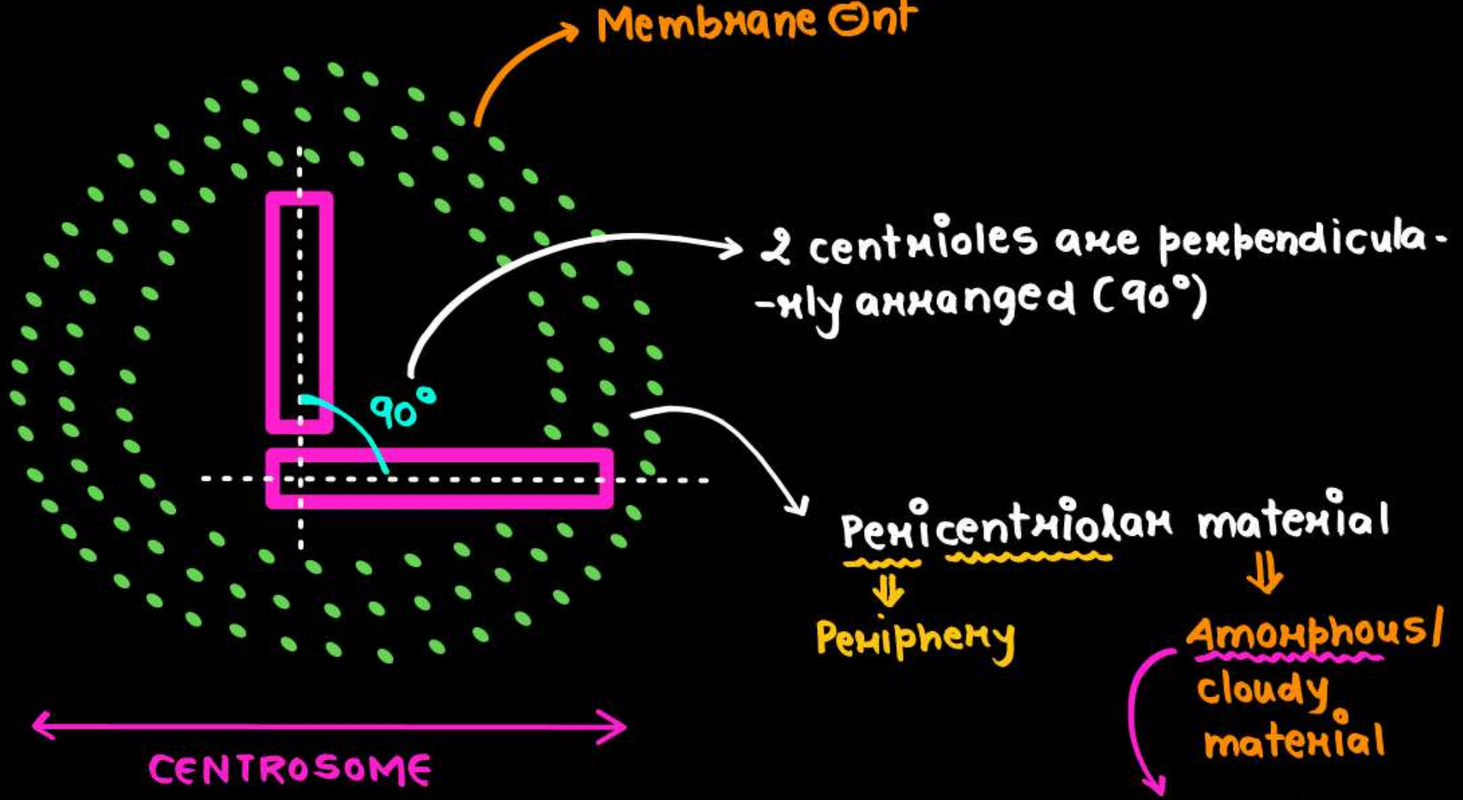
CENTRIOLE AND CENTROSOME

- Membrane-less
- Present only in animal cells
  - Helps in 1. cell division
    - By helping in 2. spindle formation & by helping in formation of mitotic apparatus
- Basal body of cilia & flagella is made by centriole like str.

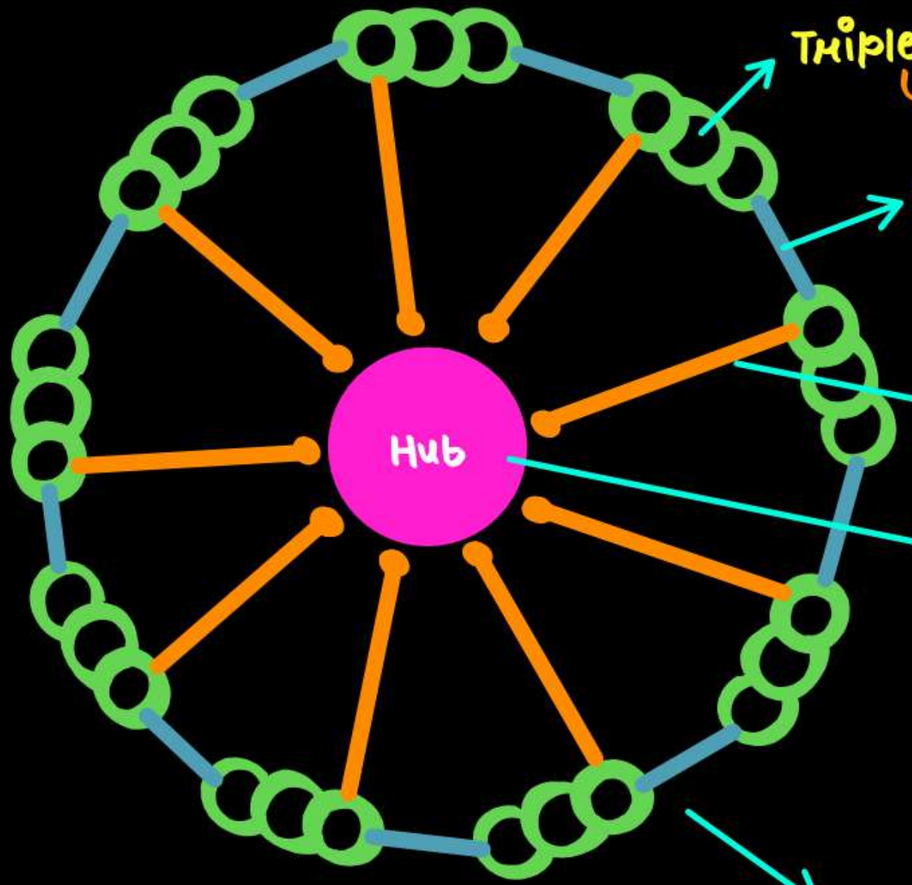


CENTRIOLE AND CENTROSOME

Cylindrical structure having (9+0) arrangement & cartwheel like structure



Structure of a centriole



Triplet microtubule (9)
↳ Found distally → दूर

Intertriplet bridge

Radial Spokes (9)
↳ Conn. Triplet to Hub

Proteinaceous Hub: found proximally
↓
पास

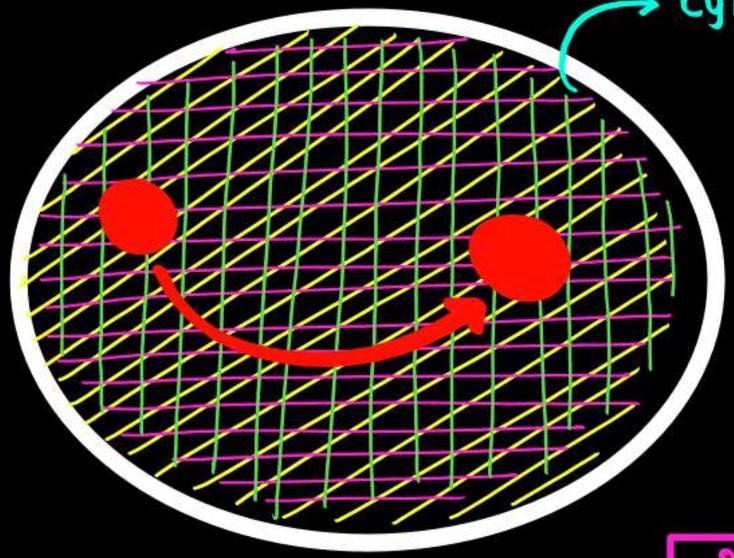
Microtubules ⊖nt ∴ zero

Membrane ⊖nt

CYTOSKELETAL ELEMENTS

Cell

Frame

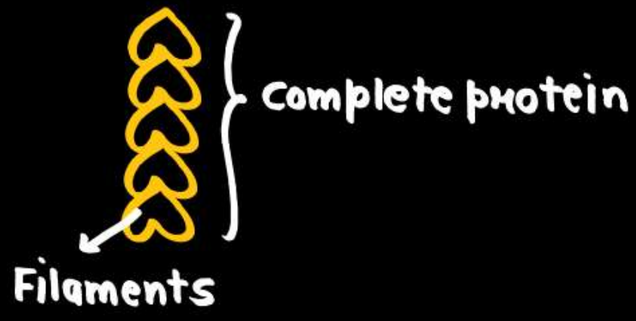


→ Cytoskeletal elements are network of filamentous proteins

⇓

proteins formed of small parts

1. Microtubule
2. Intermediate filament
3. Microfilament / Actin filament



Diameter:

Microtubule > Int. filament > Microfil.

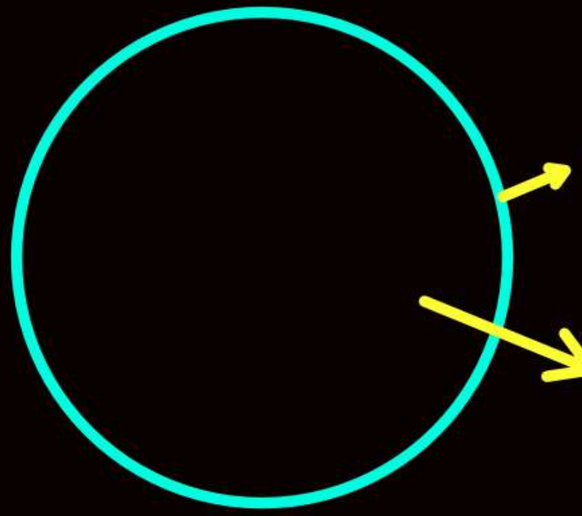
25nm 11nm 6nm

Functions:

1. Shape
2. Strength
3. Motility: Cilia & Flagella

MICROBODIES

Small size



Single membrane of Microbody

Microbody contains special enzymes in them

NOTE : can be found in BOTH plants & animals

1. e.g., Peroxisome body

Peroxide metabolism

$$2H_2O_2 \xrightarrow[\text{catalase}]{\text{peroxidase}} 2H_2O + O_2$$

$2H_2O_2$: Hydrogen peroxide (Harmful)

$2H_2O + O_2$: Safe

- Found in Both plants & animals

2. Glyoxysome: convert fatty acid into carbohydrates

⇓

Glyoxylate cycle

⇓

seen in germinating seeds

3. Sphaerosome / oleosome → stores LIPID in plant cells

NCERT LINE by LINE

8.5.8 Cilia and Flagella

Cilia (sing.: cilium) and flagella (sing.: flagellum) are hair-like outgrowths of the cell membrane. Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer and responsible for cell movement. The prokaryotic bacteria also possess flagella but these are structurally different from that of the eukaryotic flagella.

The electron microscopic study of a cilium or the flagellum show that they are covered with plasma membrane. Their core called the **axoneme**, possesses a number of microtubules running parallel to the long axis. The axoneme usually has nine doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the 9+2 array (Figure 8.10). The central tubules are connected by bridges and is also enclosed by a central sheath, which is connected to one of the tubules of each peripheral doublets by a radial spoke. Thus, there are nine radial spokes. The peripheral doublets are also interconnected by linkers. Both the cilium and flagellum emerge from centriole-like structure called the basal bodies.

9+0

CRITICAL POINTS

1 Match the List-I with List-II. **(2024)**

List-I		List-II	
A.	Axoneme	I.	Centriole
B.	Cartwheel pattern	II.	Cilia and flagella
C.	Crista	III.	Chromosome
D.	Satellite	IV.	Mitochondria

Choose the **correct** answer from the options given below.

(1) (A)-(IV); (B)-(III); (C)-(II); (D)-(I)

(2) (A)-(IV); (B)-(II); (C)-(III); (D)-(I)

(3) (A)-(II); (B)-(IV); (C)-(I); (D)-(III)

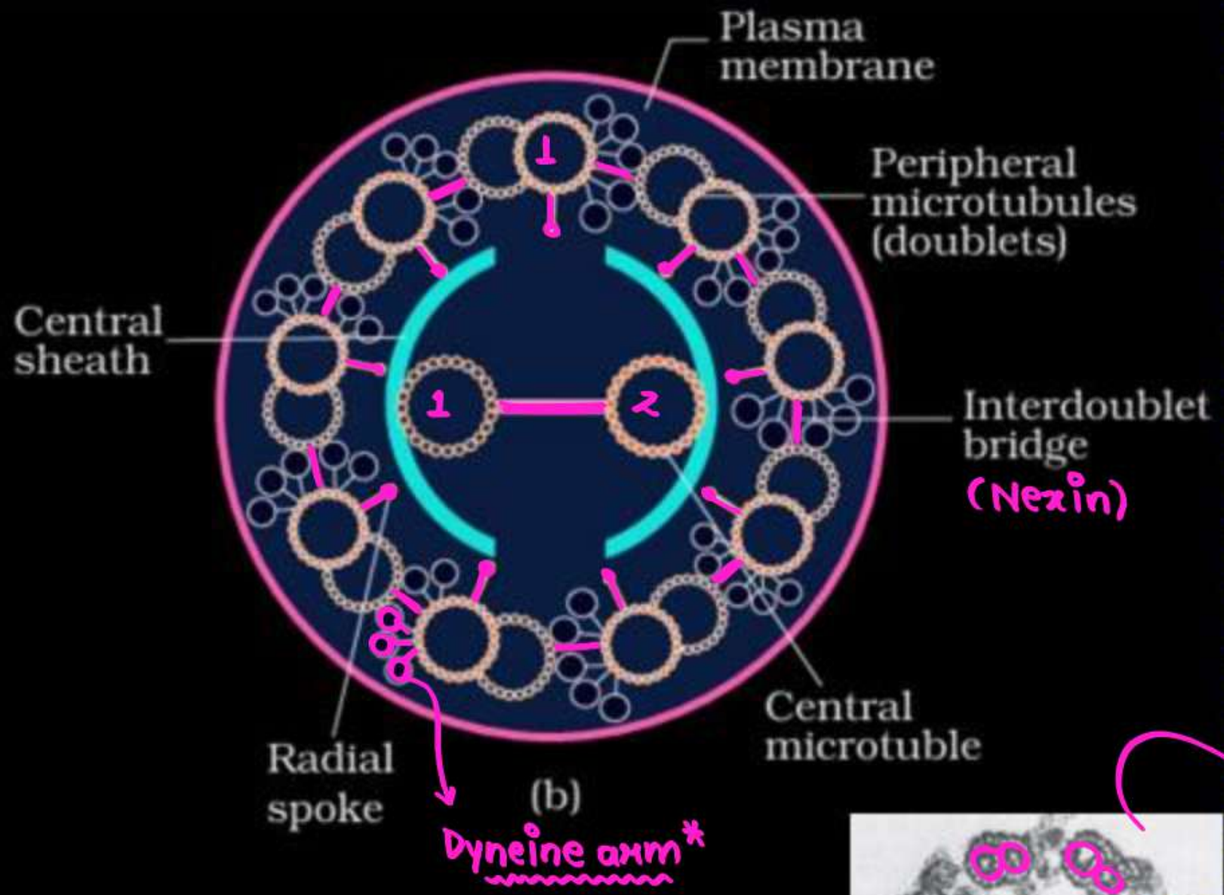
(4) ✓ (A)-(II); (B)-(I); (C)-(IV); (D)-(III)

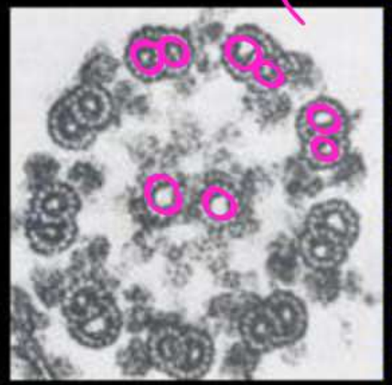
2 Cilium and flagellum emerge from centriole-like structure called:

(1) Centrosome (2) Kinetochore

(3) ✓ Basal body (4) Centromere

NCERT LINE by LINE





e⊖ microscopic str. of cilia & flagella

CRITICAL POINTS

3 Match the lists and select the **correct** option:

	List-I		List-II
A.	Cristae	P.	Golgi apparatus
B.	Cisternae	Q.	Cilia
C.	Flattened membranous structures	R.	Mitochondria
D.	Axoneme	S.	Thylakoid

(1) A-(S); B-(P); C-(Q); D-(R)

(2) A-(Q); B-(R); C-(S); D-(P)

(3) A-(R); B-(P); C-(S); D-(Q)

(4) A-(Q); B-(S); C-(R); D-(P)

NCERT LINE by LINE

8.5.9 Centrosome and Centrioles

Centrosome is an organelle usually containing two cylindrical structures called centrioles. They are surrounded by amorphous pericentriolar materials. Both the centrioles in a centrosome lie perpendicular to each other in which each has an organisation like the cartwheel. They are made up of nine evenly spaced peripheral fibrils of tubulin protein. Each of the peripheral fibril is a triplet.The adjacent triplets are also linked. The central part of the proximal region of the centriole is also proteinaceous and called the **hub**, which is connected with tubules of the peripheral triplets by radial **spokes** made of protein. The centrioles form the basal body of cilia or flagella, and spindle fibres that give rise to spindle apparatus during cell division in animal cells.

CRITICAL POINTS

4 Organelle important in spindle formation during nuclear division is:

(1) Centriole (2) Golgi body
(3) Chloroplast (4) Mitochondrion

5 The central proteinaceous part of proximal region of the centriole is called:

(1) Radial spoke (2) Hub
(3) Central sheath (4) Axoneme

6 The principal protein found in centrioles is:

(1) Tubulin (2) Nexin
(3) Basal body (4) Pilin

7 Each centriole has a cartwheel organisation having a whorl of 9 peripheral fibrils, can be represented with:

(1) 9 singlet + 0 central
(2) 9 doublet + 0 central
(3) 9 triplet + 2 central singlet
(4) 9 triplet + 0 central

NCERT LINE by LINE

8.5.7 Cytoskeleton

An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm is collectively referred to as the **cytoskeleton**. The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, maintenance of the shape of the cell.

CRITICAL POINTS

8 Which of the following provides mechanical support and maintains the cell shape?

(1) Golgi complex
(2) Centrioles
(3) Ribosomes
(4) Cytoskeleton

Punchayat

with Vipu Sir

Question-9

Assertion: The prokaryotic bacteria also possess flagella but these are structurally different from that of the eukaryotic flagella.

Reason: They are made up of nine evenly spaced triplet of peripheral fibrils of tubulin protein.

A Assertion and reason both are true and the reason is correct explanation of assertion.

B Assertion and reason both are true but reason is not correct explanation of assertion.

C Assertion is true but reason is wrong.

D Assertion and reason both are wrong.

Question-10

Assertion: Core of centrioles called axoneme.

Reason: In centrioles arrangement of microtubules is referred to as the 9+2 array.

A Assertion and reason both are true and the reason is correct explanation of assertion.

B Assertion and reason both are true but reason is not correct explanation of assertion.

C Assertion is true but reason is wrong.

D Assertion and reason both are wrong.

Question-11

Statement I: Cilia are longer than flagella and responsible for cell movement.

Statement II: Both prokaryotic and eukaryotic flagella are structurally similar.

A. Both statements are correct

B. Statement I is correct and II is incorrect

C. Statement I is incorrect and II is correct

D. Both statements are incorrect

Question-12

Which characters for cilia and flagella are correct from given characters?

(i) They are covered with plasma membrane.
(ii) Their core called the axoneme, possesses a number of microtubules running parallel to the long axis.
(iii) The axoneme usually has nine pairs of triplets of radially arranged peripheral microtubules, and a pair of centrally located microtubules.
(iv) The central tubules are connected by bridges and are also enclosed by a central sheath.
(v) Central sheath is connected to one of the tubules of each peripheral doublets by a radial spoke.
(vi) Cilium but not flagellum emerge from centriole- like structure called the basal bodies.

A (i), (iii), (iv) and (v)

B (iii), (iv) (v) and (vi)

C (i), (ii), (iv) and (v)

D (ii), (iii), (iv) and (v)

Question-13

Which of the following is correct regarding the structure of a section of cilia / flagella?

	Peripheral microtubules (doublets)	Central microtubules (singlets)	Radial spokes	Central sheath
A	9 + 0	2	8	1
B	9 + 2	9 + 0	9	1
C	9	2	9	1
D	3	6	9	1

Question-14

The movement of cilia and flagella is due to the presence of

A radial spokes ✗

B central sheath ✗

C singlet microtubules ✗

D dyneins ✓

Question-15

The motile bacteria are able to move by: (2014)

A Pili ✗

B Fimbriae ✗

C Flagella ✓

D Cilia ✗

Active Recall

Home Work

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarabh: 4, 11
Prarambh: 2, 4, 5, 6, 7, 9, 10, 11, 12, 13
Prabal: 1, 2
Parikshit: 6, 19, 20
PYQs: 24, 28


THANK
YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 13

By: Vipin Sharma Sir

Topics to be covered

1. Nucleus
2. Chromatin
3. Nuclear Pore Complex
4. Chromosomes
5. PUNCHayat

NUCLEUS

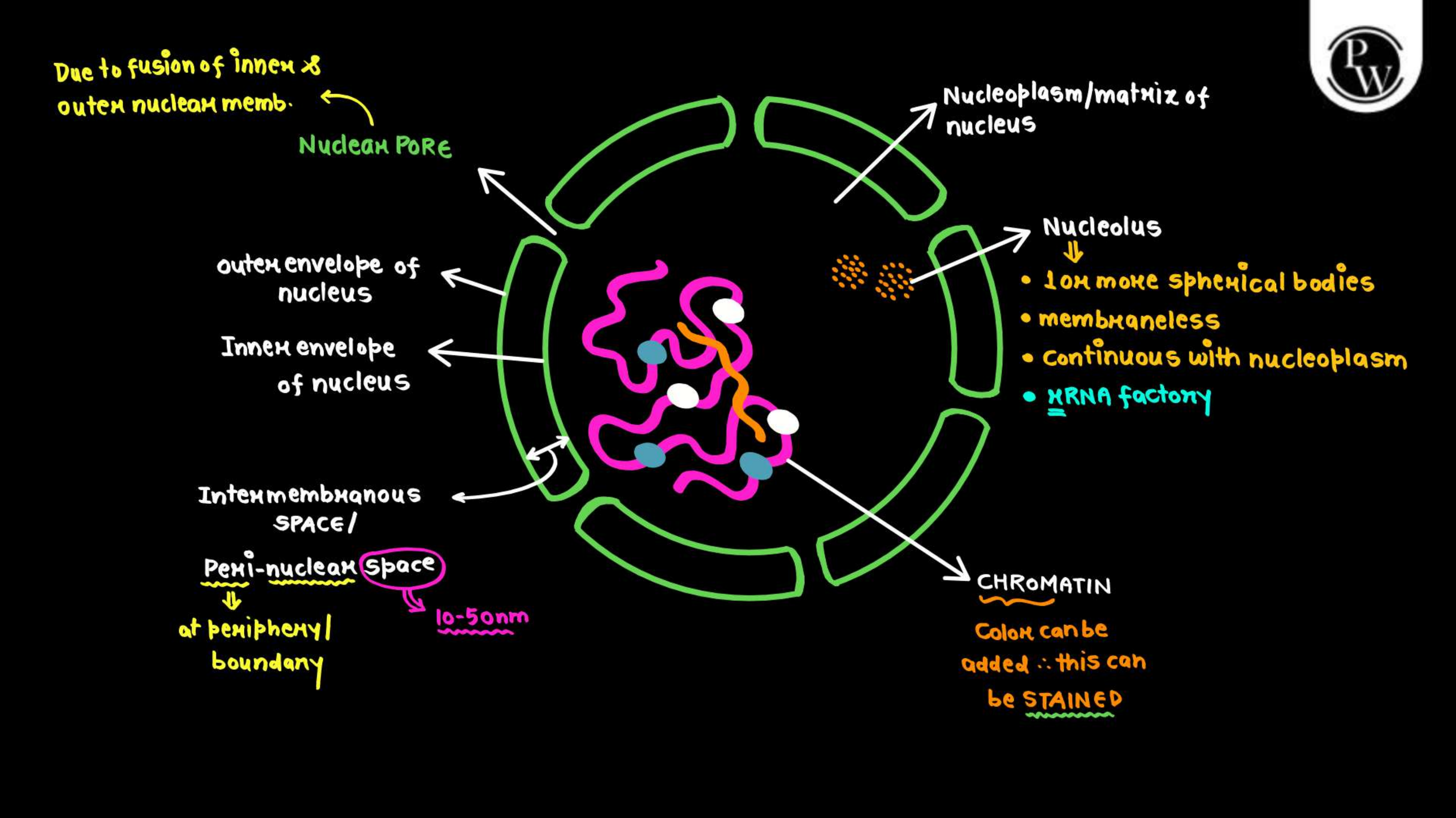
- also called as 'BRAIN OF THE CELL'
- Discovered by Robert BROWN, 1831
- Usually, only one nucleus is seen per cell

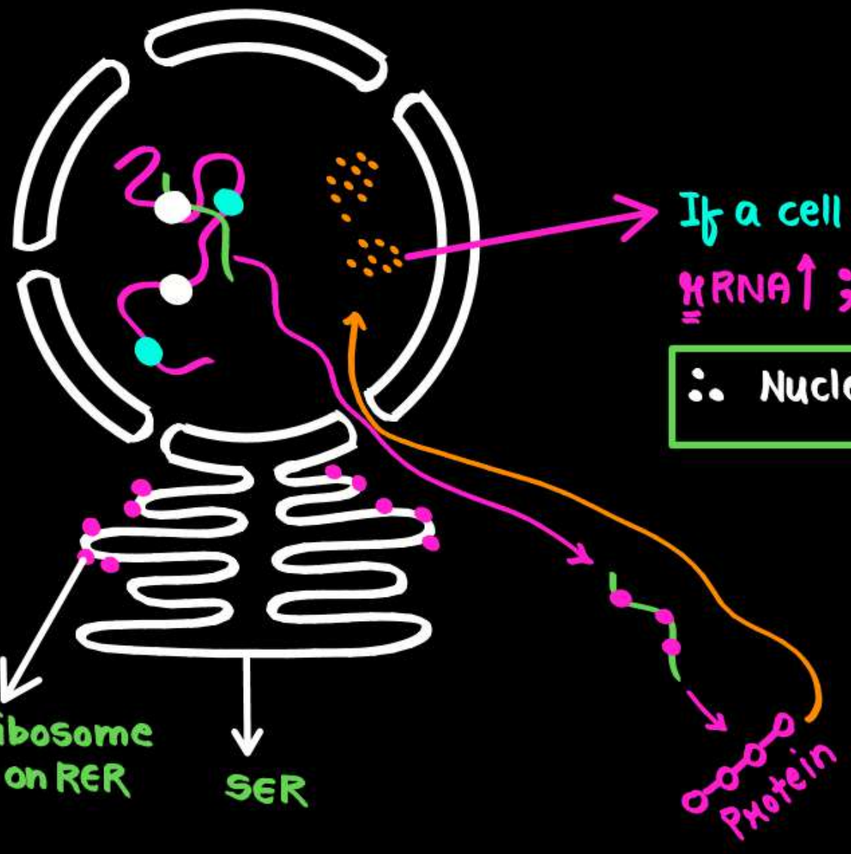
Cells with no nucleus

- Matured mammalian RBC
- Tracheid, vessel & fiber of xylem donot have nucleus
- Sieve tube & fiber of phloem donot have nucleus

some cells may have (>1) nucleus

1. Paramecium has 2 nuclei
2. Phycomycetes: FUNGI

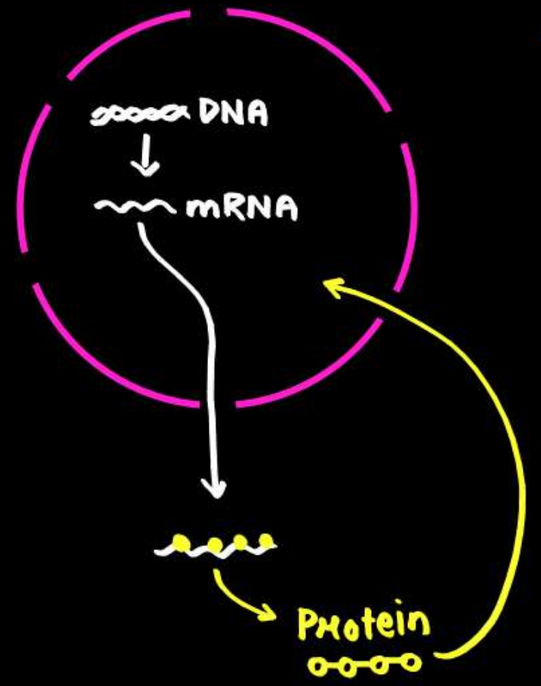

Due to fusion of innen & outen nucleam memb.
Nuclean PORE
Nucleoplasm/matrix of nucleus
outen envelope of nucleus
Innen envelope of nucleus
Nucleolus
• 1 or more spherical bodies
• membraneless
• continuous with nucleoplasm
• RNA factory
Intermembranous SPACE/
Peri-nuclean space
10-50nm
at periphery/ boundary
CHROMATIN
Color can be added ∴ this can be STAINED



If a cell has more numerous & large nucleolus, then

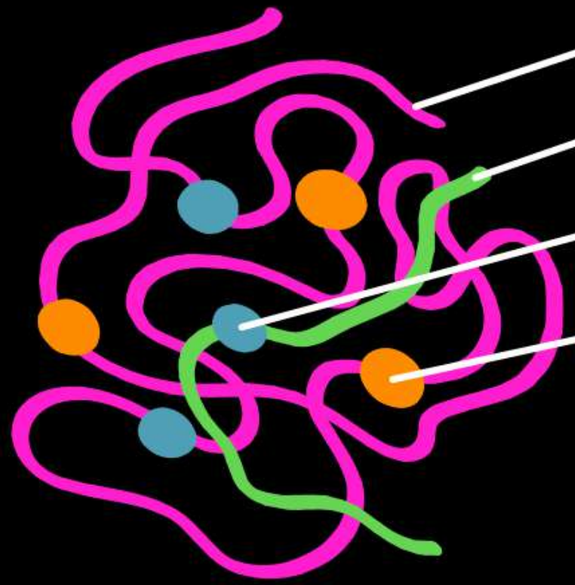
mRNA ↑ ; ribosome ↑ ; proteins ↑

∴ Nucleolus ↑ ; protein synthesis ↑



- Nuclear pore can do transport BI-DIRECTIONALLY
  1. mRNA from nucleus to cytoplasm
  2. protein from cytoplasm to nucleus

CHROMATIN



DNA

RNA

Histone proteins

Non-histone chromosomal proteins (NHC proteins)

CHROMATIN

⇓

Nucleo-protein structure

⇓

Nucleic acid

Histone + NHC

DNA RNA

Main part of chromatin is ACIDIC

⇓

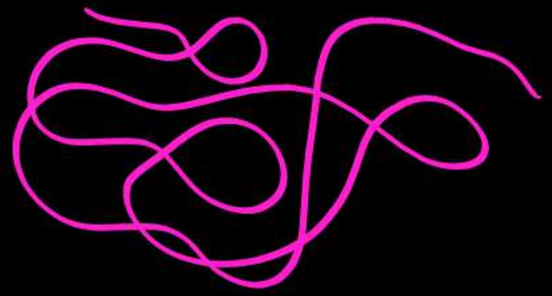
Stained with BASIC DYES

- Discovered & Named by Flemming
- In interphase nucleus (when cell is in non-dividing state) : DNA strands are extended & elaborate (फैले हुए)

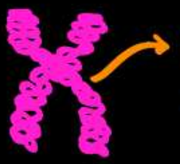
CHROMOSOME

DNA in interphase nucleus

- Elaborate & extended



DNA in a dividing cell



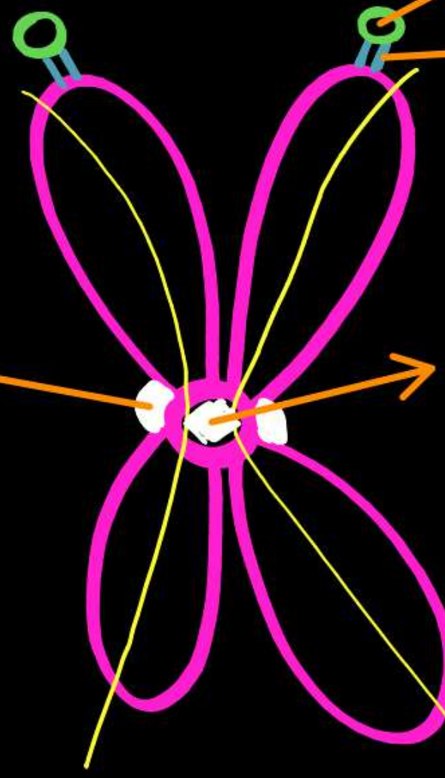
DNA packed in form of chromosomes

CHROMOSOME

→ contains DNA

- Colour → can be stained with BASIC DYES
- Body

If found in any chromosome, it will be called as 'SAT chromosome'



- satellite
- 2° constriction

- not found in all chromos-omes
- small non-staining region
- ⊕nt at a constant location (end)

Proteinaceous disc like structures on the sides of centromere are K/a KINETOCHORE

centromere / 1° constriction
↓
usually found in ALL chromosomes

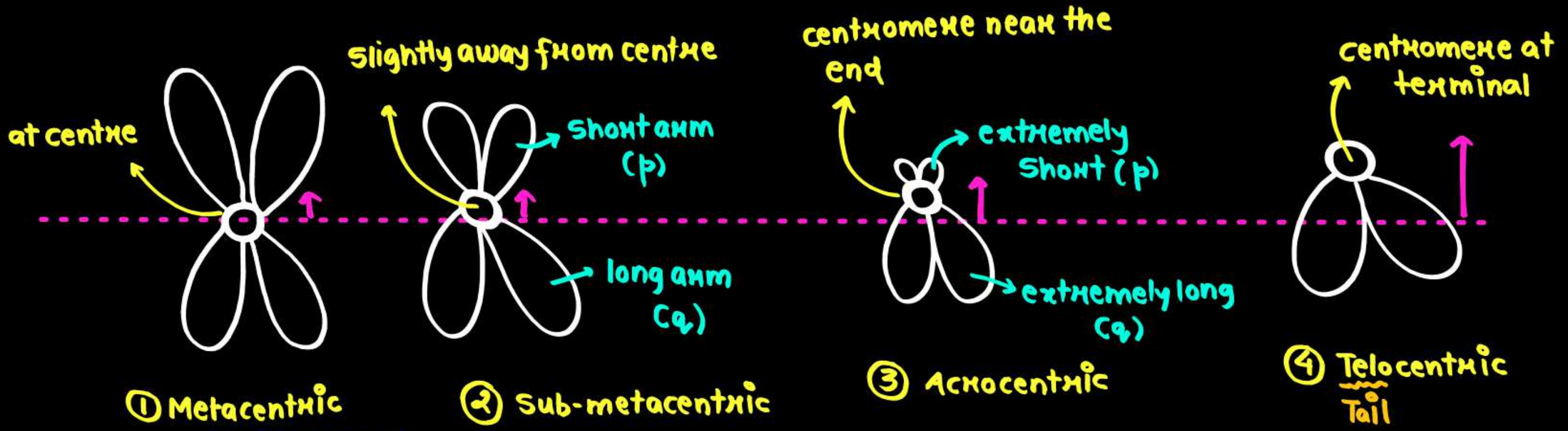
1st chromatid

2nd chromatid

connected to SAME centromere
∴ they are called 'SISTER CHROMATIDS'

TYPES OF CHROMOSOMES

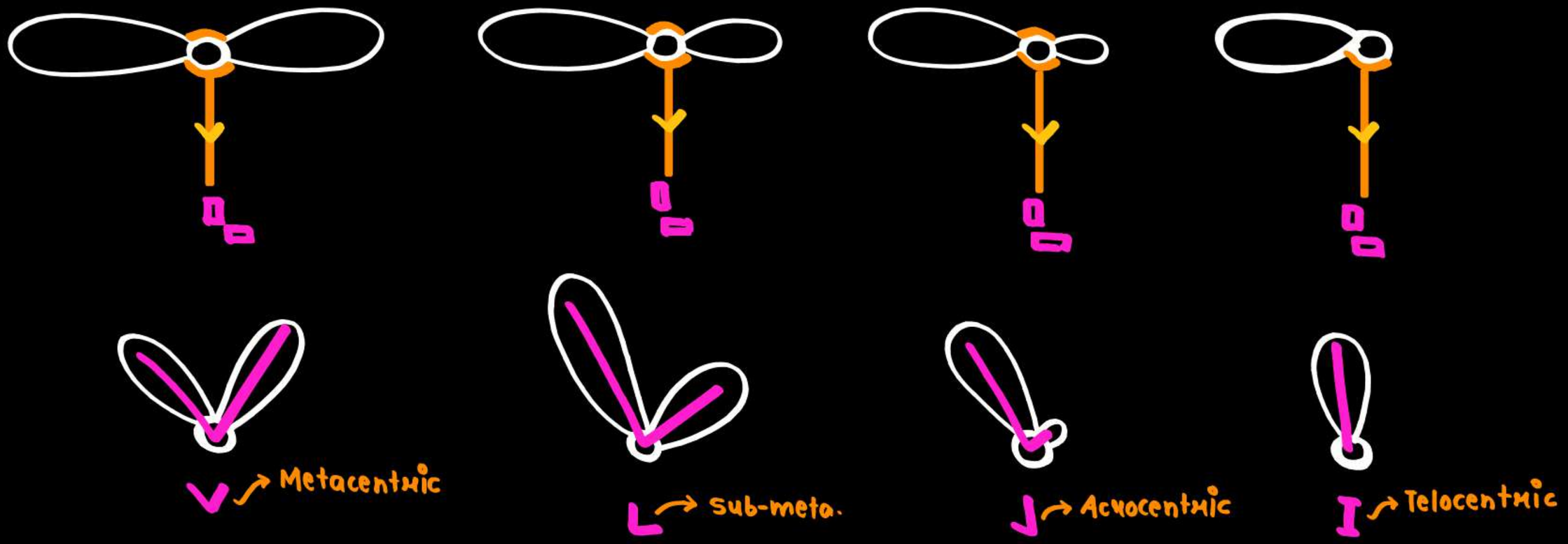
on the basis of position centromere



TYPES OF CHROMOSOMES

⇓

Shape of chromosomes



NCERT LINE by LINE

8.5.10 Nucleus

Nucleus as a cell organelle was first described by Robert Brown as early as 1831. Later the material of the nucleus stained by the basic dyes was given the name **chromatin** by Flemming.

The interphase nucleus (nucleus of a cell when it is not dividing) has highly extended and elaborate nucleoprotein fibres called chromatin, nuclear matrix and one or more spherical bodies called **nucleoli** (sing.: nucleolus) (Figure 8.11). Electron microscopy has revealed that the nuclear envelope, which consists of two parallel membranes with a space between (10 to 50 nm) called the **perinuclear space**, forms a barrier between the materials present inside the nucleus and that of the cytoplasm. The outer membrane usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it. At a number of

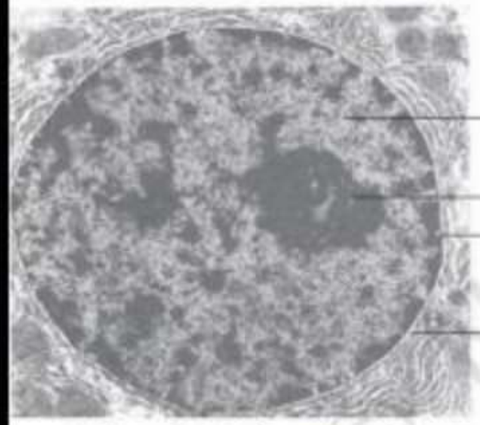


Figure 8.11 Structure of nucleus

CRITICAL POINTS

1 Chromosome having centromere in its middle is:

(1) Acrocentric (J) (2) Telocentric (I)
(3) Metacentric (V) (4) Sub-metacentric (L)

2 Chromosomes can be classified on the basis of position of:

(1) Centriole X (2) Centromere
(3) Primary constriction (4) Both (2) and (3)

3 Which structure is present in chromosomes?

(1) Nucleus X (2) Centromere
(3) Centrosome X (4) Golgi body X

4 The function of nucleous is the synthesis of:

(1) DNA (2) m-RNA
(3) r-RNA (4) t-RNA

NCERT LINE by LINE

places the nuclear envelope is interrupted by minute pores, which are formed by the fusion of its two membranes. These nuclear pores are the passages through which movement of RNA and protein molecules takes place in both directions between the nucleus and the cytoplasm. Normally, there is only one nucleus per cell, variations in the number of nuclei are also frequently observed. *Can you recollect names of organisms that have more than one nucleus per cell?* Some mature cells even lack nucleus, e.g., erythrocytes of many mammals and sieve tube cells of vascular plants. *Would you consider these cells as 'living'?*

The nuclear matrix or the **nucleoplasm** contains nucleolus and chromatin. The nucleoli are spherical structures present in the nucleoplasm. The content of nucleolus is continuous with the rest of the nucleoplasm as it is not a membrane bound structure. It is a site for active ribosomal RNA synthesis. Larger and more numerous nucleoli are present in cells actively carrying out protein synthesis.

CRITICAL POINTS

5 Which of the following is/are the nucleoprotein structure(s)?

(1) Chromatin (2) DNA
(3) Centromere (4) All of these

6 In which type of chromosome, one arm is very long and one arm is very short?

(1) Acrocentric (2) Metacentric
(3) Sub-metacentric (4) Telocentric

7 Sometimes a few chromosomes have ____A____ secondary constrictions at a constant location. This gives the appearance of a small fragment called the ____B____.

(1) A-non-staining , B-satellite.
(2) A- staining, B - satellite.
(3) A- non-staining, B -kinetochore.
(4) A- non-staining, B - Nucleoplasm

NCERT LINE by LINE

CRITICAL POINTS

You may recall that the interphase nucleus has a loose and indistinct network of nucleoprotein fibres called chromatin. But during different stages of cell division, cells show structured **chromosomes** in place of the nucleus. Chromatin contains DNA and some basic proteins called **histones**, some non-histone proteins and also RNA. A single human cell has approximately two metre long thread of DNA distributed among its forty six (twenty three pairs) chromosomes. You will study the details of DNA packaging in the form of a chromosome in class XII.

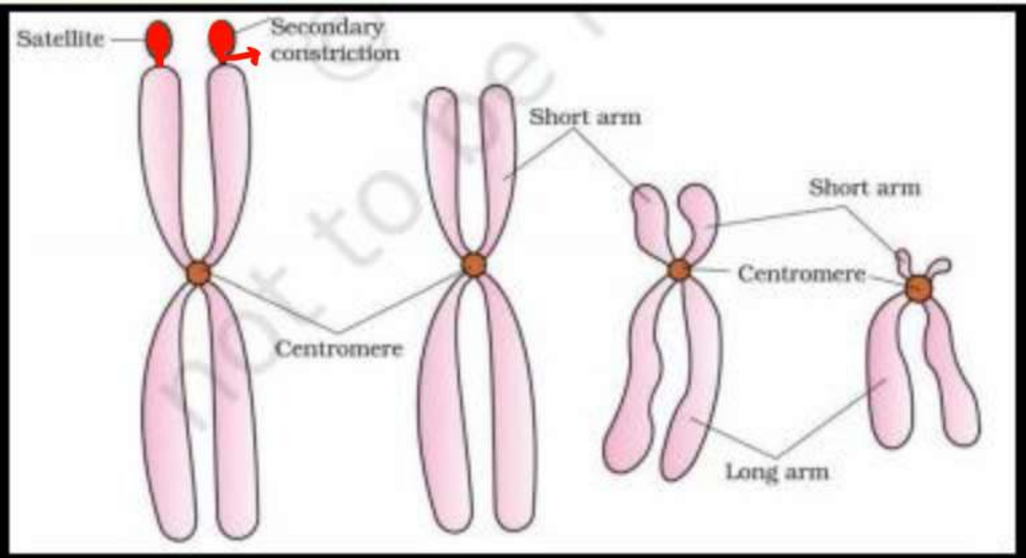
Every chromosome (visible only in dividing cells) essentially has a primary constriction or the **centromere** on the sides of which disc shaped structures called **kinetochores** are present (Figure 8.12). Centromere holds two chromatids of a chromosome. Based on the position of the centromere, the chromosomes can be classified into four types (Figure 8.13). The **metacentric** chromosome

→ 46 chromosomes
↓
2·2m

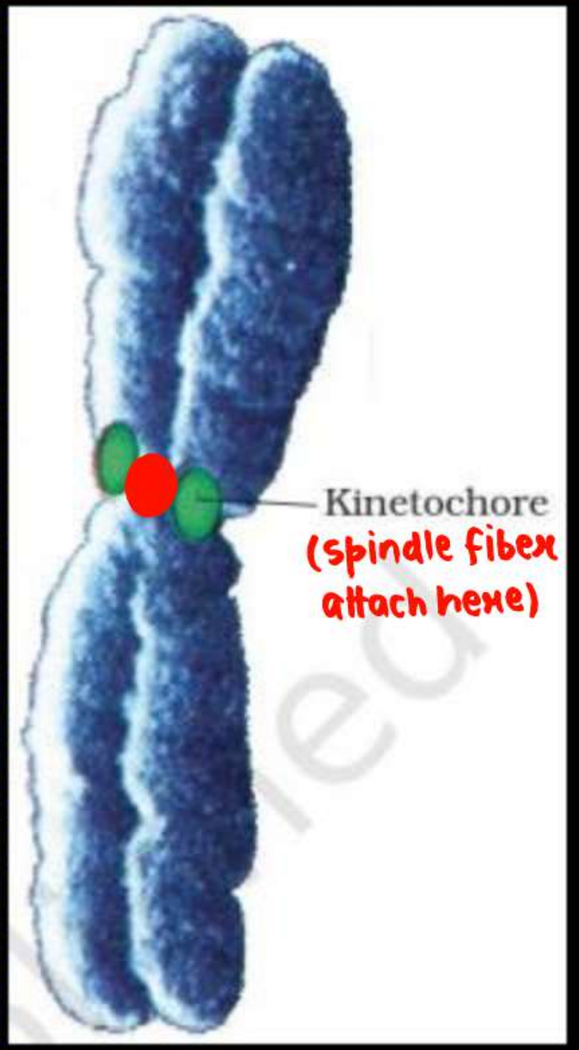
NCERT LINE by LINE

has middle centromere forming two equal arms of the chromosome. The **sub-metacentric** chromosome has centromere slightly away from the middle of the chromosome resulting into one shorter arm and one longer arm. In case of **acrocentric** chromosome the centromere is situated close to its end forming one extremely short and one very long arm, whereas the **telocentric** chromosome has a terminal centromere.

Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of a small fragment called the **satellite**.



CRITICAL POINTS



Punchayat

with Vipu Sir

Question-8

Statement I: Every chromosome essentially has a primary constriction known as kinetochore.

Statement II: In acrocentric chromosomes, the centromere is situated close to its end forming one extremely short and one very long arm.

A Both statements are correct

B Statement I is correct and II is incorrect

C Statement I is incorrect and II is correct

D Both statements are incorrect

Question-9

Which characters for chromosome are correct from given statements?*

(i) Part of chromosome after secondary constriction is known as satellite.

(ii) On the sides of centromere a disc-shaped structure called kinetochores are present.

(iii) In metacentric chromosome centromere present in middle forming two equal arms of the chromosome.

(iv) In sub-metacentric chromosome centromere present close to its end, resulting into one shorter arm and one longer arm.

(v) In case of acrocentric chromosome the centromere is situated slightly away from the middle forming one extremely short and one very long arm.

(vi) Telocentric chromosome has a terminal centromere.

A (i), (ii), (iv) and (vi)

B (i), (ii), (iii) and (vi)

C (iii), (iv) and (v)

D (i), (ii) and (vi)

Question-10

Choose the correct statement for nucleus.*

(i) Nucleus as a cell organelle was first described by Robert Brown.

(ii) Space between nuclear envelope called perinuclear space (10 to 50 nm).

(iii) Through nuclear pores, movement of RNA and protein molecules takes place only in one direction between the nucleus and the cytoplasm.

(iv) Normally, there is only one nucleus per cell but variations frequently observed.

(v) Nucleolus is membrane bound structure and it is a site for active ribosomal RNA synthesis.

(vi) Larger and more numerous nucleoli are present in cells actively carrying out protein synthesis.

A (iii), (iv) and (v)

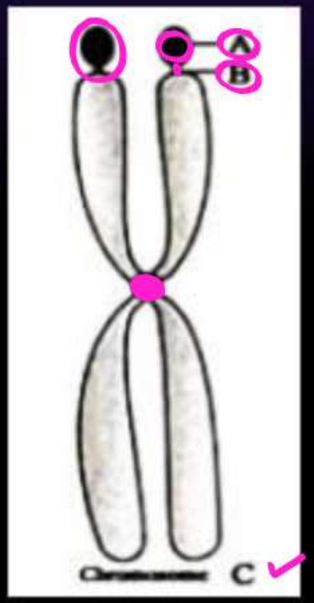
B All except (v)

C All except (iii) and (v)

D All of these

Question-11

The following diagram represents a structure of chromosome. Identify the structures marked as A, B and C.

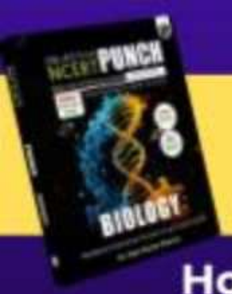


A. A Satellite, B Primary constriction, C-Acrocentric

B. A – Satellite, B - Secondary constriction, C-Metacentric

C. A-Satellite, B-Centromere, C-Telocentric

D. A-Satellite, B-Centromere, C-Submetacentric



Question-12

How many characters for chromosomes are not correct from given characters?*

(i) Interphase nucleus has a loose and indistinct network of nucleoprotein fibres called chromatin.

(ii) The name chromatin for material of the nucleus was given by Flemming.

(iii) Chromatin consists of DNA and some basic proteins called histones, some non-histone proteins and RNA.

(iv) A single human cell has approximately two metre long thread of DNA distributed among its forty six chromosomes.

(v) Every chromosome essentially has a primary constriction or the centromere.

(vi) Every chromosome have non-staining secondary constrictions.

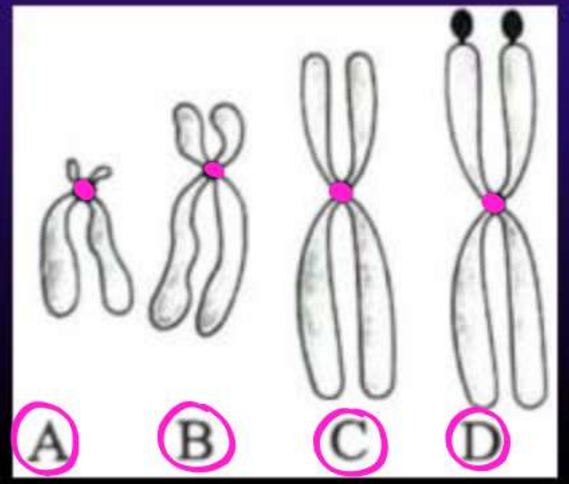
A (i), (ii) and (iii)

B (i), (iv) and (v)

C (iv) and (vi)

D (vi) only

Question-13



The given diagram shows the types of chromosomes (labelled as A, B, C and D) based on the position of centromere. Which one is the correct option for the labelled chromosomes. A, B, Cand D?

A. A - Telocentric chromosome, B - Acrocentric chromosome, C - Submetacentric chromosome, D-Metacentric chromosome

B. A Acrocentric chromosome, B - Telocentric chromosome, C - Metacentric chromosome, D-Submetacentric chromosome

C. A-Submetacentric chromosome, B- Metacentric chromosome, C - Telocentric chromosome, D-Acrocentric chromosome

D. A- Metacentric chromosome, B - Submetacentric chromosome, C- Acrocentric chromosome, D-Telocentric chromosome.

Question-14

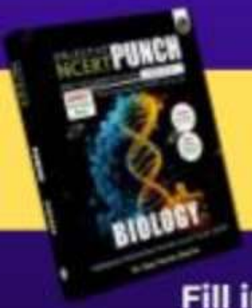
Satellite chromosomes have

A Primary constriction only

B Secondary constriction only

C Tertiary constriction only

D Both primary and secondary constriction ✓



Question 15

Fill in the blanks (yellow marked) and choose the correct option given below.

(i) The arrangement of axonemal microtubules in flagella is referred to as A array.

(ii) In flagella, the central tubules are connected by bridges and is enclosed by B, which is connected to one of each peripheral doublets by C.

(iii) The cilium and flagellum emerge from centriole-like structure called the D.

(iv) Centriole is made up of nine evenly spaced peripheral fibrils of E protein.

(v) The central part of the proximal region of the centriole is called F, which is connected with tubules of peripheral triplets by G.

(vi) The space between two parallel membranes of nuclear envelope is called H.

(vii) The nuclear matrix is called as I, which contain J and chromatin.

(viii) Nucleolus is a site for K RNA synthesis. (ix) The interphase nucleus has a loose and indistinct network of nucleoprotein fibres called L, which contains DNA, and some basic protein called M.

(x) Based on position of N, chromosome are metacentric, sub-metacentric, O and P.

(xi) The primary constriction in a structure of chromosome is Q and the secondary constriction give small fragment called R.

(xii) The S in the plastid is the site of light reactions and the T of dark reaction.

A. A-9+2 array, C-Radial spokes, E-Flagellin, O-Metacentric

B. B-Central Sheath, E-Tubulin, G-Radial Spokes, S-Strama

C. D-Basal bodies, K-Ribosomal, N-Centromere, P-Telocentric

D. E-Tubulin, F-Hub, R-Satellite, T-Grana

Active Recall

Home Work

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarabh: 4, 11
Prarambh: 2, 4, 5, 6, 7, 9, 10, 11, 12, 13
Prabal: 1, 2
Parikshit: 6, 19, 20
PYQs: 24, 28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WELCOME TO
J.A.R.V.I.S.
ARMY
THANK YOU!

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 04

By: Vipin Sharma Sir

Topics to be covered

1) Prokaryotic Cell *

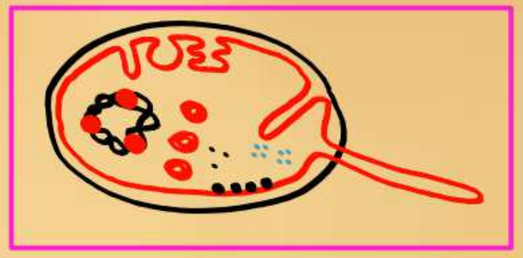
2) Mesosomes

3) Inclusion Bodies

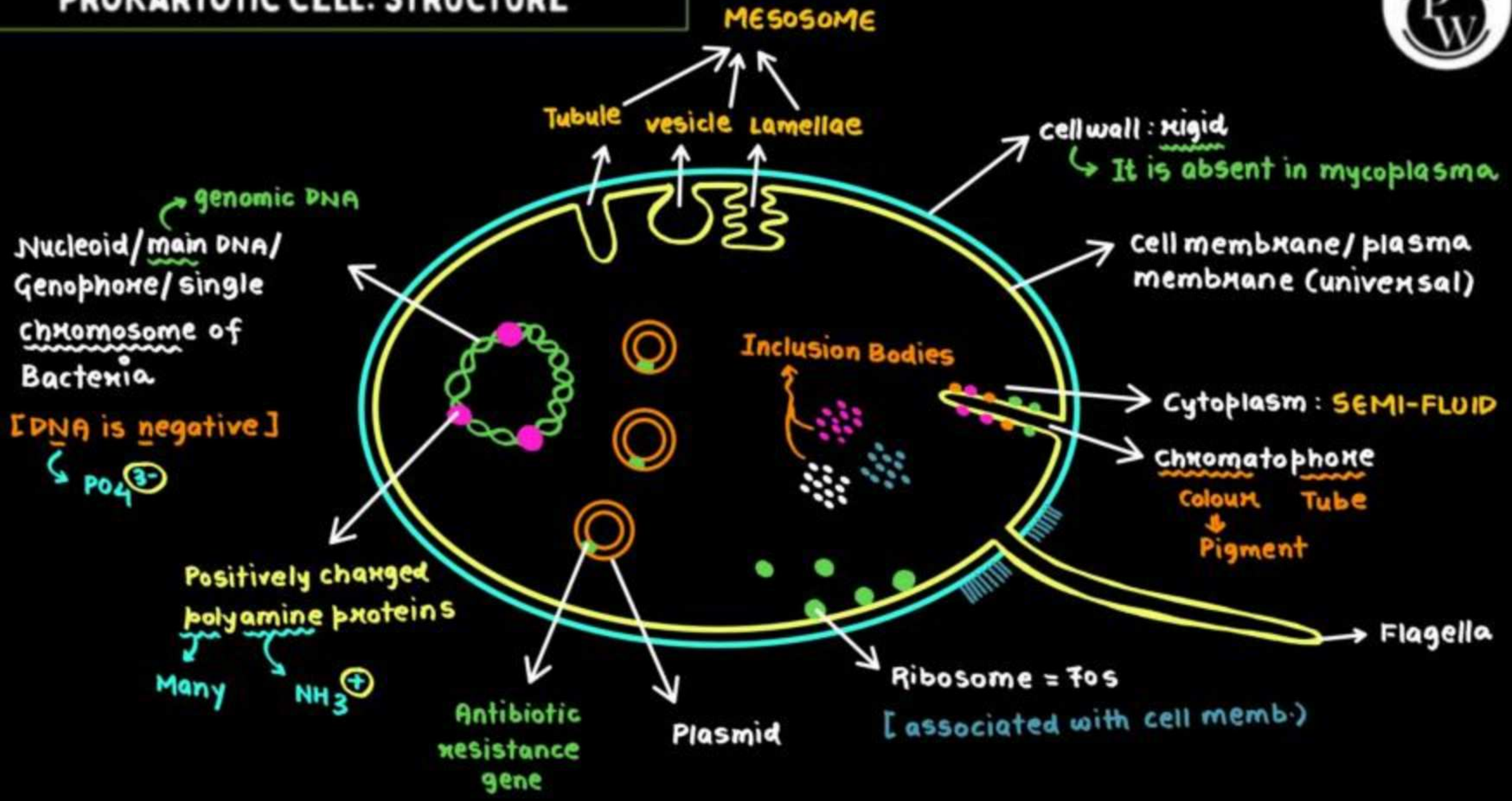
4) Flagella

5) Surface Structures

6) PUNCH Questions and PYQs



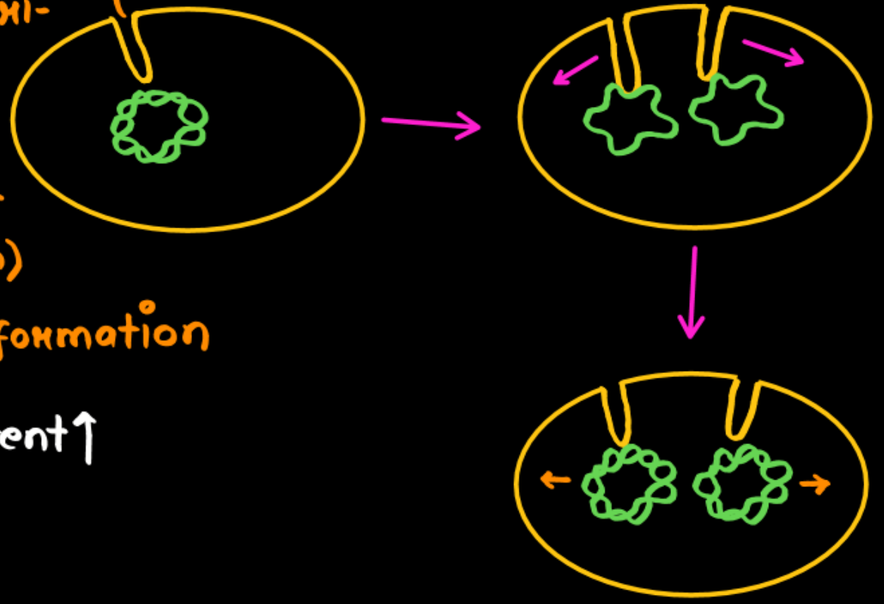
PROKARYOTIC CELL: STRUCTURE



MESOSOME

- Formed by extension/invagination of cell membrane → folds inside the cell
- Characteristic feature of prokaryotic cell
- Forms → Tubule, vesicle, Lamellae

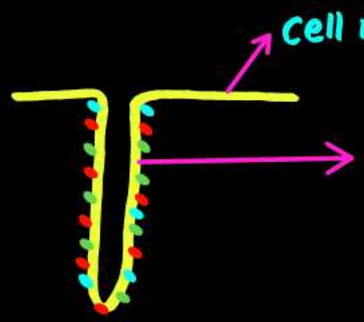
1. DNA replication
2. DNA distribution
3. Transport (secretion)
4. Cell wall formation
5. Surface area ↑ ; enzymatic content ↑
   Respiration ↑ → Just like mitochondria



CHROMATOPHORE

Colour
- due to presence of pigments

Elongated structure



e.g., Blue-green algae or cyanobacteria

- Infolding of cell membrane*

INCLUSION BODIES

Characteristic of prokaryotic cells

- Do not have a membrane
- Lie freely in cytoplasm of prokaryotic cell
- Helps in storage of materials

Glycogen granule ⇓ Store glycogen

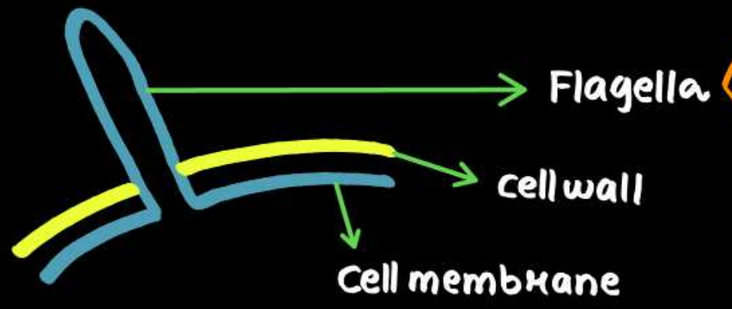
Phosphate granule ⇓ Store phosphate

Gas → Gas vacuole → provides buoyancy
- Blue-green bacteria, purple green photobacteria*

Cyanophycean granule ⇓ Store blue coloured pigment

SURFACE STRUCTURES

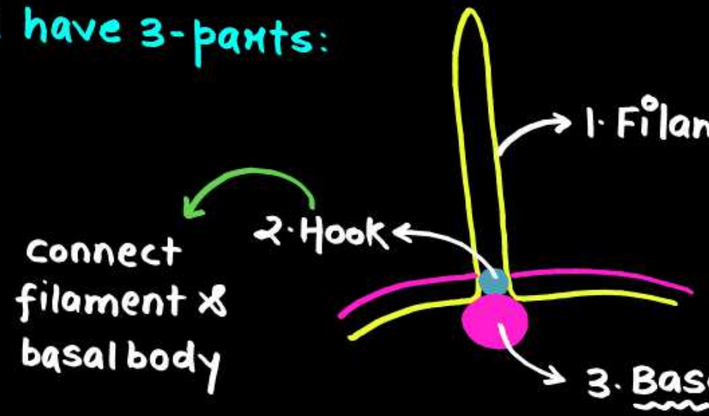
① Flagella : ⊖nt in non-motile bacteria
⊕nt in motile bacteria



1. Extension of cell membrane → outfolding of cell memb.
2. Extended from cell wall → Crashed cell wall

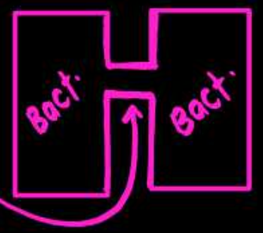
* Flagella in prok. & eukaryotes is different
- prok. → Flagellin protein
- eukaryotes → Tubulin protein

Flagella have 3-parts:



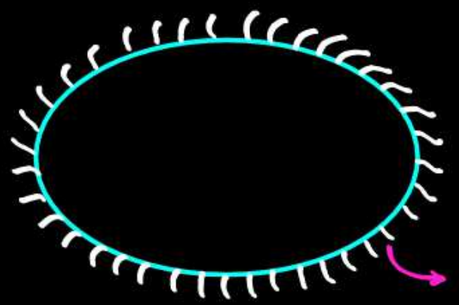
② Pili : Tubular, elongated structure
- Connects 2 bacteria
- formed of special protein called 'PILIN' protein

Helps in the transfer of plasmid/ DNA



SURFACE STRUCTURES

3. Fimbriae: formed of 'fimbrin protein'
   - Small bristle like structure found on surface of bacteria
   - helps in anchorage ment / attachment



→ anchorage ment on surfaces like rocks, host tissue

NOTE: Pili & Fimbriae have no role in motility

NCERT MAIYAAAA KI READING!!

prokaryotes have a cell wall surrounding the cell membrane except in mycoplasma. The fluid matrix filling the cell is the cytoplasm. There is no well-defined nucleus. The genetic material is basically naked, not enveloped by a nuclear membrane. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular DNA outside the genomic DNA. These smaller DNA are called plasmids. The plasmid DNA confers certain unique phenotypic characters to such bacteria. One such character is resistance to antibiotics. In higher classes you will learn that this plasmid DNA is used to monitor bacterial transformation with foreign DNA. Nuclear membrane is found in eukaryotes. No organelles, like the ones in eukaryotes, are found in prokaryotic cells except for ribosomes. Prokaryotes have something unique in the form of inclusions. A specialised differentiated form of cell membrane called mesosome is the characteristic of prokaryotes. They are essentially infoldings of cell membrane.

NCERT MAIYAAAA KI READING!!

NEET-2023

A special membranous structure is the **mesosome** which is formed by the extensions of plasma membrane into the cell. These extensions are in the **form of vesicles, tubules and lamellae**. They help in cell wall formation, DNA replication and distribution to daughter cells. They also help in respiration, secretion processes, to increase the surface area of the plasma membrane and enzymatic content. In some prokaryotes like cyanobacteria, there are other membranous extensions into the cytoplasm called chromatophores which contain pigments.

NEET-2014

NEET-2015

3-pants

Bacterial cells may be motile or non-motile. If motile, they have thin filamentous extensions from their cell wall called flagella. Bacteria show a range in the number and arrangement of flagella. Bacterial flagellum is composed of three parts – **filament, hook** and **basal body**. The filament is the longest portion and extends from the cell surface to the outside.

NEET-2014

Besides flagella, Pili and Fimbriae are also surface structures of the bacteria but do not play a role in motility. The **pili** are elongated tubular structures made of a special protein. The **fimbriae** are small bristle like fibres sprouting out of the cell. In some bacteria, they are known to help attach the bacteria to rocks in streams and also to the host tissues.

NEET-2016

NEET-2015

NCERT MAIYAAAA KI READING!!

8.4.2 Ribosomes and Inclusion Bodies

In prokaryotes, ribosomes are associated with the plasma membrane of the cell. They are about 15 nm by 20 nm in size and are made of two subunits - 50S and 30S units which when present together form 70S prokaryotic ribosomes. Ribosomes are the site of protein synthesis. Several ribosomes may attach to a single mRNA and form a chain called **polyribosomes** or **polysome**. The ribosomes of a polysome translate the mRNA into proteins.

Inclusion bodies: Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies. These are not bound by any membrane system and lie free in the cytoplasm, e.g., phosphate granules, cyanophycean granules and glycogen granules. Gas vacuoles are found in blue green and purple and green photosynthetic bacteria.

Gneen = photosynthetic
↳ due to chlorophyll

NEET-2018,16

NEET-2020,15

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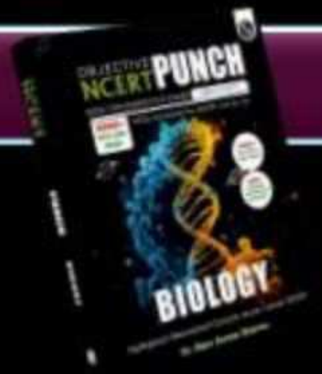


QUESTIONS AND PYQs

1 Which of the following is **NOT** a function of mesosomes?

(1) Respiration ✓

(2) DNA replication ✓

(3) Increases enzymatic content ✓ → surface area ↑ → respiration ↑

(4) Reproduction ✗

2 The genetic material of prokaryotic cells is called:

(1) Nucleus (2) Nucleolus

(3) Nucleoid (4) Centrosome

3 Which of the following structures is **NOT** found in a prokaryotic cell?

(1) Nuclear envelope (2) Ribosome

(3) Mesosome (4) Plasma membrane

4 Prokaryotic cell does not have:

(1) Nucleolus ✗

(2) Membrane bound organelles ✗

(3) Centrioles ✗

(4) All of these

5 The longest portion of the bacterial flagellum that extends from the cell surface to the outside is called:

(1) Filament (2) Hook

(3) Basal body (4) Shaft

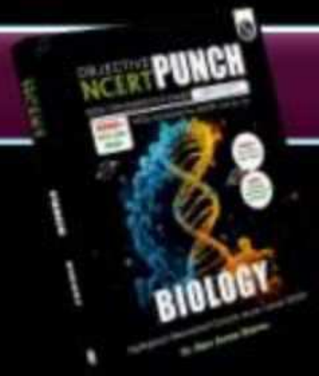
6 Bacteria show a range in the number of arrangement of flagella. Bacterial flagellum is composed of

(1) Two parts – pili and fimbriae

(2) Three parts – filament, hook and basement membrane

(3) Three parts – filament, shaft and basal body

(4) Three parts – filament, hook and basal body



7 Given below are two statements: **(2023 manipur)**

Statement-I: In bacteria, the mesosomes are formed by the extensions of plasma membrane.

Statement-II: The mesosomes, in bacteria, help in DNA replication and cell wall formation.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) **Statement-I** is correct but **Statement-II** is incorrect.
(2) **Statement-I** is incorrect but **Statement-II** is correct.
(3) Both **Statement-I** and **Statement-II** are correct.
(4) Both **Statement-I** and **Statement-II** are incorrect.

8 Which of the following statements about inclusion bodies is **incorrect**? **(2020)**

(1) These are involved in ingestion of food particles.
(2) They lie free in the cytoplasm
(3) These represent reserve material in cytoplasm
(4) They are not bound by any membrane

9 Inclusion bodies of blue-green, purple and green photosynthetic bacteria are: **(2020 Covid)**

(1) Gas vacuoles
(2) Centrioles
(3) Microtubules
(4) Contractile vacuoles

Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 4, 5, 10, 11
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 34, 35, 36, 39
Exercise-2: 2, 3, 4


THANK
YOU

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NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 07

By: Vipin Sharma Sir

Topics to be covered

1) Cell Membrane Components → Lipid* Protein* + Carbohydrates + Cholesterol
   - Phospholipid / phosphoglycer.
2) Fluid Mosaic Model
3) Functions of Cell Membranes
4) Transport across Cell Membrane
5) Different Proteins in Membrane
6) PUNCH Questions and PYQs

LIPID

→ In RBC: Ratio of protein & Lipid is 52:40
(52% protein, 40% lipid)

→ Rest 8% is carbohydrate & cholesterol

→ Ratio of protein & lipid vary in different membranes

e.g., Myeline sheath has 70-80% lipid

→ Lipid: Main lipid that makes membrane is phospholipid

⇓

Hydrophobic

H_2O Fear

Polar

Hydrophillic as it can interact with H_2O

Polar Head

⇓

due to phosphate

Single bond → NCERT

double bond

Saturated or unsaturated*

Hydrocarbon Tail

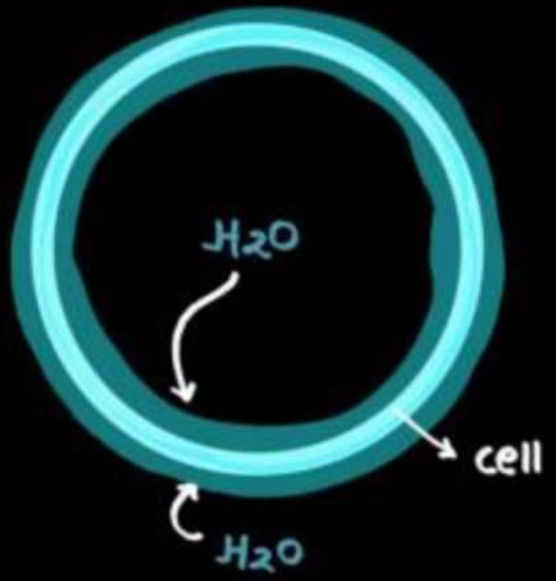
Hydrogen → carbon

Non-polar ← H—C

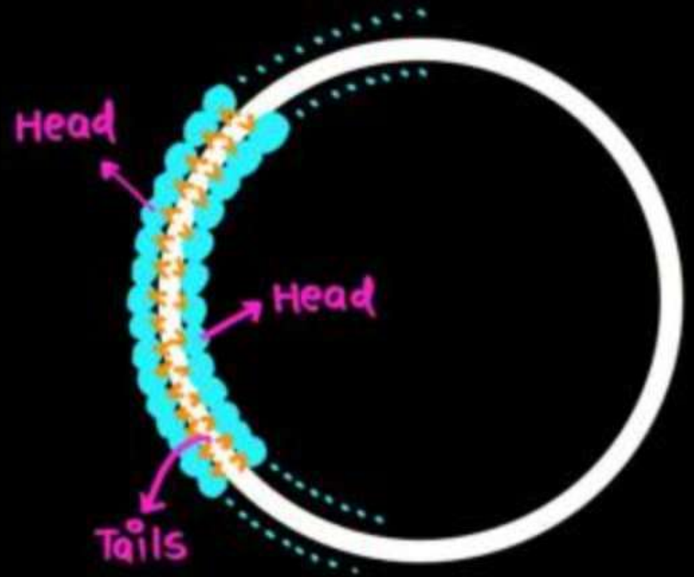
Can't interact with H_2O

∴ Hydrophobic

LIPID



Lipids forms a bilayer to make a membrane

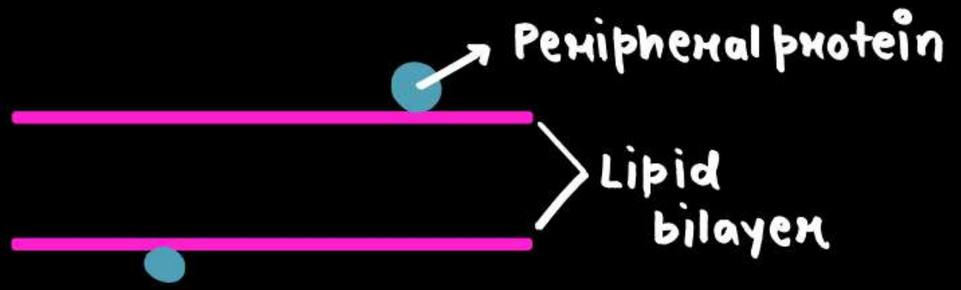


TYPES OF PROTEINS IN CELL MEMBRANE

on the basis of ease of extraction

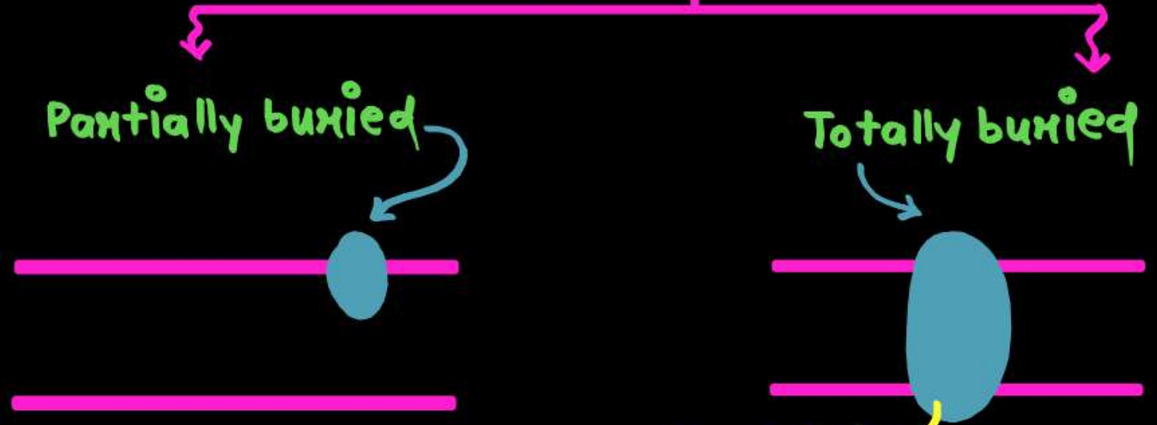
Peripheral / extrinsic protein (exit)

- Easily extracted



Integral / intrinsic protein

- not easily extracted



FLUID MOSAIC MODEL OF CELL MEMBRANE

→ Given by Singer & Nicolson in 1972

→ Fluid-mosaic model

⇓

Lipid

(can show fluidity)

⇘ Protein: they are randomly distributed in lipid bilayer

→ According to Singer & Nicolson, Lipids are like 'sea' and proteins are like 'icebergs' present in it

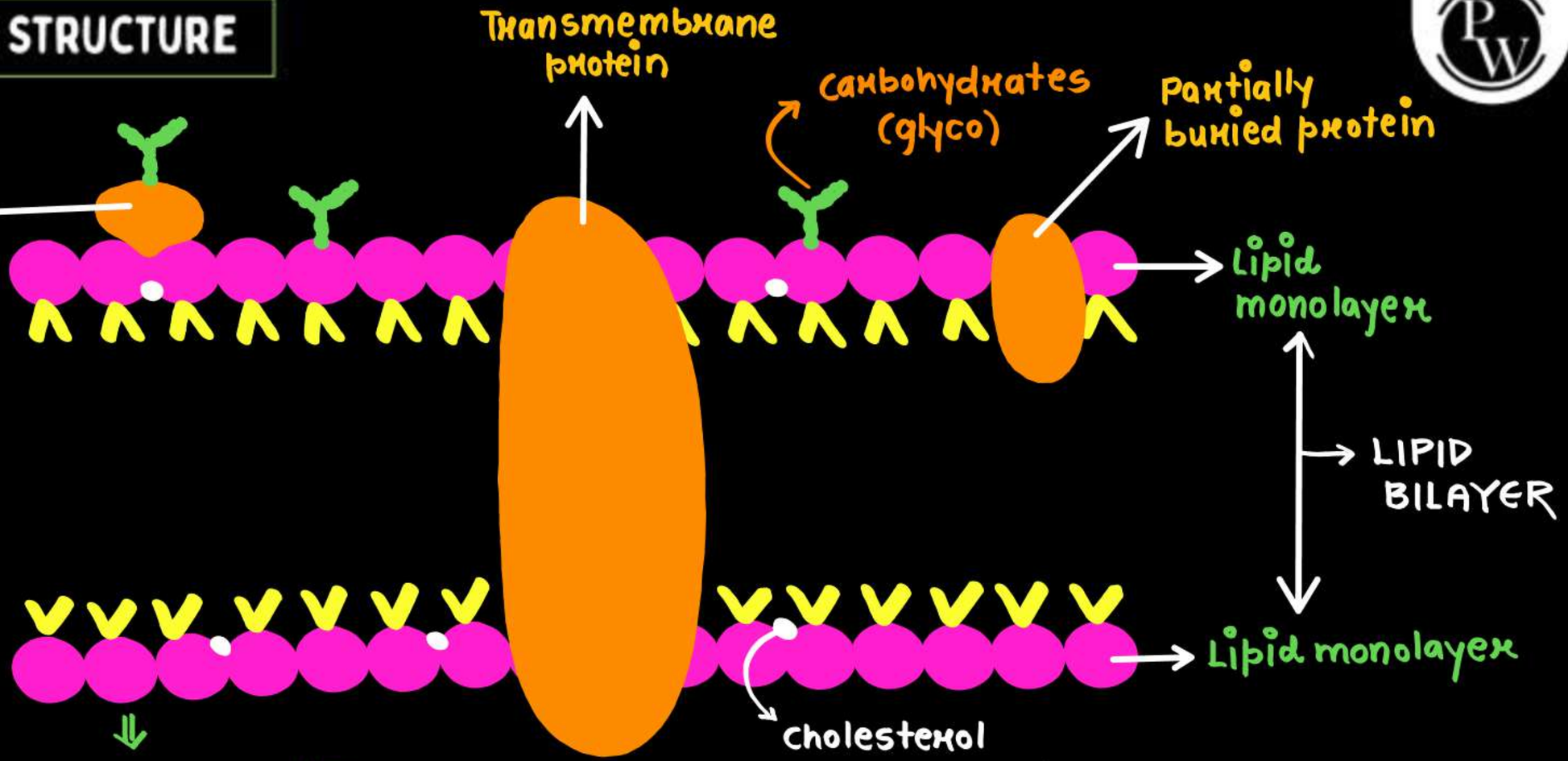
⇓

Quasi-fluid

⇓

Glass-like

CELL MEMBRANE: STRUCTURE

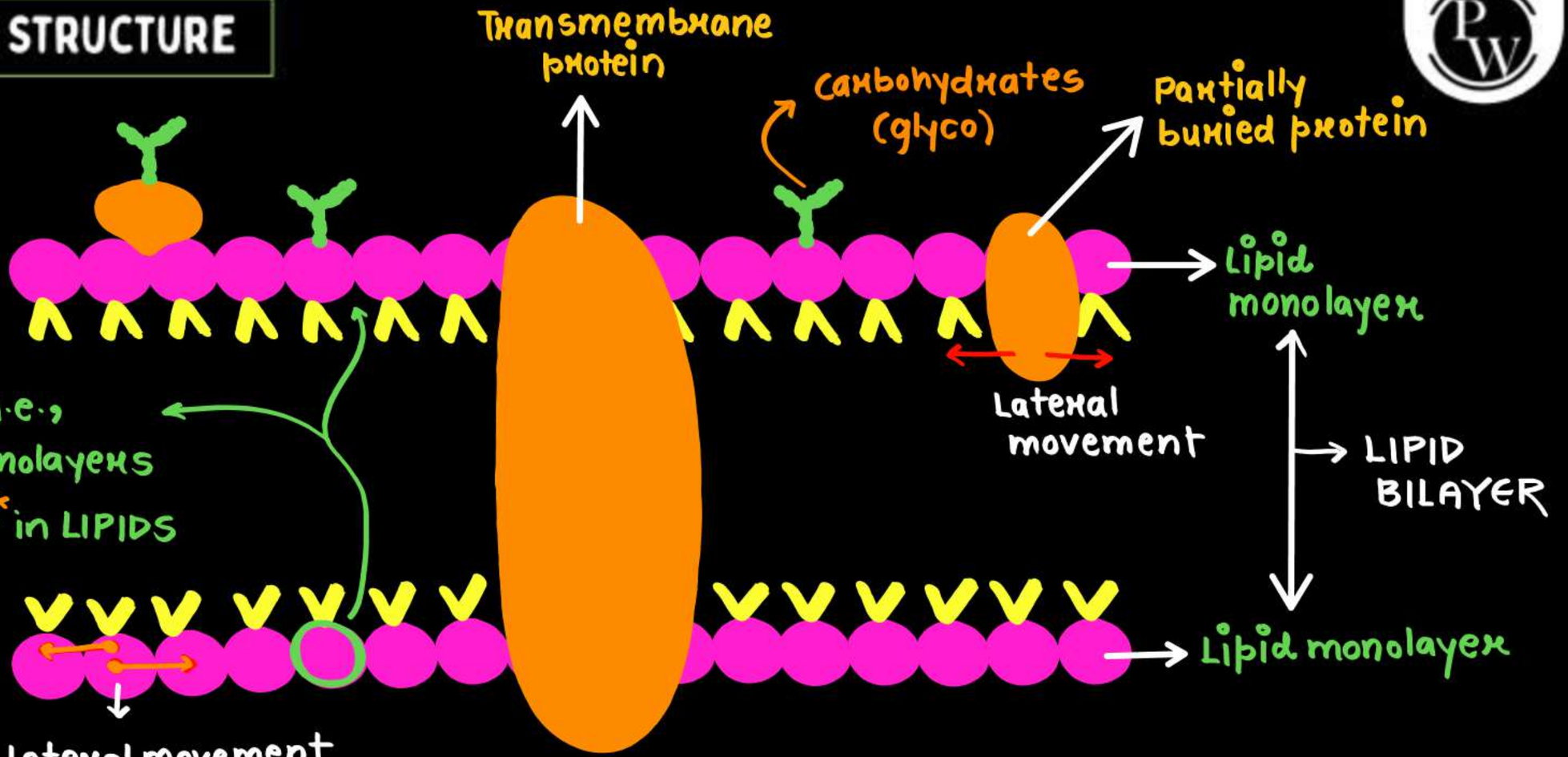


Carb. + Lipid = Glycolipid
AND
Carb. + Protein = Glycoprotein

⇓
No carbohydrates on inner side
⇓
∴ Membrane gets ASSYMETRICAL

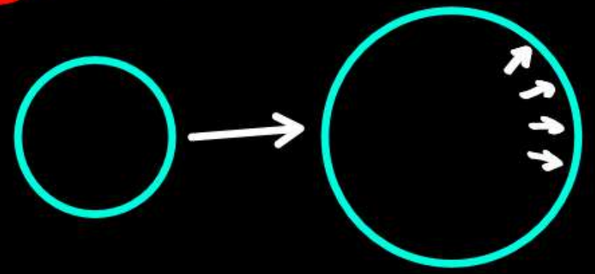
(membrane stabilizer)
⇓
only ⊕nt in animal cells
- In plants other sterols can be found e.g., stigmasterol

CELL MEMBRANE: STRUCTURE

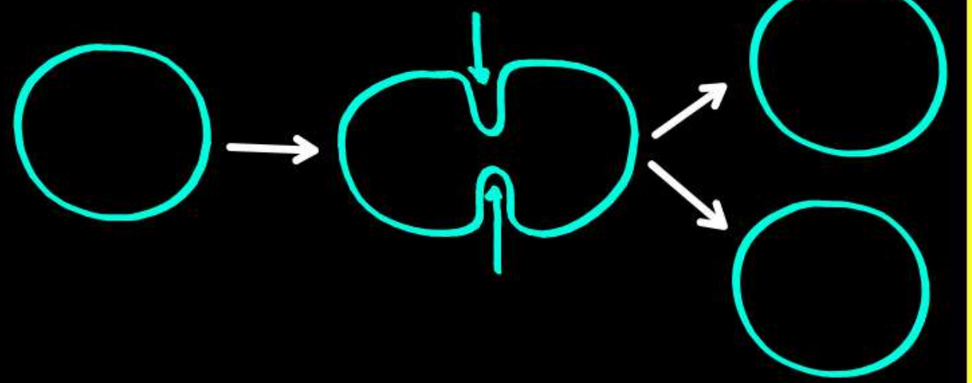


CELL MEMBRANE: FUNCTIONS

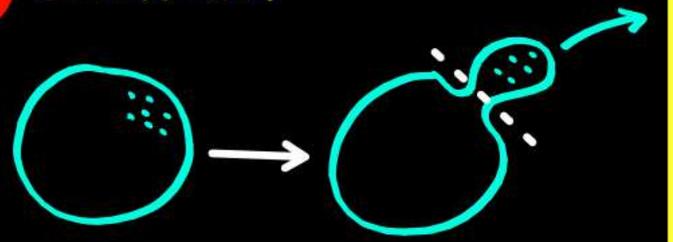
1 Cell growth



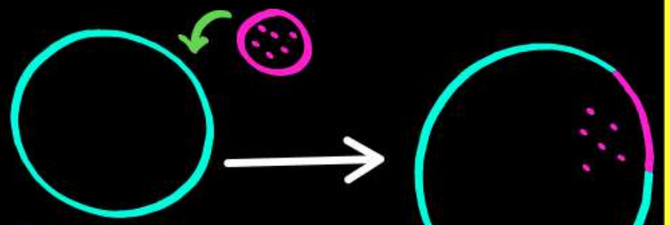
2 Cell division



3 Secretion



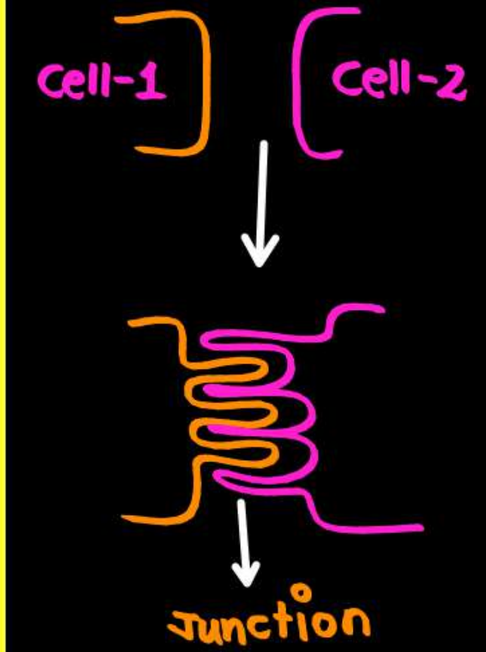
Endocytosis



4

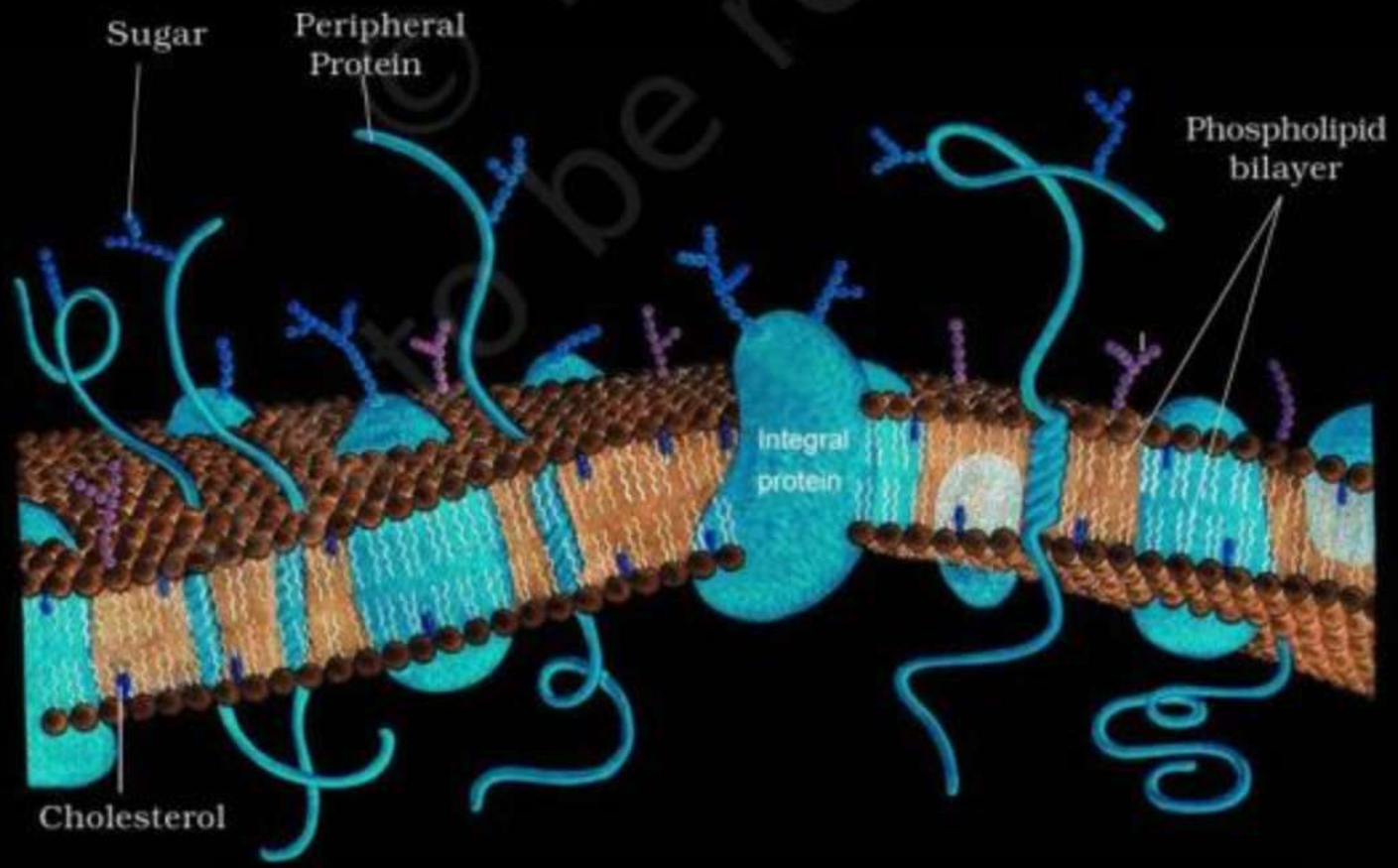
5 Formation of Intexcellular junct·

In between



NCERT MAIYAAAA KI READING!!

Depending on the ease of extraction, membrane proteins can be classified as integral and peripheral. Peripheral proteins lie on the surface of membrane while the integral proteins are partially or totally buried in the membrane.



NCERT MAIYAAAA KI READING!!

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An improved model of the structure of cell membrane was proposed by Singer and Nicolson (1972) widely accepted as **fluid mosaic model** (Figure 8.4). According to this, the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer. This ability to move within the membrane is measured as its fluidity.

The fluid nature of the membrane is also important from the point of view of functions like cell growth, formation of intercellular junctions, secretion, endocytosis, cell division etc.

NCERT MAIYAAAA KI READING!!

One of the most important functions of the plasma membrane is the transport of the molecules across it. The membrane is selectively permeable to some molecules present on either side of it. Many molecules can move briefly across the membrane without any requirement of energy and this is called the **passive transport**. Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, i.e., from higher concentration to the lower. Water may also move across this membrane from higher to lower concentration. Movement of water by diffusion is called **osmosis**. As the polar molecules cannot pass through the nonpolar lipid bilayer, they require a carrier protein of the membrane to facilitate their transport across the membrane. A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called **active transport**, e.g., Na^+/K^+ Pump.

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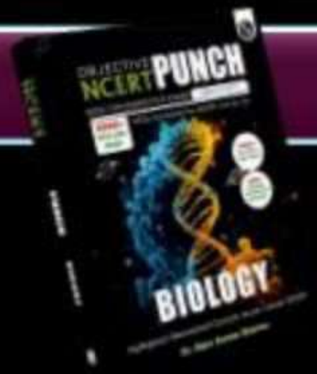
with Vipu Sir



QUESTIONS AND PYQs

1 Which of the following statements is not true for the plasma membrane?

(1) It is present in both plant and animal cells
(2) Lipids are present in it as bilayer
(3) Proteins may be peripheral or integral in it
(4) Carbohydrates are never found in it

2 What is **true** regarding fluid mosaic model?

(1) Phospholipid monolayer is present over protein layer
(2) Phospholipid bilayer is present over protein layer
(3) Proteins are embedded in phospholipid bilayer
(4) Phospholipid layer is sandwiched between two protein layers

3 When was the most accepted model for plasma membrane organization given?

(1) 1962 (2) 1972
(3) 1984 (4) 1964

4 Molecules which are transported across the membrane against their concentration gradient, i.e., from the lower to higher concentration. Such a transport is called

(1) Active transport, e.g., diffusion
(2) Passive transport, e.g., diffusion
(3) Active transport, e.g., Na^+/K^+ pump
(4) Osmosis, a type of simple diffusion

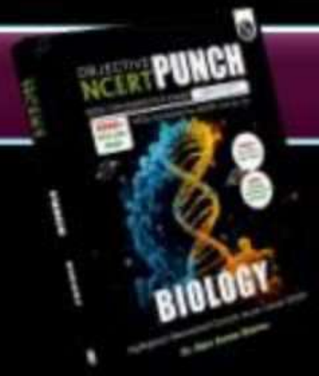
5 Most common lipid in plasma membrane is?

(1) Cholesterol
(2) Glycolipid
(3) Phosphoglyceride
(4) Hopanoids

6 According to fluid mosaic model (proposed by Singer & Nicolson), plasma membrane is composed of;

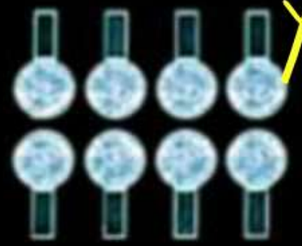
(1) Cellulose, hemicellulose
(2) Phospholipid and integrated protein
(3) Phospholipid, integral protein and peripheral protein
(4) Phospholipid and hemicellulose

more connect

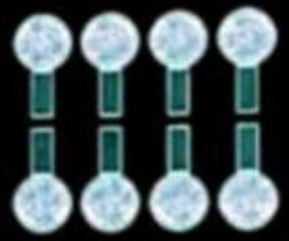


7 The lipid molecules present in plasma membrane have polar heads and non-polar tails (as shown in figure). Which option represents the correct arrangement of lipids in lipid bilayer?

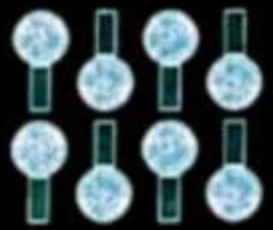
(1)



(2)



(3)



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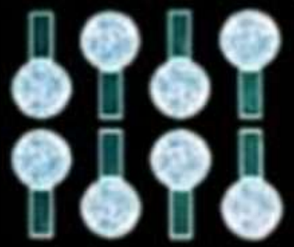


Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from Botany MED EASY Book or from Class Notes

Module Questions
Aarambh: 2, 4, 5, 10, 11, 12, 13
Exercise-1: 16, 18, 20, 21, 24, 25, 28, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48, 49, 50
Exercise-2: 2, 3, 4, 5, 12, 13


THANK
YOU

ARJUNA

NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

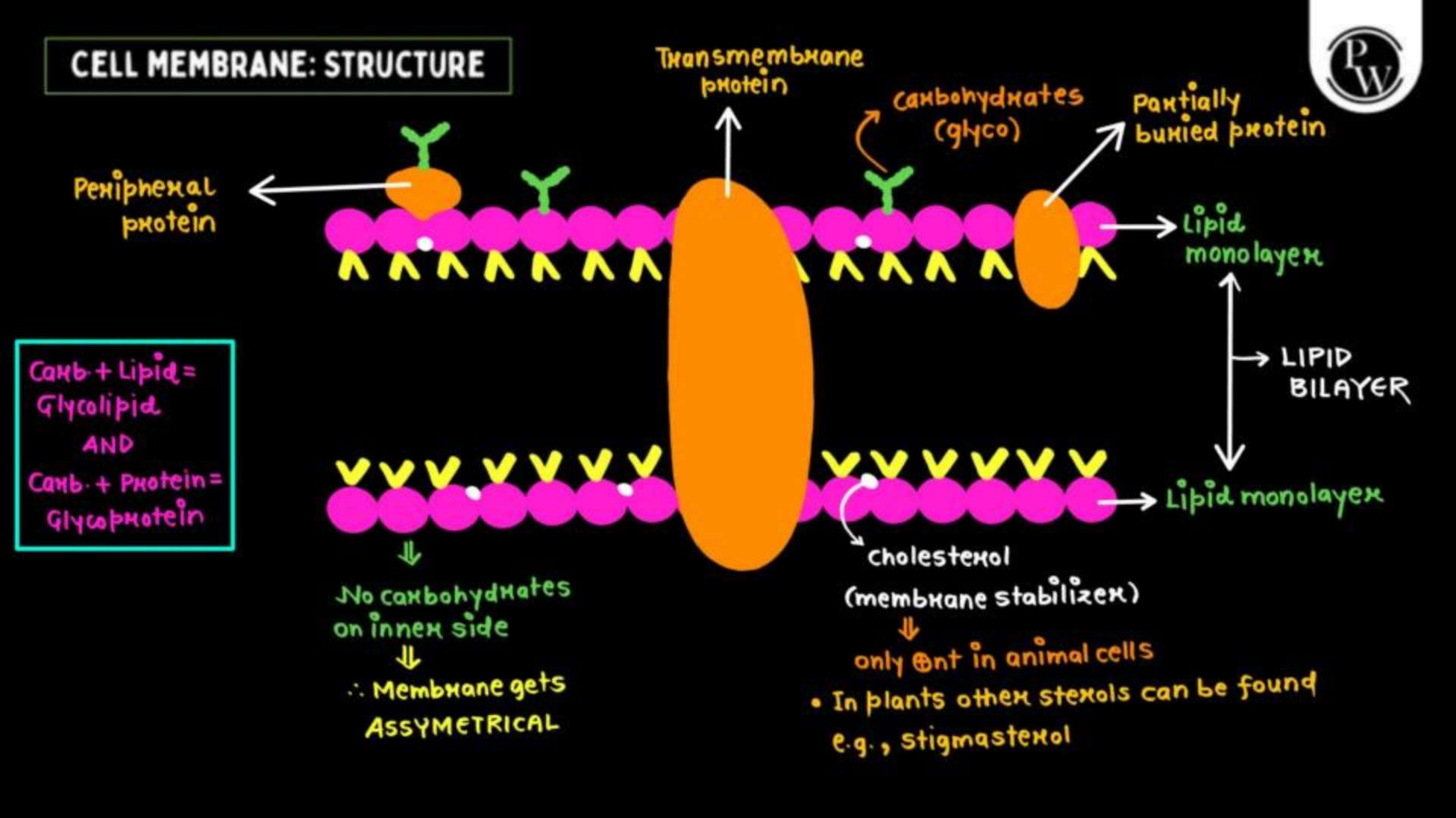
Lecture: 08

By: Vipin Sharma Sir

Topics to be covered

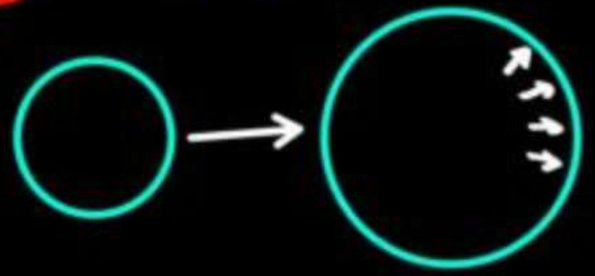
1) Cell Membrane Components
2) Fluid Mosaic Model
3) Functions of Cell Membranes
4) Transport across Cell Membrane
5) Cell Wall
6) PUNCH Questions and PYQs

CELL MEMBRANE: STRUCTURE

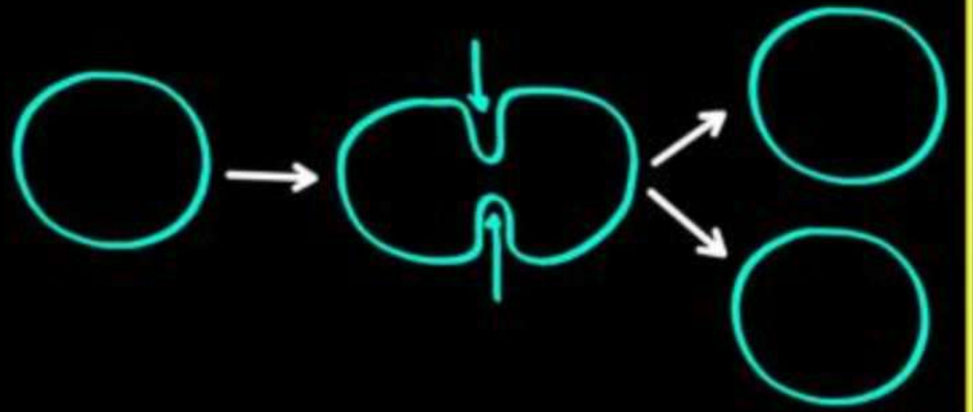


CELL MEMBRANE: FUNCTIONS

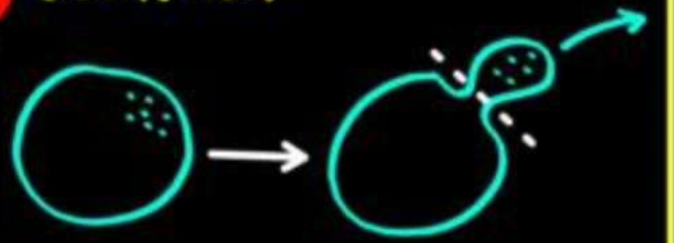
1 Cell growth



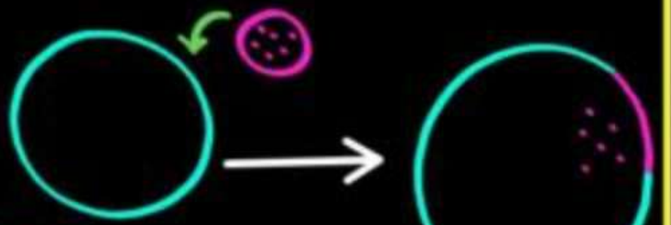
2 Cell division



3 Secretion



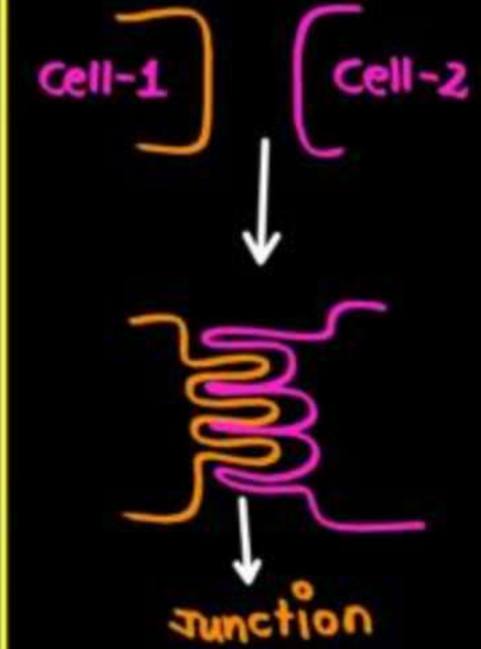
Endocytosis



4

5 Formation of Intercellular junct·

In between



TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

PASSIVE TRANSPORT

- No energy (ATP) needed
- Substances will move along the concentration gradient (↑conc. to low conc.)
- DOWNHILL movement

ACTIVE TRANSPORT

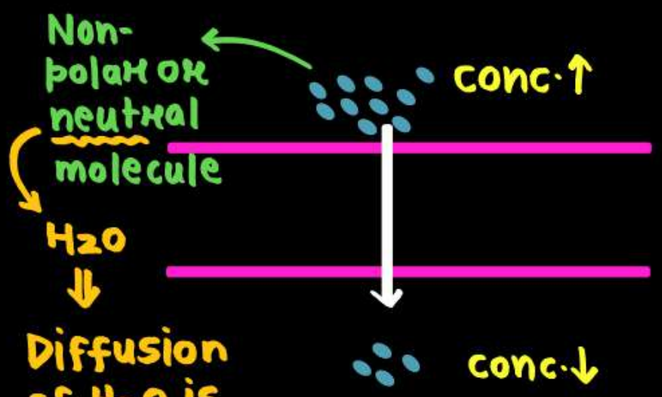
- ATP or energy is needed
- Substances move AGAINST the conc. gradient (↓ conc. to ↑ conc.)
- UPHILL movement

TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

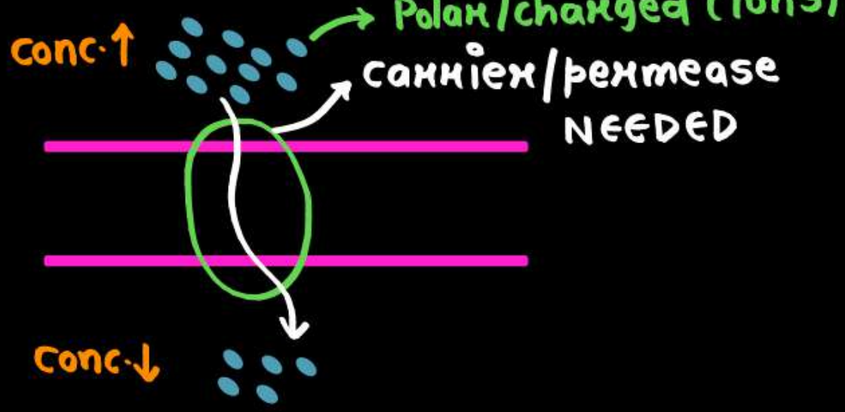
PASSIVE TRANSPORT

Simple diffusion
(↑conc. to ↓conc.)

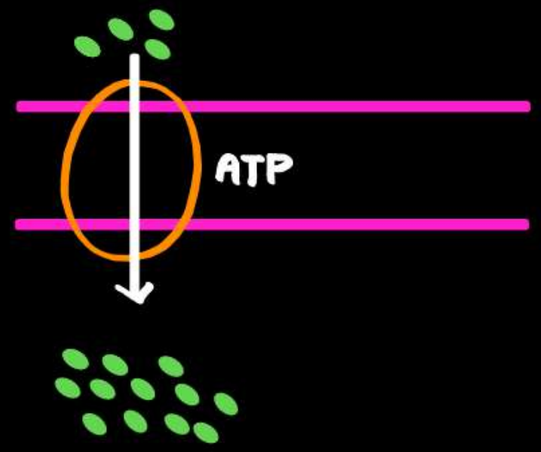


Diffusion of H_2O is OSMOSIS

Facilitated Diffusion
(↑conc. to ↓conc.)



ACTIVE TRANSPORT



e.g., Na^+/K^+ Pump
⇓
used for active trans.

TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

PASSIVE TRANSPORT

ACTIVE TRANSPORT

NOTE-1: Neutral & non-polar molecules can directly cross lipid bilayer
↳ Major part of memb. is non-polar

NOTE-2: Polar molecules/ions (charged) can't cross the lipid bilayer directly
∴ They need carrier protein

CELL WALL

↝ RIGID, NON-LIVING

↓

- Give shape to a cell
- Protects cell from mechanical damage & infection
- Helps in cell-cell interaction (∵ it is outer)
- Stops the entry of MACRO-molecules in a cell (Large)

↝ Archaebacteria: Pseudomurein

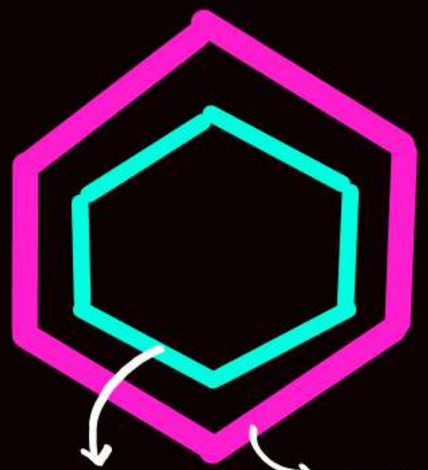
Eubacteria: Peptidoglycan/murein

Fungi: Chitin

Algae: Cellulose + Galactans + Mannans + Minerals like $CaCO_3$

Plants: Cellulose + Hemicellulose + Pectin + some proteins
(Higher)

Animals: Ont



Cell membrane

Cell wall

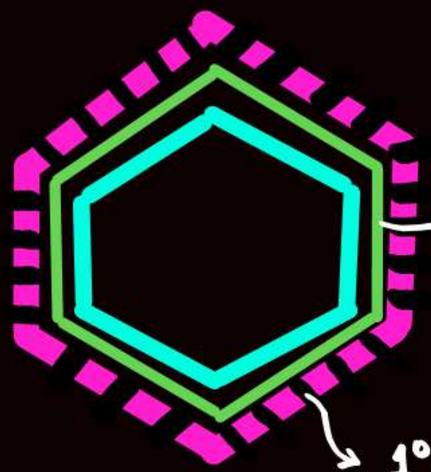
⇓

1° cell wall on young plant cell

⇓

Allows growth

Grows & matures



RIGID ∴ don't allow growth

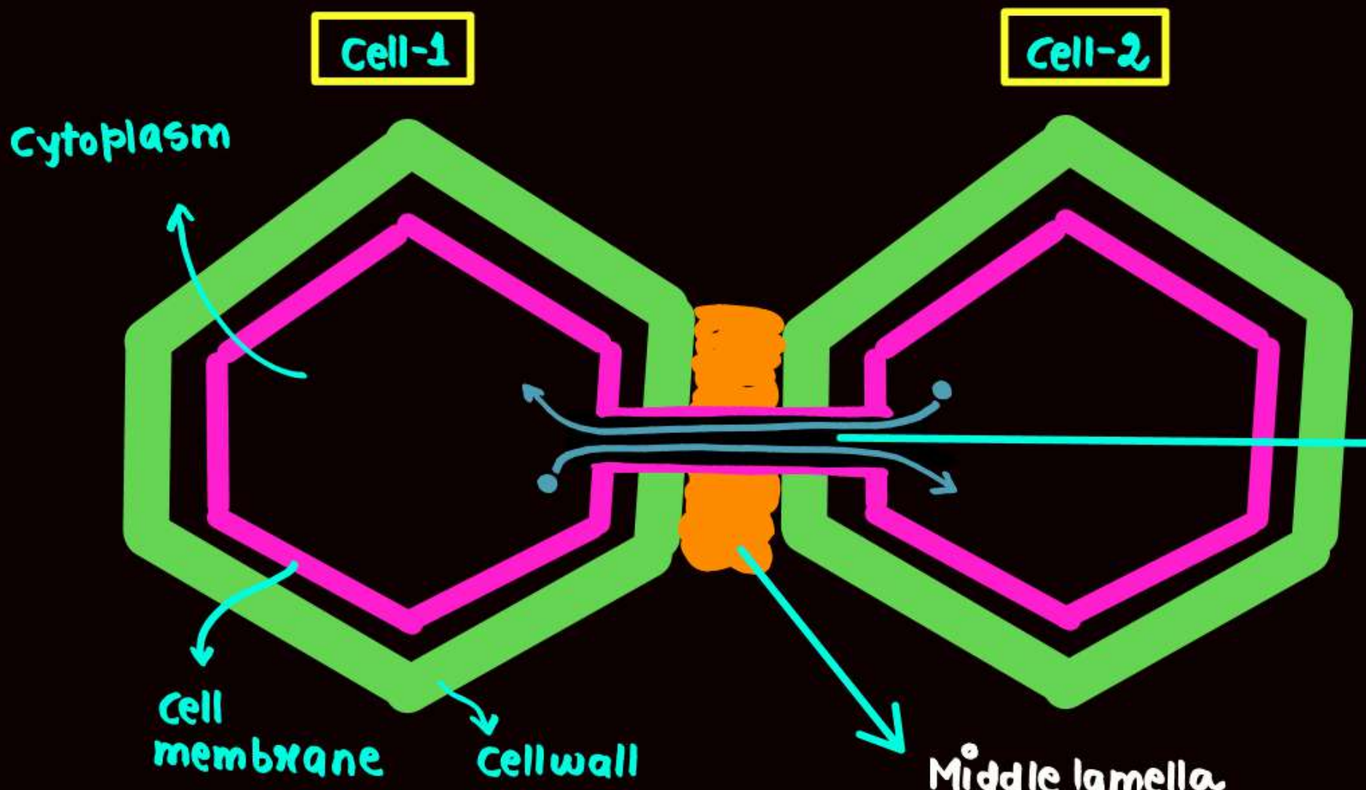
2° cell wall (formed on inner side of 1° cell wall i.e., towards membrane)

1° cell wall (gets deminished)

NOTE

Outer to inner

1° cell wall → 2° cell wall → Cell memb.



Plasmodesmata

- cytoplasmic strand that connects the cytoplasm of 2 plant cells
- Traverse cellwall & middle lamella to connect 2 plant cells

Middle lamella

- connects or glues 2 neighbouring plant cells together
- Made of Calcium-pectate (1/ case में Mg pectate)

NCERT MAIYAAAA KI READING!!

One of the most important functions of the plasma membrane is the transport of the molecules across it. The membrane is selectively permeable to some molecules present on either side of it. Many molecules can move briefly across the membrane without any requirement of energy and this is called the **passive transport**. Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, i.e., from higher concentration to the lower. Water may also move across this membrane from higher to lower concentration. Movement of water by diffusion is called **osmosis**. As the polar molecules cannot pass through the nonpolar lipid bilayer, they require a carrier protein of the membrane to facilitate their transport across the membrane. A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called **active transport**, e.g., Na^+/K^+ Pump.

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8.5.2 Cell Wall

As you may recall, a non-living rigid structure called the cell wall forms an outer covering for the plasma membrane of fungi and plants. Cell wall not only gives shape to the cell and protects the cell from mechanical damage and infection, it also helps in cell-to-cell interaction and provides barrier to undesirable macromolecules. Algae have cell wall, made of cellulose, galactans, mannans and minerals like calcium carbonate, while in other plants it consists of cellulose, hemicellulose, pectins and proteins. The cell wall of a young plant cell, the **primary wall** is capable of growth, which gradually diminishes as the cell matures and the secondary wall is formed on the inner (towards membrane) side of the cell.

The middle lamella is a layer mainly of calcium pectate which holds or glues the different neighbouring cells together. The cell wall and middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

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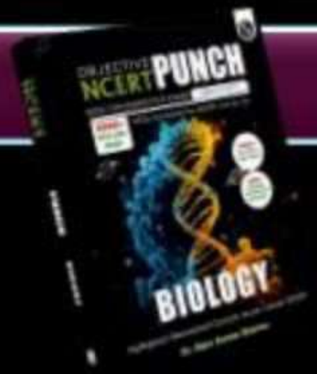

QUESTIONS AND PYQs

1 Molecules which are transported across the membrane against their concentration gradient, i.e., from the lower to higher concentration. Such a transport is called

(1) Active transport, e.g., diffusion
(2) Passive transport, e.g., diffusion
(3) Active transport, e.g., Na^+/K^+ pump
(4) Osmosis, a type of simple diffusion

2 Movement and accumulation of ions across a membrane against their concentration gradient can be explained by **(2023)**

(1) Facilitated Diffusion (2) Passive Transport
(3) Active Transport (4) Osmosis

3 The different neighbouring cells are held together by a Ca-pectate layer called:

(1) Primary cell wall (2) Secondary cell wall
(3) Middle lamella (4) Tertiary cell wall

4 A structure that connect the cytoplasm of neighbouring cells, and another which holds or glues the different neighbouring cell together. These are:

(1) cell wall and middle lamella, respectively
(2) plasmodesmata and middle lamella, respectively
(3) middle lamella and desmosomes, respectively
(4) middle lamella and plasmodesmata, respectively

5 Which of the following is absent in algal cell wall?

(1) Galactans (2) Mannans
(3) Cellulose (4) Peptidoglycan

6 The cell wall of a young plant cell, the primary wall is capable of growth, which gradually diminishes as the cell matures and the secondary wall is formed on the:

(1) inner (towards middle lamella) side of the cell.
(2) outer (towards middle lamella) side of the cell.
(3) inner (towards membrane) side of the cell.
(4) outer (towards membrane) side of the cell.

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THANK
YOU