

ARJUNA
NEET 2026

BOTANY

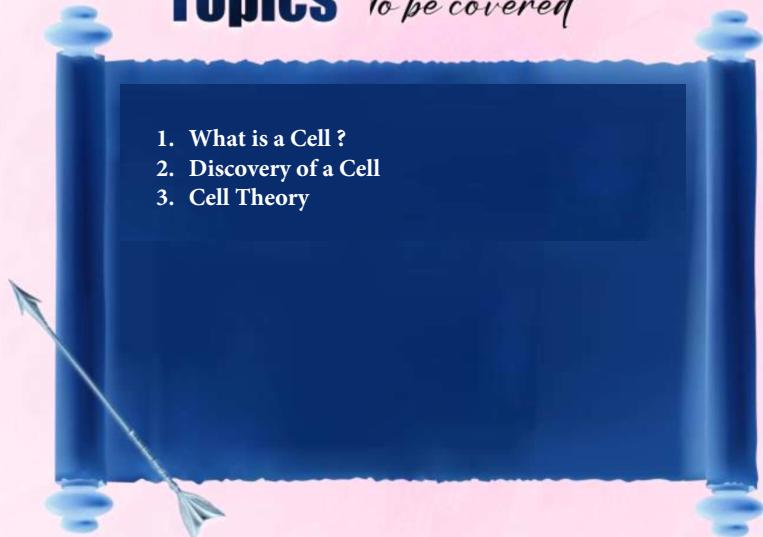
CELL: THE UNIT OF LIFE

Lecture: 01 By: Vipin Sharma Sir



Topics *to be covered*

1. What is a Cell ?
2. Discovery of a Cell
3. Cell Theory



WHO AM I?

- Exams, Medals, Thesis, GSP-21
- Papers, Journals, YSA
- Times 40U40, Entrepreneur 30U30, 2 Startups
- 8+ Years in teaching, 6 Books, Records, helping slum students, Recognitions

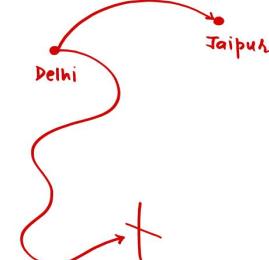
Student **Researcher** **Entrepreneur** **Teacher/ Author**



5 "P" RULE

P_{proper}
P_{lanning}
P_{revents}
P_{oor}
P_{erformance}

• consistant DAY-1
HARDWORK
↓
DIRECTION





BATCH FLOW

NCERT Recap

NCERT Recaps are designed to quickly revise the NCERT book chapters. They include key concepts, formulas, and diagrams.

Punchayat

Punchayat is a platform for students to practice NEET PYQs (Most Important Questions) from 2013-2025. It also includes Minor and Major Tests.

NEET PYQs (Most Important Questions)

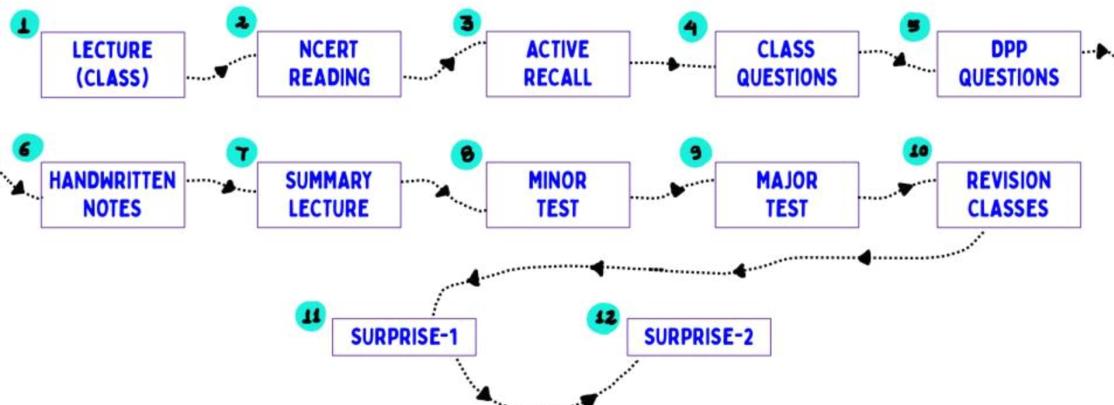
Minor and Major Tests

Yehse Neet 4.0 (2024)

This section displays a screenshot of the Yehse Neet 4.0 (2024) app, which contains various study materials and resources for NEET preparation.



BATCH FLOW SIMPLIFIED



SUCCESS PLANNER

Chapter	Lecture	Punch	PYQ's	Notes	DPPs	Test-1	Test-2	Rev-1	Rev-2	Rev-3	Rev-4
Cell Biology	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cell Cycle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Living World	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓
Plant Kingdom	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Respiration	✗	✓	✓	✗	✓	✓	✓	✓	✗	✓	✓
PGD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Photosynth.	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓





SYLLABUS DECODED

- 1. CELL BIOLOGY
 - 1. Cell: The unit of Life*
 - 2. Cell cycle & cell division

- 2. STRUCTURAL ORGANISATION
 - 3. Morphology of flowering plant
 - 4. Anatomy of flowering plant

- 3. SYSTEMATICS
 - 5. The Living World
 - 6. Biological classification
 - 7. Plant Kingdom

- 4. PLANT PHYSIOLOGY
 - 8. Photosynthesis
 - 9. Respiration
 - 10. Plant Growth & development



CHALIYE SHURU KARTE HAIN!!!

WHAT IS BIOLOGY

Life → Study

- Living organisms
- Living processes
- Origin of Life

2 major BRANCHES

Zoology

Animals की study

Father: Aristotle

Father of BIOLOGY, modern embryology etc.

Botany

Plants की study

Father: Theophrastus



What is a Cell?

* NOTE: Human body have > 200 different types of cells

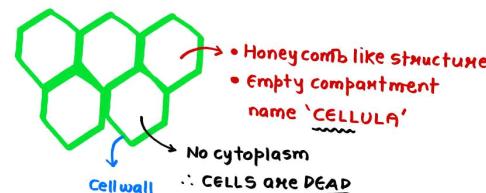
* CELL BIOLOGY: Here we study about structure, function & division of cell



Discovery of a Cell?

① Robert Hooke: 1665

• Observed CORK cells



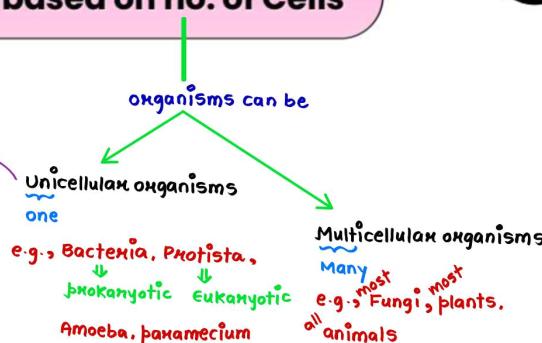
• Robert Hooke wrote a Book named MICROGRAPHIA
→ used simple lenses to watch cork cells





Types of Organisms based on no. of Cells

- 1st feature: capable of independent existence
 - 2nd feature: unicellular organism is capable to perform 'all' functions essential for life
- * Anything less than a cell can't survive independently & can't be called living
e.g., VIRUS is not living



Cell Theory

① Schleiden: German Botanist

↳ 1838



observed many plants & said that "Body of plants is made of various different types of cells which further makes diff. types of tissues"

② Schwann: BRITISH zoologist

↳ 1839



Observed many animal cells & reported a thin layer around them which is called 'CELL MEMBRANE' today

- He then observed plant cells & found out that they have cell wall outer to cell membrane

• HYPOTHESIS: Body of plants & animals are formed of cells & product of cells

③ Rudolf Virchow: 1855

'Omnis-cellula-e-cellula'

④ New cells arise from pre-existing cells

TOGETHER FORMULATED
CELL THEORY

⑤ All organisms are formed up of cells & products of cells

DRAWBACK: They didn't describe the origin of new cells

Hypothesis vs Theory

• Stating something without experimental PROOF

Hypothesis becomes a theory when proved experimentally

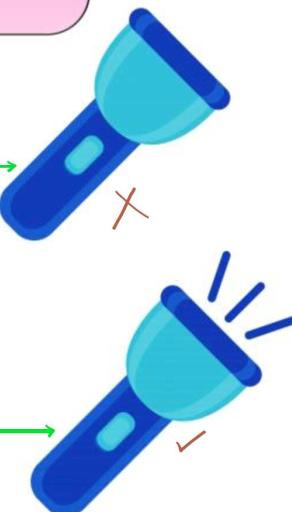


Hypothesis vs Theory



Filament is BROKEN

अपकी मारो





NCERT MAIYAAAA KI READING!!

When you look around, you see both living and non-living things. You must have wondered and asked yourself – ‘what is it that makes an organism living, or what is it that an inanimate thing does not have which a living thing has?’ The answer to this is the presence of the basic unit of life – the cell in all living organisms.

All organisms are composed of cells. Some are composed of a single cell and are called unicellular organisms while others, like us, composed of many cells, are called multicellular organisms.



NCERT MAIYAAAA KI READING!!

8.1 WHAT IS A CELL?

Unicellular organisms are capable of (✓) independent existence and (✓) performing the essential functions of life. Anything less than a complete structure of a cell does not ensure independent living. Hence, cell is the fundamental structural and functional unit of all living organisms.

Anton Von Leeuwenhoek first saw and described a live cell. Robert Brown later discovered the nucleus. The invention of the microscope and its improvement leading to the electron microscope revealed all the structural details of the cell.

1950s
↓



NCERT MAIYAAAA KI READING!!

8.2 CELL THEORY

In 1838, Matthias Schleiden, a German botanist, examined a large number of plants and observed that all plants are composed of different kinds of cells which form the tissues of the plant. At about the same time, Theodore Schwann (1839), a British Zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the ‘plasma membrane’. He also concluded, based on his studies on plant tissues, that the presence of cell wall is a unique character of the plant cells. On the basis of this, Schwann proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.

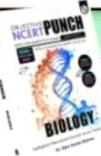
Schleiden and Schwann together formulated the cell theory. This theory however, did not explain as to how new cells were formed. Rudolf Virchow (1855) first explained that cells divided and new cells are formed from pre-existing cells (*Omnis cellula e cellula*). He modified the hypothesis of Schleiden and Schwann to give the cell theory a final shape. Cell theory as understood today is:

- ✓ all living organisms are composed of cells and products of cells.
- ✓ all cells arise from pre-existing cells.



NEET-2014

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 Cell was discovered by:

- (1) Flemming
- (2) Leeuwenhoek
- (3) Robert Hooke
- (4) Robert Brown

live

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

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

4 Theodore Schwann, reported that cells had a thin outer layer which is today known as the:

- (1) Tonoplast
- (2) Plasma membrane
- (3) Basement membrane
- (4) Biological membrane

5 *Omnis cellula-e cellula* is a generalisation given by:

- (1) Schwann.
- (2) Camillo
- (3) Leeuwenhook
- (4) Virchow

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

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

7 Who proposed the theory that states all cells arise from the pre-existing cells?

- (1) Mohl
- (2) Virchow
- (3) Haeckel
- (4) Robert Brown

QUESTIONS AND PYQs



8 Cell theory states that:

- (1) all cells arise from pre-existing cells.
- (2) all living organisms are composed of cells and products of cells.
- (3) all cells are living.
- (4) both (1) and (2).

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

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



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, 2, 4, 5, 6, 9, 10, 11

Exercise-2: 1, 4



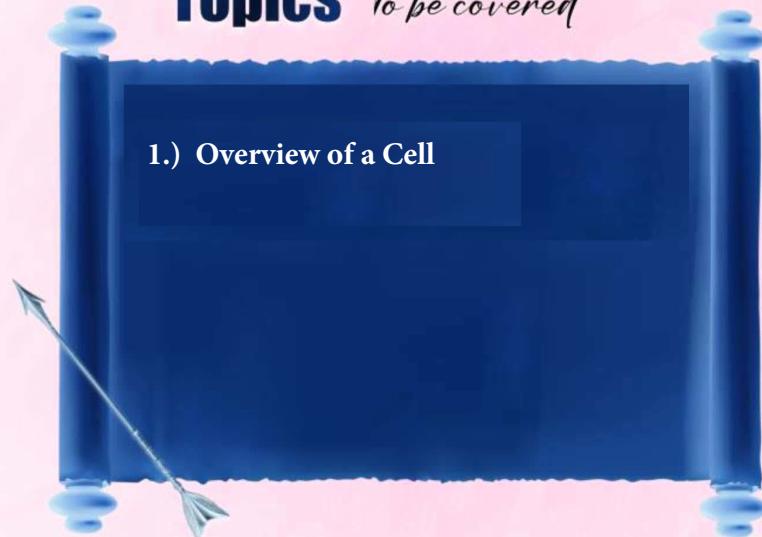


BOTANY
CELL: THE UNIT OF LIFE
Lecture: 02 By: Vipin Sharma Sir

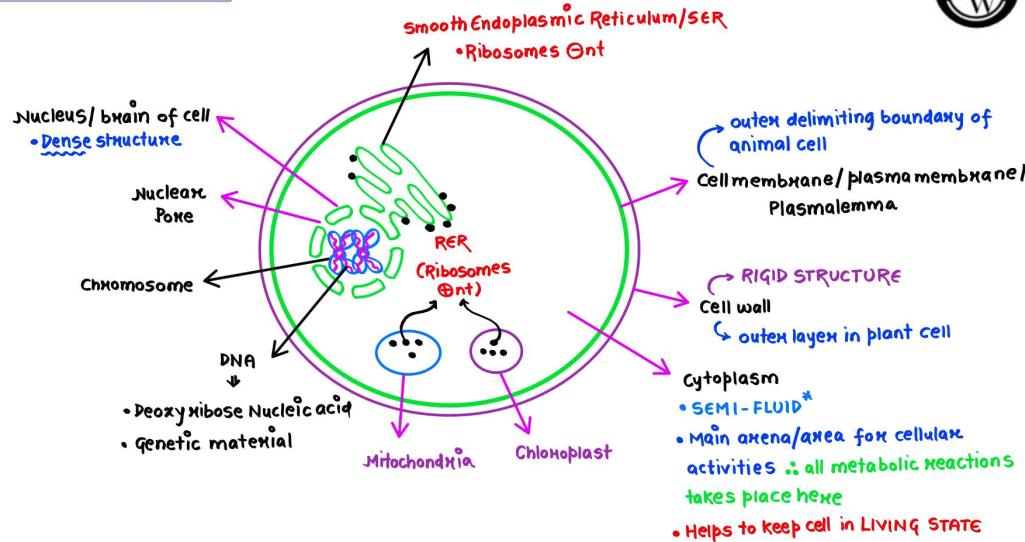


Topics to be covered

1.) Overview of a Cell



OVERVIEW OF A CELL

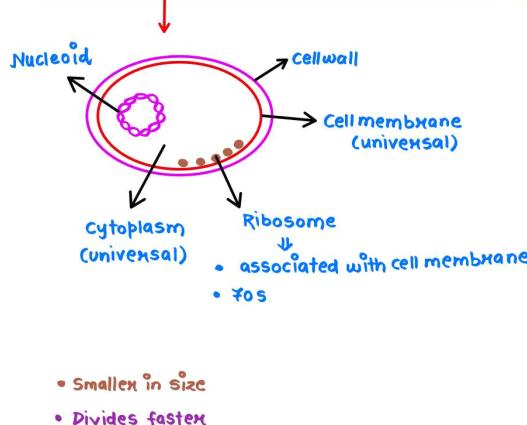


PROKARYOTIC CELL VS EUKARYOTIC CELL

- | | |
|---|--|
| <ul style="list-style-type: none"> • Prok. Karyon
• 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 | <ul style="list-style-type: none"> Eu. Karyon
• True / well defined • In eukaryotic nucleus, nuclear envelope/membranes are present • Membrane bound organelles are present • Cell membrane present • Usually bigger • Ribosome = 80S, 70S |
|---|--|

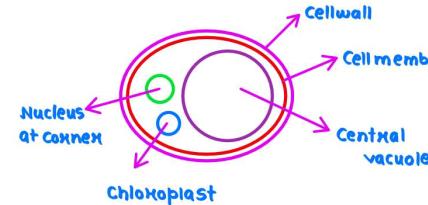


PROKARYOTIC CELL VS EUKARYOTIC CELL

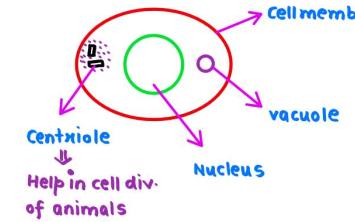


PLANT CELL VS ANIMAL CELL

- Plant Cell:**
- Cell wall present
 - Chloroplast present
 - Central vacuole present
 - Absent



- Animal Cell:**
- Absent
 - Absent
 - Absent
 - Centrioles & Centrosome present



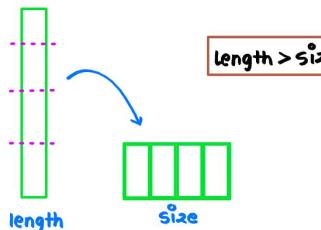
TRICK

Cell wall
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

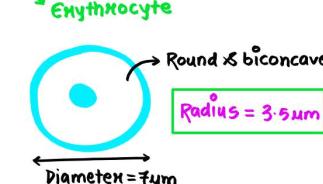
LENGTH AND SIZE



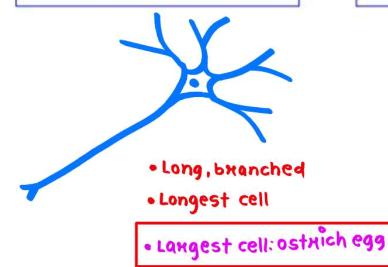
- Length of bacteria: 3-5 μm
 - Size of typical prokaryotic cell: 1-2 μm
 - Length of mycoplasma: 0.3 μm (prokaryotic)
 - smallest living cell
 - Size of PPLO: Pleuro-pneumonia Like organism: 0.1 μm
 - Type of mycoplasma
 - Virus size: 0.02-0.2 μm (NOT LIVING)
- Euk. cell is 10x bigger
~ 10-20 μm



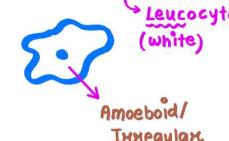
RED BLOOD CELL



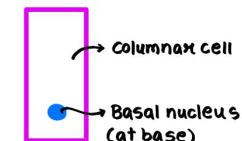
NERVE CELL



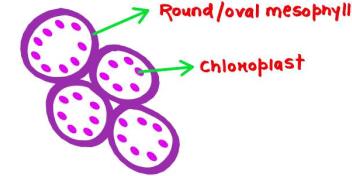
WHITE BLOOD CELL



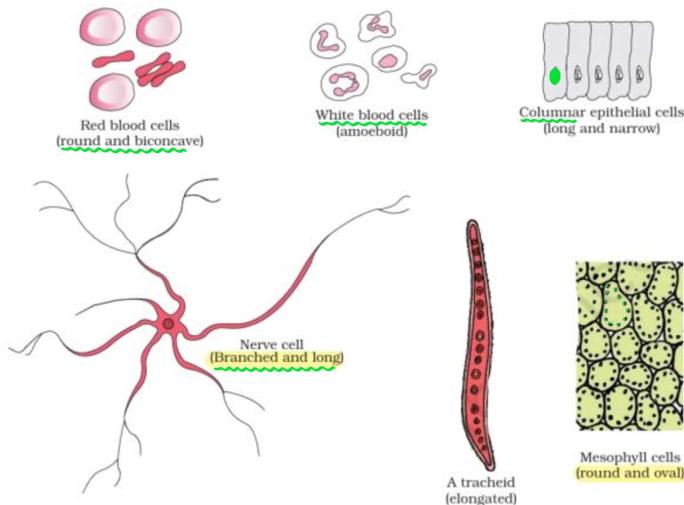
COLUMNAR EPITHELIUM



MESOPHYLL CELL



CELLS VARY GREATLY IN SHAPE, SIZE AND ACTIVITY



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'.



NCERT MAIYAAAA KI READING!!

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. The prokaryotic cells lack such membrane bound organelles.

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.

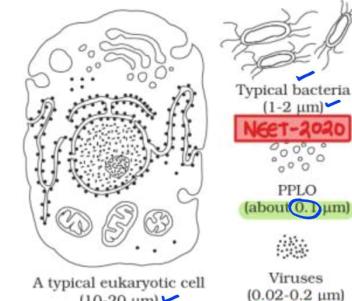


Figure 8.2 Diagram showing comparison of eukaryotic cell with other organisms

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?

- () 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
- () Cytoplasm
- (4) Ribosome

4 Ribosomes are found in;

- (1) Prokaryotic cells only
- () 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
- () Plasma membrane

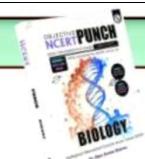
6 Which of the following is the largest isolated single cell?

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

7 The shape of human red blood cell is:

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

QUESTIONS AND PYQs



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
- II. Ostrich eggs
- III. Human RBC
- IV. Bacteria
- () 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

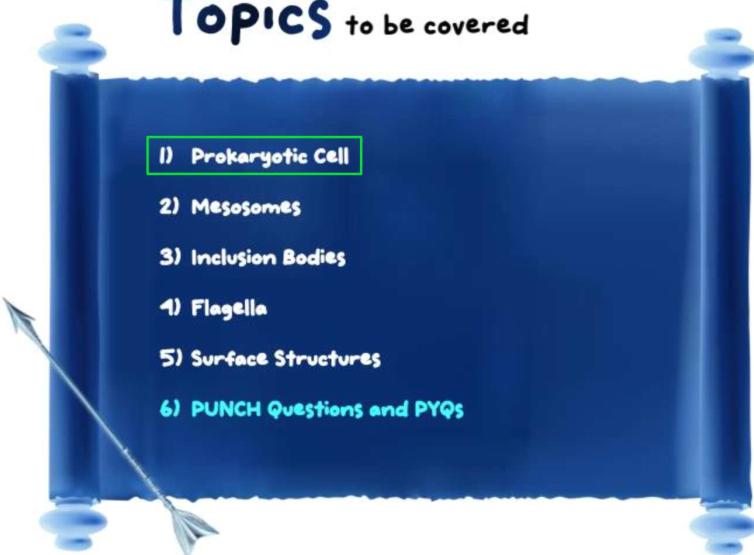


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BOTANY

CELL: THE UNIT OF LIFE

Lecture: 03 By: Vipin Sharma Sir



PROKARYOTIC ORGANISMS

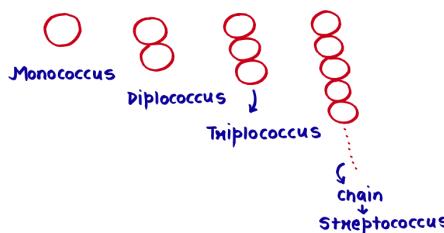
- Pro: Primitive/ less developed
Karyon: Nucleus
∴ do not have a well defined nucleus
- e.g., All bacteria, mycoplasma, Pleuro pneumonia like organism (PPLO)
- Cyanobacteria or Blue-Green Algae (BGA)
Blue Photosynthetic
- Prokaryotic cells are smaller than eukaryotic cell & they divide faster
Size = 1-2 μm Size = 10-20 μm
10X
- E. coli = 20 minutes
Human cheek cell = 24 hours



PROKARYOTIC ORGANISMS

Bacteria has 4-shapes:

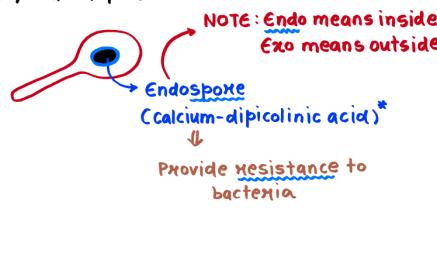
① Coccus/mound



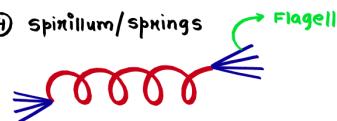
③ Vibrio/comma-shaped



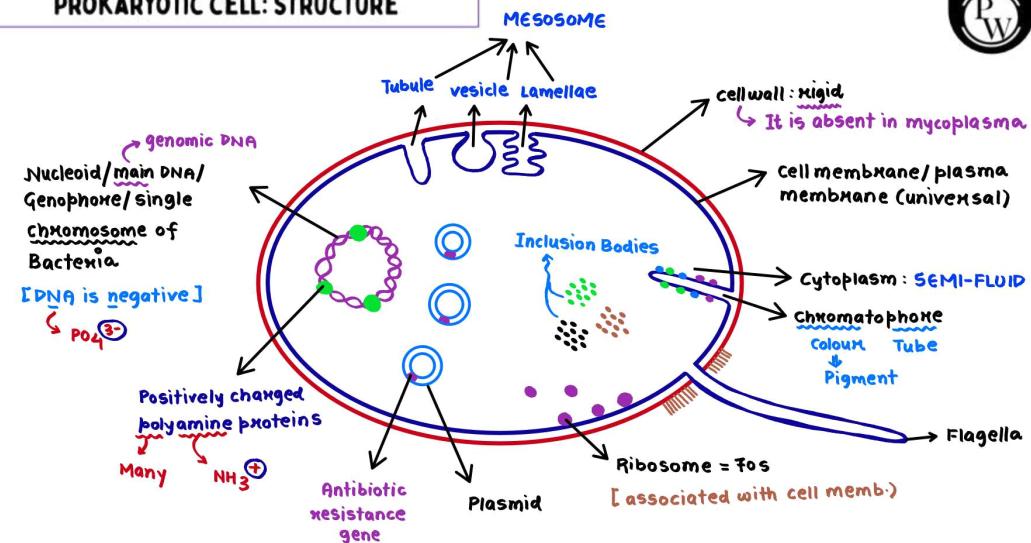
② Bacillus/rod-shaped



④ spirillum/springs



PROKARYOTIC CELL: STRUCTURE



PROKARYOTIC CELL: FEATURES

CELL WALL & CELL MEMBRANE

- Rigid

- Mycoplasma: cellwall was absent

↳ Pleiomorphic/ Janken change

↳ morphology/ shape

Flexible

• Formed up of Lipid & protein

NUCLEOID AND PLASMIDS

double stranded circular DNA

Main genetic material

NOTE:
Eubacteria = Peptidoglycan
Archaeabacteria → Pseudomurein

- Acts as a gene-taxi & helps to transfer any gene(DNA) in bacteria
- circular
- double stranded DNA
- Extrachromosomal
- Replicate independently
- Provides some phenotypic characters to bacteria like antibiotic resistance*
- donot need permission of NUCLEOID
- structure related



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 MAIYAAA 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.

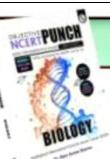


Punchayat

with Vipu Sir



QUESTIONS AND PYQs



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

- Respiration
- DNA replication
- Increases enzymatic content
- Reproduction

2 The genetic material of prokaryotic cells is called:

- Nucleus
- Nucleolus ^{found in}
- Nucleoid
- Centrosome

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

- Nuclear envelope
- Ribosome
- Mesosome
- Plasma membrane

4 Prokaryotic cell does not have:

- Nucleolus
- Membrane bound organelles
- Centrioles
- All of these

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

- Filament
- Hook
- Basal body
- Shaft

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

- Two parts – pili and fimbriae
- Three parts – filament, hook and basement membrane
- Three parts – filament, shaft and basal body
- Three parts – filament, hook and basal body



QUESTIONS AND PYQs

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:

- Statement-I is correct but Statement-II is incorrect.
- Statement-I is incorrect but Statement-II is correct.
- Both Statement-I and Statement-II are correct.
- Both Statement-I and Statement-II are incorrect.

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

- These are involved in ingestion of food particles.
- They lie free in the cytoplasm
- These represent reserve material in cytoplasm
- They are not bound by any membrane

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

- Gas vacuoles
- Centrioles
- Microtubules
- 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



ARJUNA
NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

Lecture: 04 By: Vipin Sharma Sir

The logo features a blue and silver shield with two green crosses at the top, a blue ribbon banner across the middle, and a pink arrow pointing upwards on the right side.

Vipin Sharma Sir is shown from the chest up, wearing a white polo shirt with a small 'PW' logo on the left chest.

The scroll graphic on the right lists topics to be covered, with a magnifying glass icon over a cell diagram.

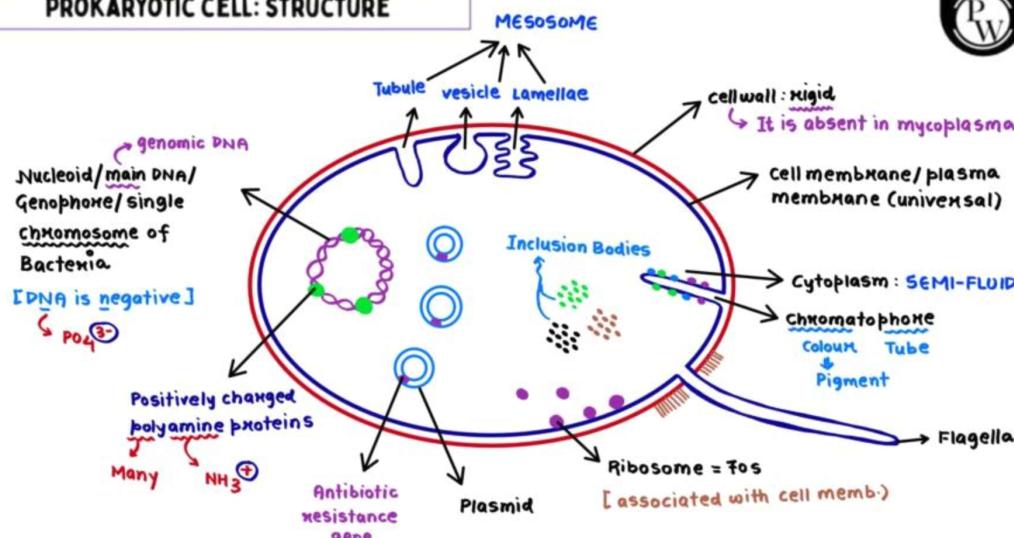


Topics to be covered

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

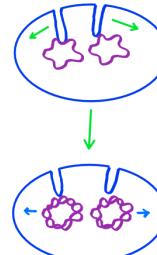
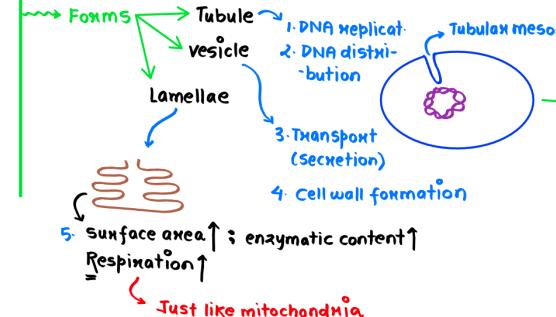


PROKARYOTIC CELL: STRUCTURE



MESOSOME

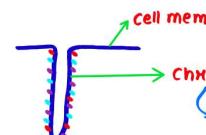
- folds inside the cell
- formed by extension / invagination of cell membrane
- characteristic feature of prokaryotic cell



CHROMATOPHORE

- Colour
- Elongated structure
- due to presence of pigments

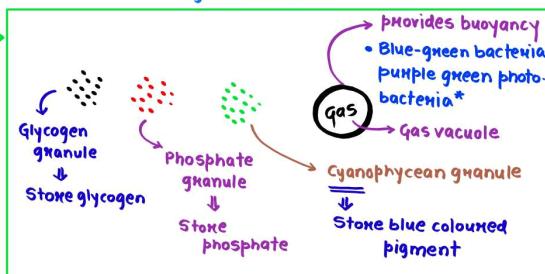
- Infolding of cell membrane*



cell membrane

chromatophore

e.g., Blue-green algae or cyanobacteria

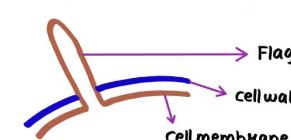


INCLUSION BODIES

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

SURFACE STRUCTURES

- ① Flagella: • Ont in non-motile bacteria
• Ont in motile bacteria

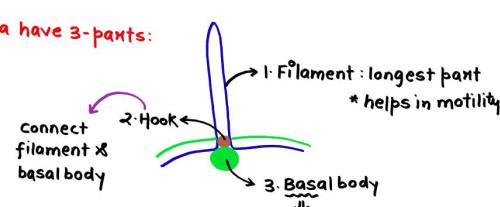


outfolding of cell memb.

1. Extension of cell membrane

2. Extended from cell wall → Crashed cell wall

Flagella have 3-parts:



- * Flagella in prok & eukaryotes is different

Flagellin protein

Tubulin protein

Helps in the transfer of plasmid / DNA



- ② Pili: • Tubular, elongated structure

• Connects 2 bacteria

• Formed of special protein called 'PILIN' protein

SURFACE STRUCTURES

③ Fimbriae: formed of 'fimbrin protein'

- Small bristle like structure found on surface of bacteria
- helps in anchorage/attachment



anchorage on surfaces like rocks, host tissue

NOTE: Pili & Fimbriae have no role in motility



NCERT MAIYAAA 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 MAIYAAA KI READING!!

NCERT MAIYAAA 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.

3-parts → 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.

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-2014

NEET-2015

NEET-2014

NEET-2016

NEET-2015

Green = photosynthetic
due to chlorophyll

NEET-2018,16

NEET-2020,15



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.

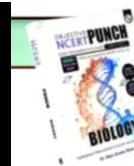
Inclusion bodies: Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies. These are not bound by any membrane system and lie free in the cytoplasm, e.g., phosphate granules, cyanophycean granules and glycogen granules. Gas vacuoles are found in blue green and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

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 X

Surface area
respiration ↑

2 The genetic material of prokaryotic cells is called:

- (1) Nucleus
- (2) Nucleolus
- X Nucleoid
- (4) Centrosome

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

- X Nuclear envelope
- (2) Ribosome
- (3) Mesosome
- (4) Plasma membrane

4 Prokaryotic cell does not have:

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

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

- X 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

QUESTIONS AND PYQs



Homework



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. X
- (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)

- X Gas vacuoles
- (2) Centrioles X
- (3) Microtubules
- (4) Contractile vacuoles

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

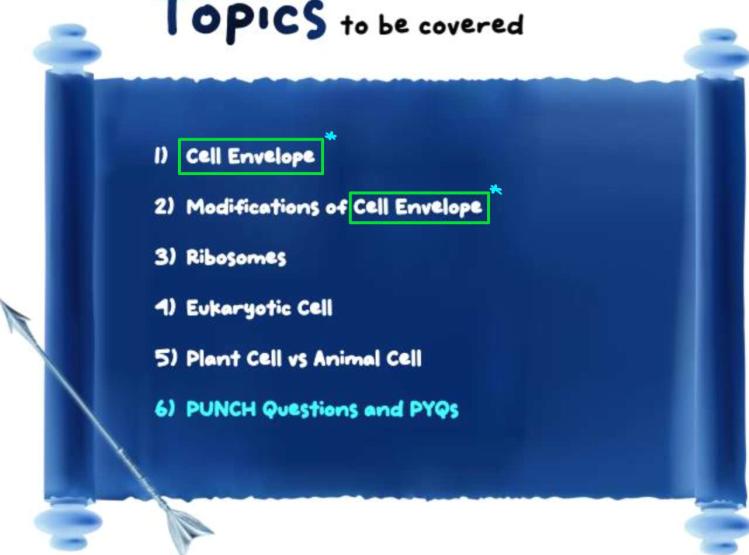


ARJUNA NEET 2026

BOTANY

CELL: THE UNIT OF LIFE

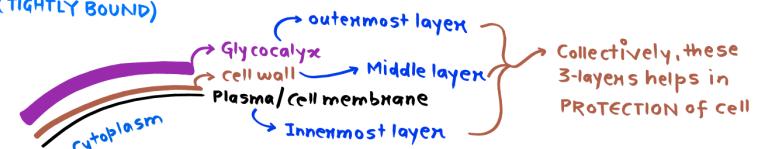
Lecture: 05 By: Vipin Sharma Sir



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 → Cova



CELL ENVELOPE

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

② Cell wall: RIGID

- Maintains structure & shape of bacterial cell
- Prevents the bursting & collapsing of bacterial cell

③ Plasma membrane: It is "selectively permeable"

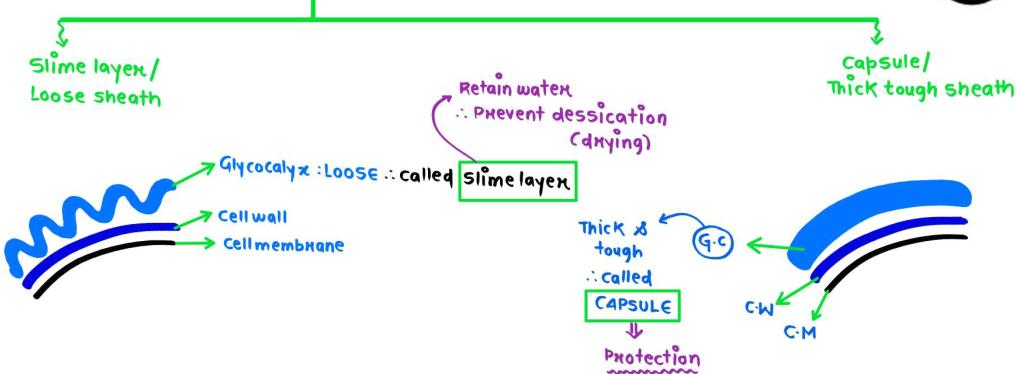
- It allows only selected molecules to come in & out of the cell
- It INTERACTS with the outside world

* Cell wall is highly permeable

Cell wall stops only heavy macromolecules



MODIFICATIONS OF CELL ENVELOPE

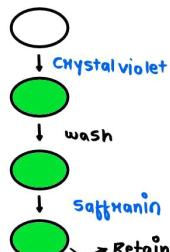


GRAM STAINING

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

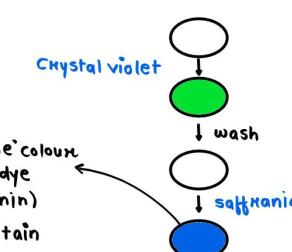


Gram positive
Retains the stain



Gram negative

E. coli
Do not retain the stain



RIBOSOMES

- Universal organelle; membrane-less organelle
- smallest cell organelle

15-20 nanometer (nm)
 \downarrow
 10^{-9} m

also called as 'palade particle'

discovered by George Palade in 1953

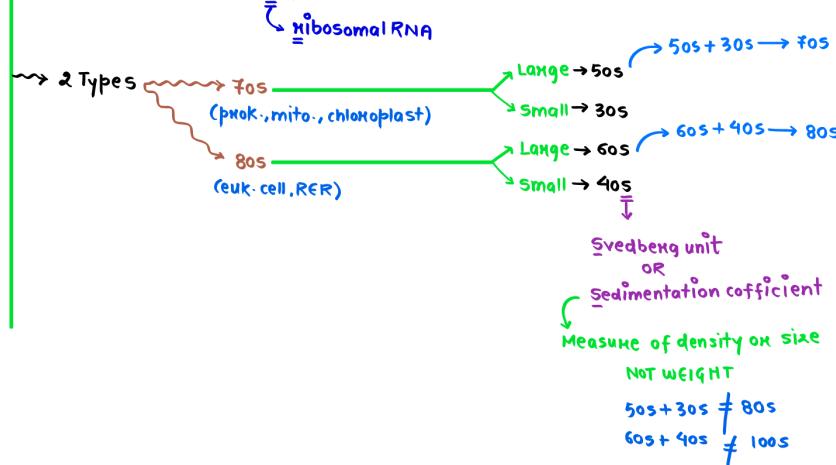
after advancement of electron microscopy

also called 'PROTEIN FACTORY'

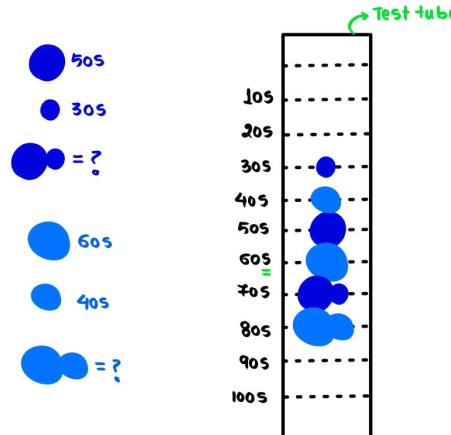


RIBOSOMES

~ Structure: Granular
~ Formed of: Protein + mRNA

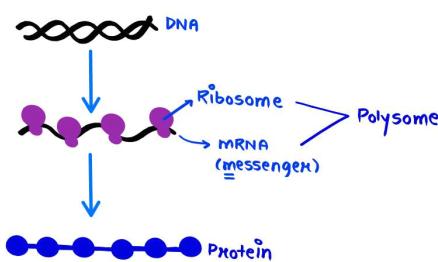


RIBOSOMES



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, ER, G.C, nucleus 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.

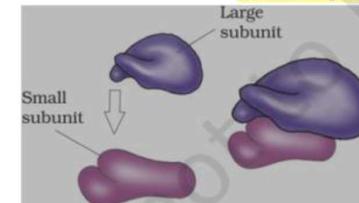


Figure 8.9 Ribosome

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



GC
CW
CM

QUESTIONS AND PYQS

- 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



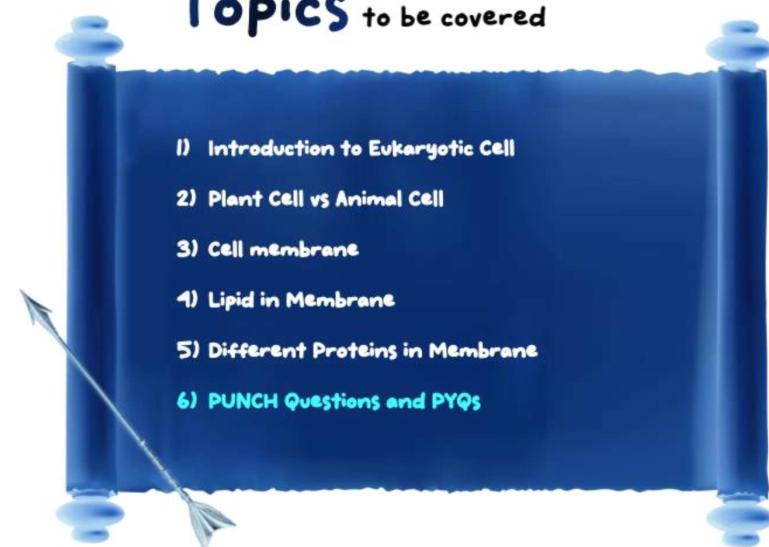
ARJUNA
NEET 2026
BOTANY
CELL: THE UNIT OF LIFE

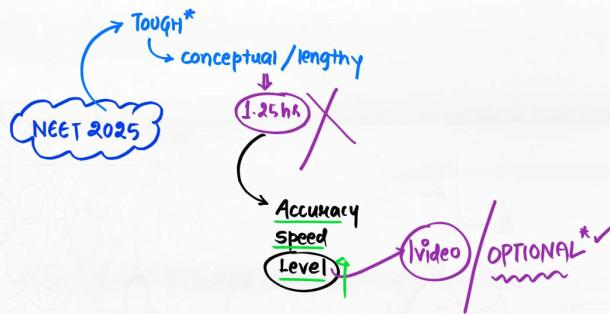
Lecture: 06 By: Vipin Sharma Sir



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





1 From the statements given below choose the correct option:

- The eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S. ✓
 - Each ribosome has two sub-units. ✓
 - The two sub-units of 80S ribosome are 60S and 40S while that of 70S are 50S and 30S. ✓
 - The two sub-units of 80S ribosome are 60S and 20S and that of 70S are 50S and 20S.
 - The two sub-units of 80S are 60S and 30S and that of 70S are 50S and 30S
- (✓) 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:

- (✓) Mesosome (2) Chromatophores X
(3) Cristae X (4) Endoplasmic Reticulum X

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 occurs

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

* Eukaryotes have complex locomotory & cytoskeletal structures

Prok: flagella: Flagellin protein

Euk: flagella: Tubulin protein

lower
Higher/complex

Cyto: cell skeletal: Frame

↓
Prok. = MHC protein

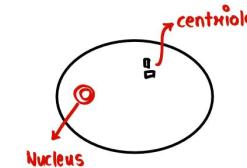
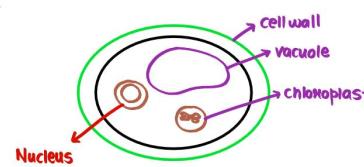
Euk. = Actin & more

↓
complex

PLANT CELL VS ANIMAL CELL

Plant cell

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

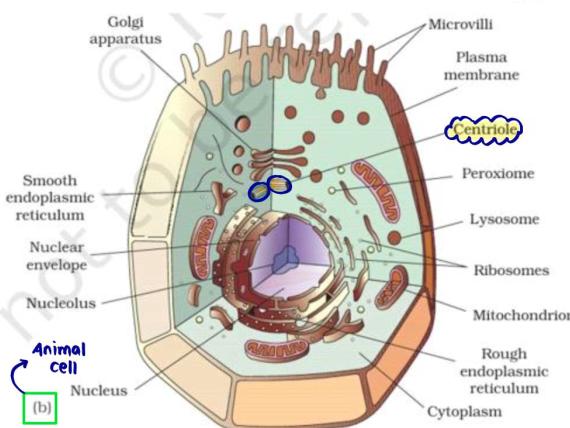
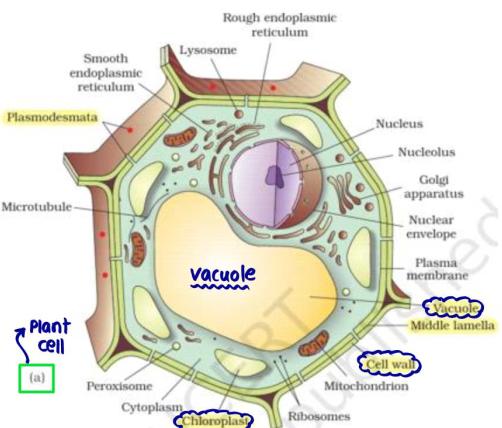


Animal cell

- ⊕nt
- ⊕nt
- ⊕nt
- Centrioles ⊕nt

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

PLANT CELL AND ANIMAL CELL



CELL MEMBRANE

→ Universal structure found in all cells

→ also called plasma membrane or plasmalemma

Membrane

→ Selectively permeable

→ Due to advancement of electron microscopy, the structure of cell membrane was elaborated well after 1950s.

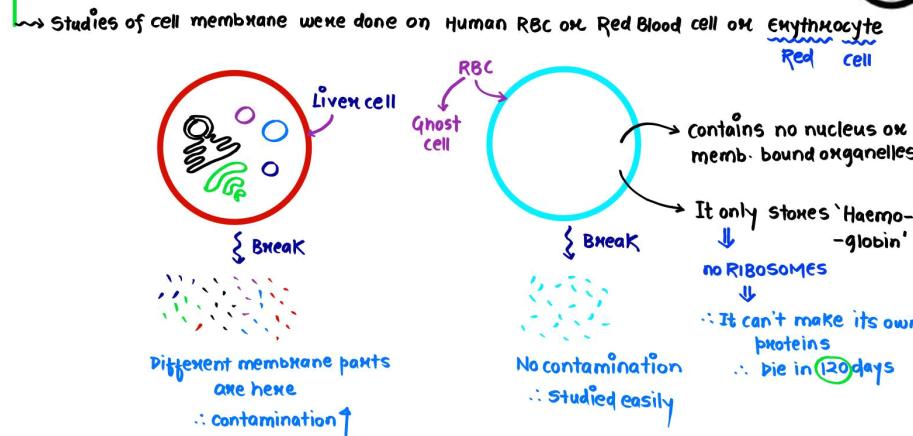
→ Flexible

→ Largely formed of Lipid & Protein

→ Membranes of all kinds are largely lipid & proteins

carbohydrates & cholesterol may also be part

CELL MEMBRANE



LIPID

→ In RBC: Ratio of protein & Lipid is 52:40

→ Rest 8% is carbohydrate & cholesterol

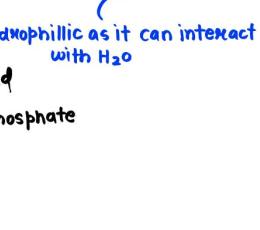
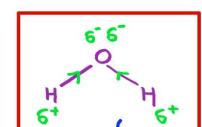
→ Ratio of protein & lipid vary in different membranes
e.g., Myeline sheath has 70-80% lipid

→ Lipid: Main lipid that makes membrane is phospholipid

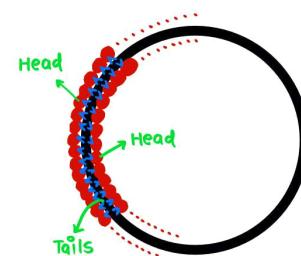
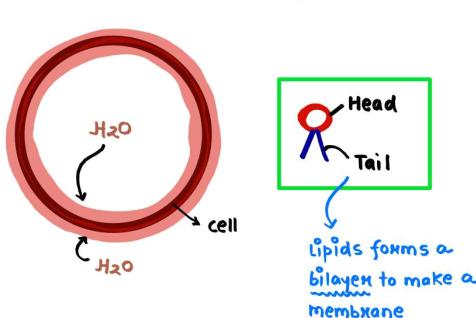
Hydrophobic
H₂O Fear

Single bond
INCERT
Saturated or unsaturated
Hydrocarbon Tail
Hydrogen & carbon
Non-polar
can't interact with H₂O
Hydrophobic

H ← C



LIPID



NCERT MAIYAAAA KI READING!!

8.5 EUKARYOTIC CELLS

Monera को देखके एवं

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.

Punchayat

with Vipu Sir



QUESTIONS AND PYQs



1 Cell membranes possess 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 ✗
- (✓) Cell wall
- (4) Mitochondrion ✗

3 A plant cell has:

- (✗) a large central vacuole and rigid cell wall.
- (2) a centriole for cell division.
- (3) a centromere 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
- (✓) 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)

- (✓) 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





BOTANY

CELL: THE UNIT OF LIFE

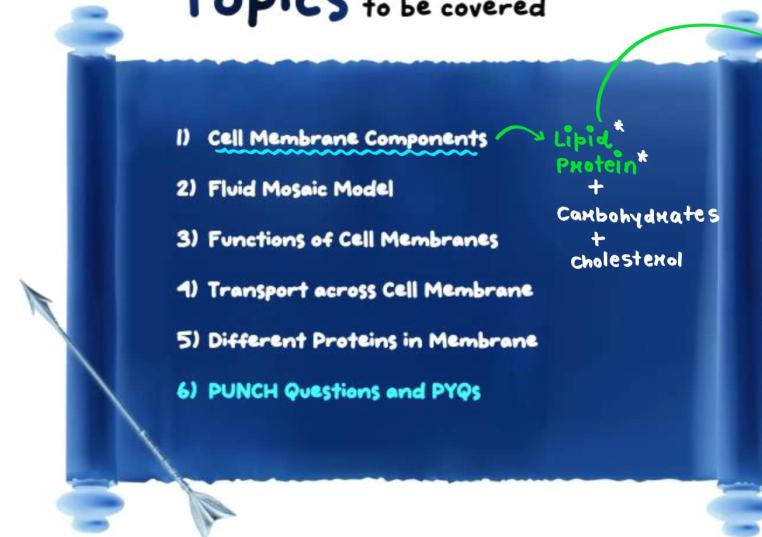
Lecture: 07 By: Vipin Sharma Sir



Topics to be covered

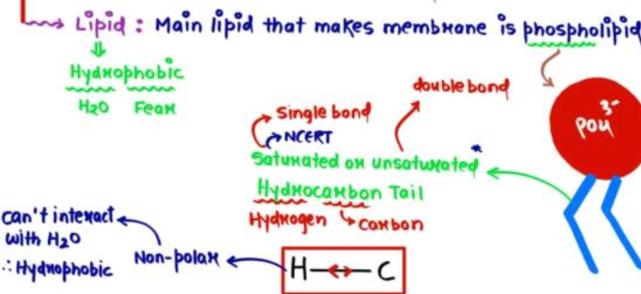
- 1) Cell Membrane Components
 - Lipid *
 - Protein *
 - + Carbohydrates
 - + Cholesterol
- 2) Fluid Mosaic Model
- 3) Functions of Cell Membranes
- 4) Transport across Cell Membrane
- 5) Different Proteins in Membrane
- 6) PUNCH Questions and PYQs

Phospholipid/
phosphoglycer-

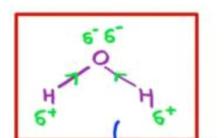


LIPID

- In RBC: Ratio of protein & Lipid is 52:40
 $\frac{52}{40}$
- Rest 8% is carbohydrate & cholesterol
- Ratio of protein & lipid vary in different membranes
e.g., Myeline sheath has 70-80% lipid

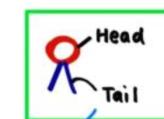
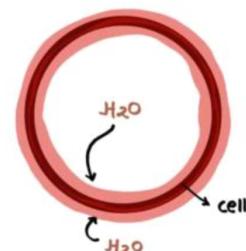


LIPID

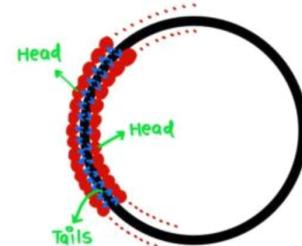


Hydrophilic as it can interact with H₂O

Hydrophilic Head due to phosphate

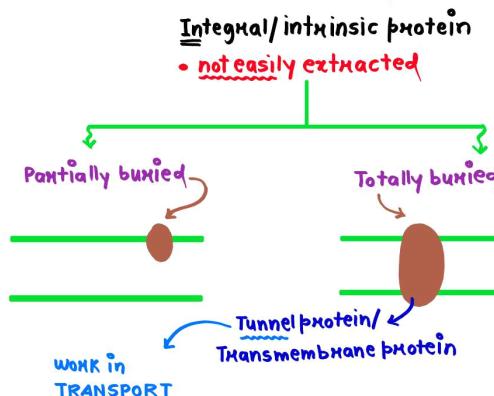
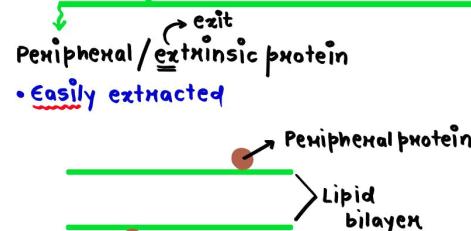


Lipids forms a bilayer to make a membrane



TYPES OF PROTEINS IN CELL MEMBRANE

on the basis of ease of extraction



FLUID MOSAIC MODEL OF CELL MEMBRANE

Given by Singer & Nicolson in 1972

Fluid-mosaic model

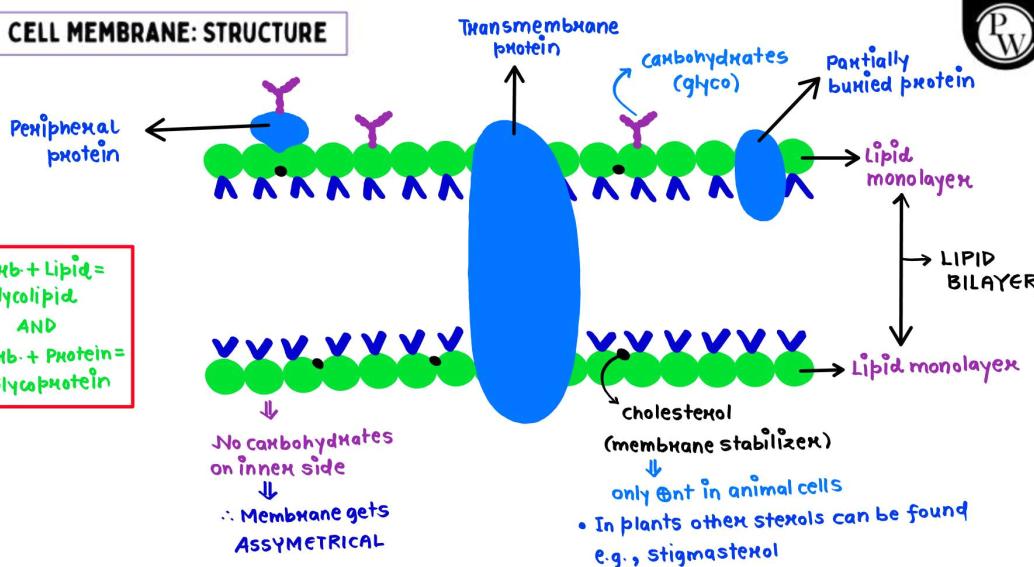
Protein: they are randomly distributed in lipid bilayer
Lipid
(can show fluidity)

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

Quasi-fluid
Glass-like

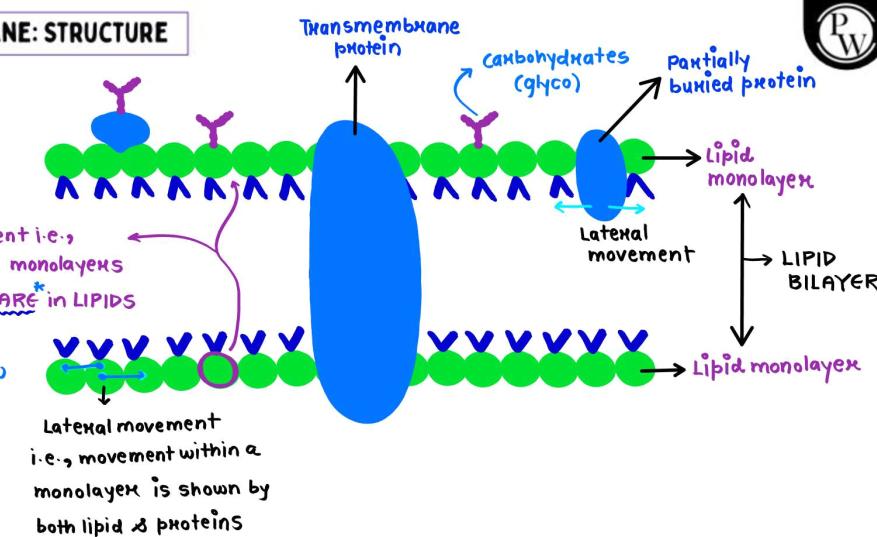
CELL MEMBRANE: STRUCTURE

Carb + Lipid = Glycolipid
AND
Carb + Protein = Glycoprotein

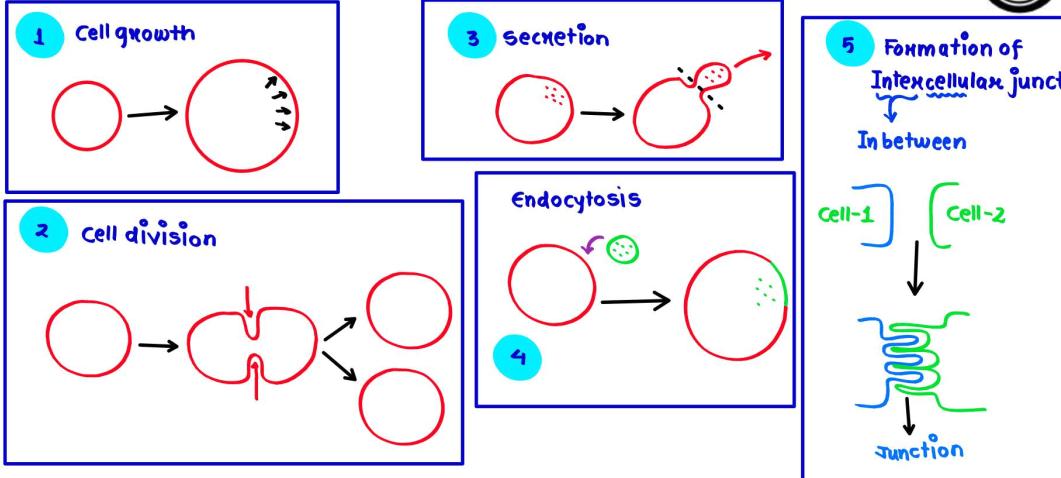


CELL MEMBRANE: STRUCTURE

Flip-flop movement i.e., movement b/w 2 monolayers
IS EXTREMELY RARE* in LIPIDS
BUT PROTEINS CAN NEVER* SHOW FLIP FLOP

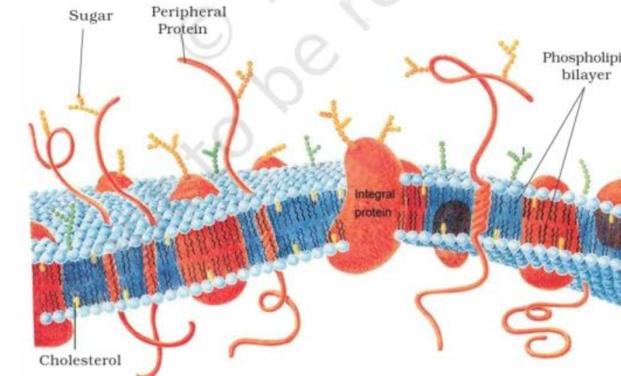


CELL MEMBRANE: FUNCTIONS



NCERT MAIYAAA 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 MAIYAAA KI READING!!

NEET-2012

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 MAIYAAA 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.

NEET-2012



Punchayat

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;

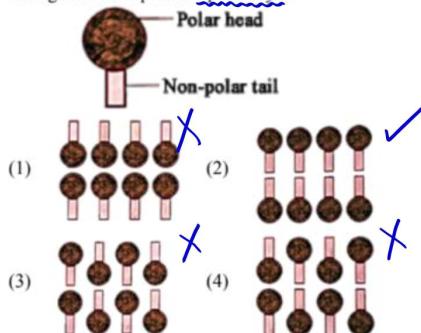
- (1) Cellulose, hemicellulose
- (2) Phospholipid and integrated protein
- (3) Phospholipid, integral protein and peripheral protein
- (4) Phospholipid and hemicellulose

more
connect

QUESTIONS AND PYQs



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?



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



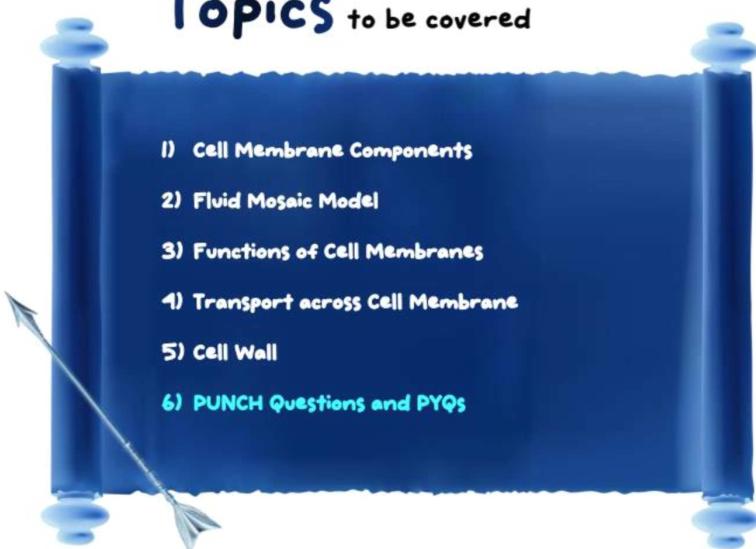


ARJUNA NEET 2026

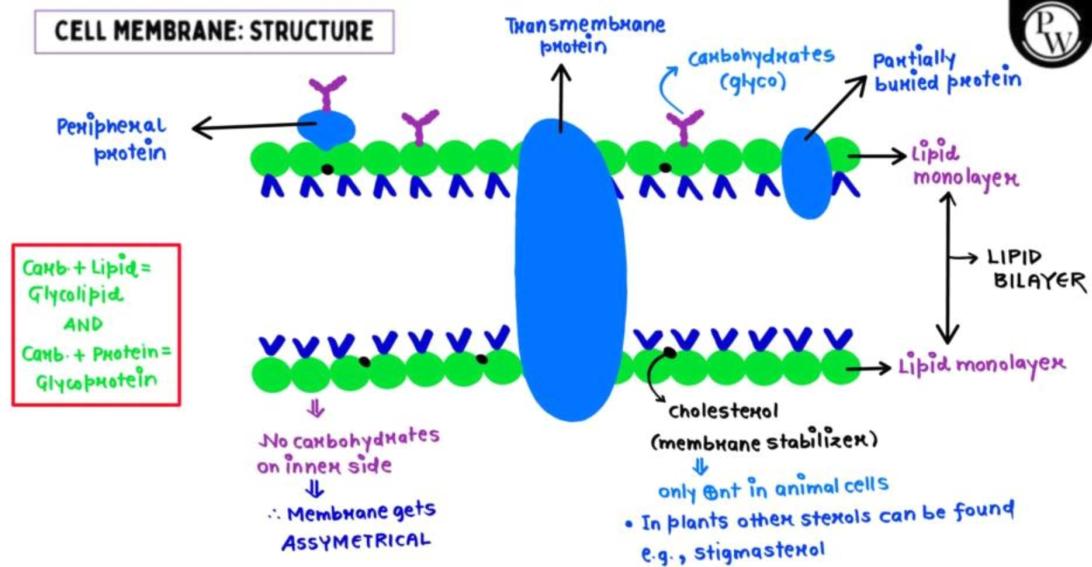
BOTANY

CELL: THE UNIT OF LIFE

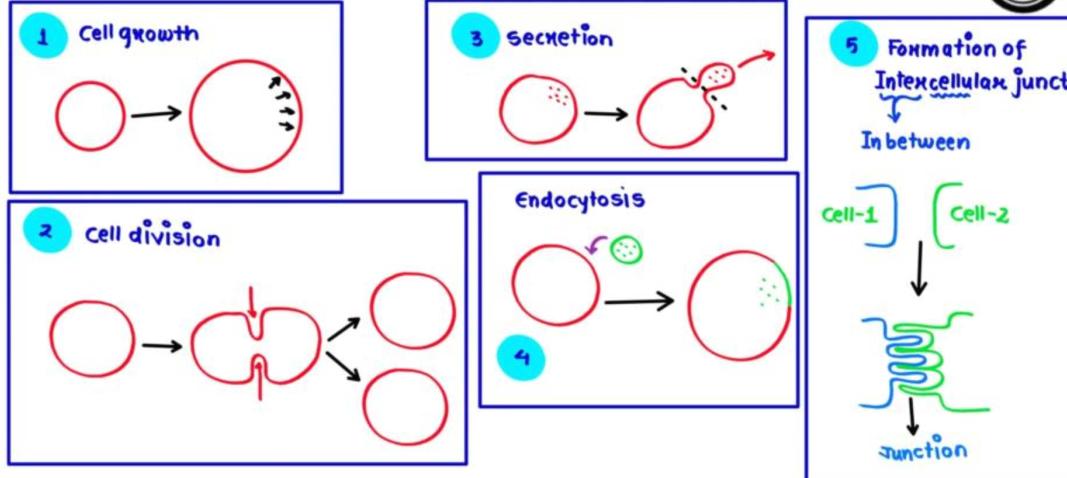
Lecture: 08 By: Vipin Sharma Sir



CELL MEMBRANE: STRUCTURE



CELL MEMBRANE: FUNCTIONS



TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

PASSIVE TRANSPORT

- No energy (ATP) needed
- Substances will move along the concentration gradient (\uparrow conc. to \downarrow conc.)
- DOWNHILL movement



ACTIVE TRANSPORT

- ATP or energy is needed
- Substances move AGAINST the conc. gradient (\downarrow conc. to \uparrow conc.)
- UPHILL movement



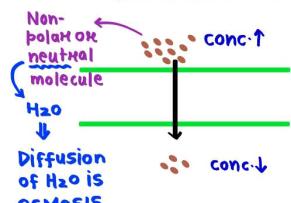
TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

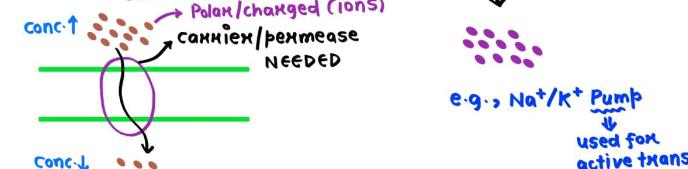


PASSIVE TRANSPORT

Simple diffusion
(\uparrow conc. to \downarrow conc.)



Facilitated Diffusion
(\uparrow conc. to \downarrow conc.)



TRANSPORT ACROSS CELL MEMBRANE

- selectively permeable
- Transport are of 2 Types

ACTIVE TRANSPORT

PASSIVE 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

ACTIVE TRANSPORT

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)

→ Archaeabacteria: Pseudomurein

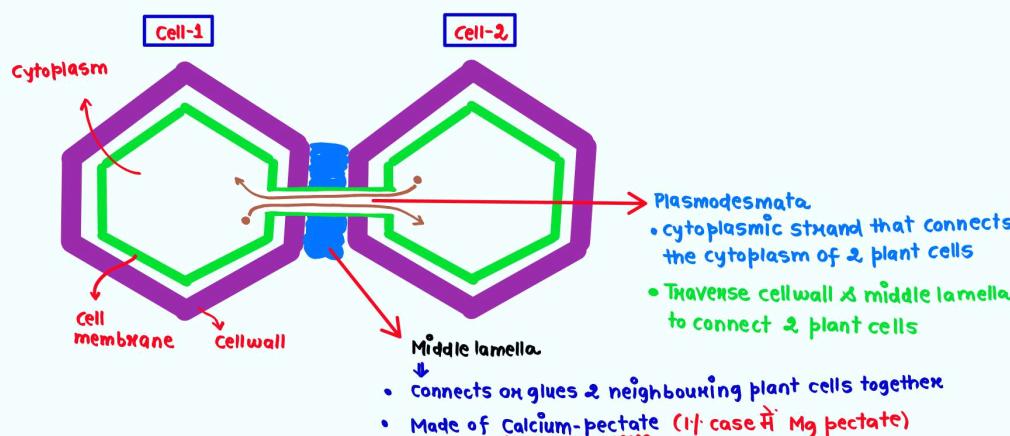
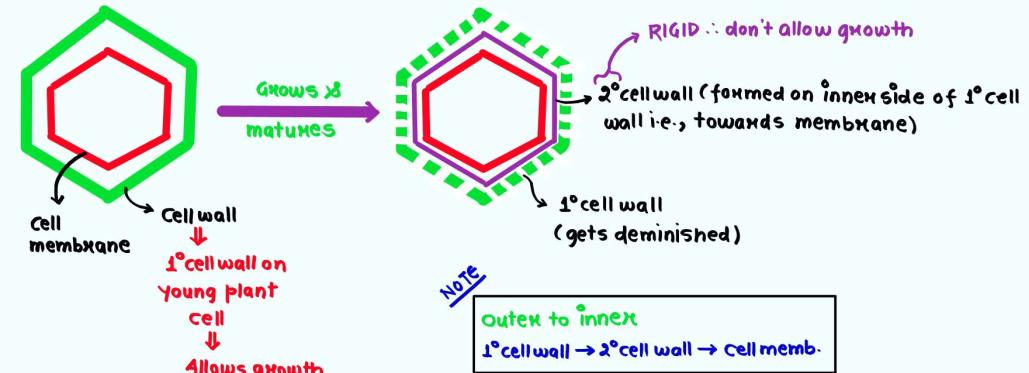
Eubacteria: Peptidoglycan/murein

Fungi: Chitin

Algae: Cellulose + Galactans + Mannans + Minerals like CaCO₃

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

Animals: Ent



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.



NCERT MAIYAAA KI READING!!

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.

NEET-2013

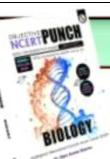


Punchayat

with Vipu Sir



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 connects 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.



Homework

Solve **OBJECTIVE NCERT PUNCH TOPIC WISE QUESTIONS**

Revise concepts from **Botany MED EASY Book** or from **Class Notes**

Module Questions

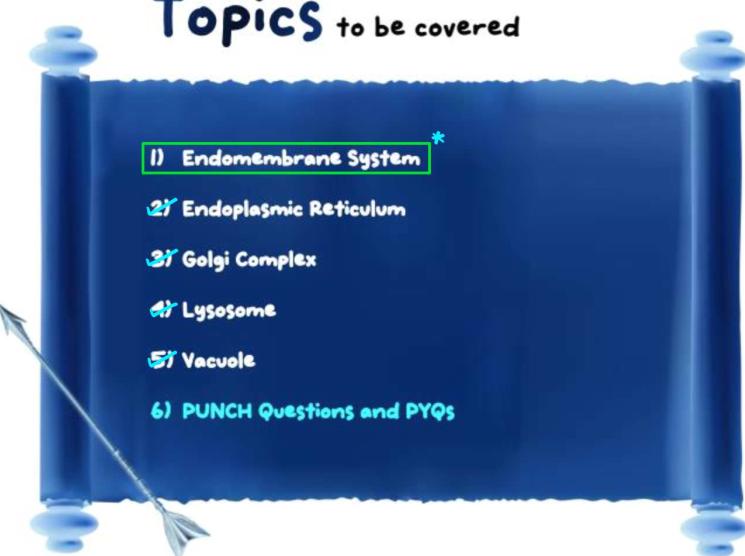
Aarambh: 2, 4, 5, 10, 11, 12, 13

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





ENDOMEMBRANE SYSTEM

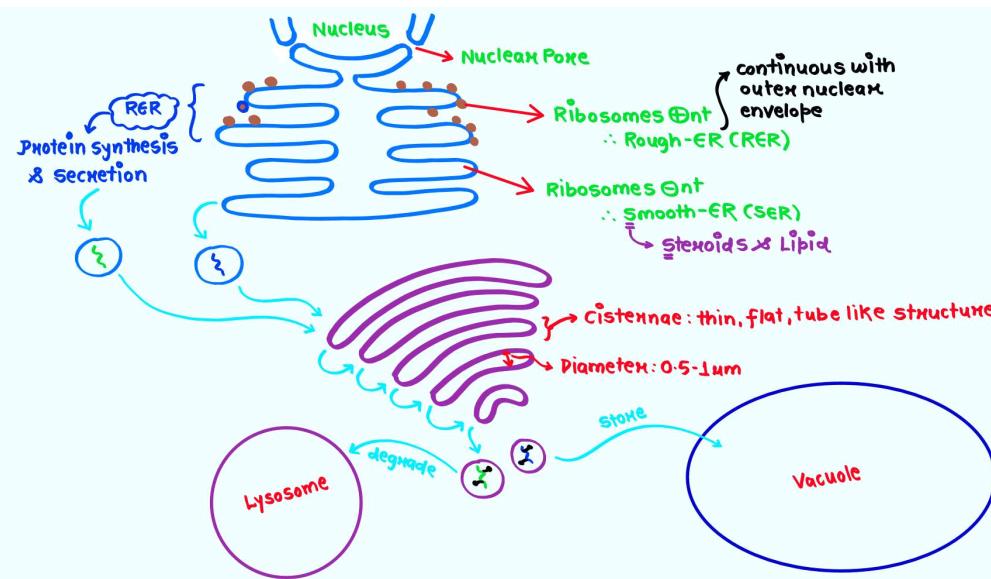
- Endo: Inside cell
- Membrane: vesicles
- System: coordination

- All organelles in a cell have distinct/ different structure & functions
BUT
Some organelles function are coordinated as they are connected by VESICLES

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

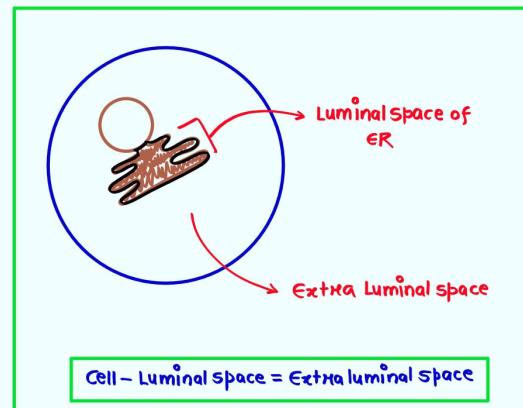
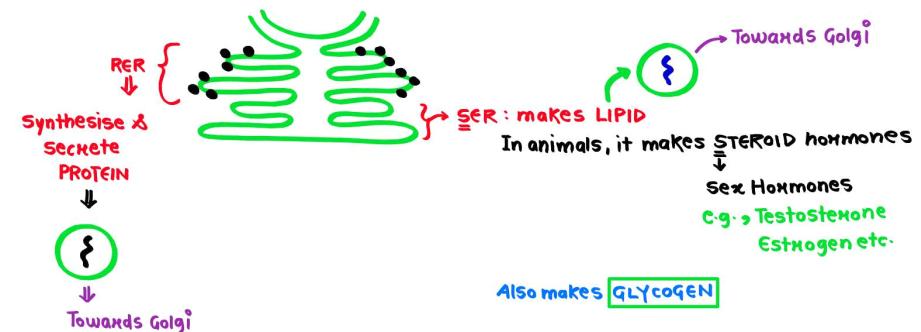
- NOTE: Mitochondria, chloroplast, peroxisome are 'NOT' parts of Endomemb. system





ENDOPLASMIC RETICULUM

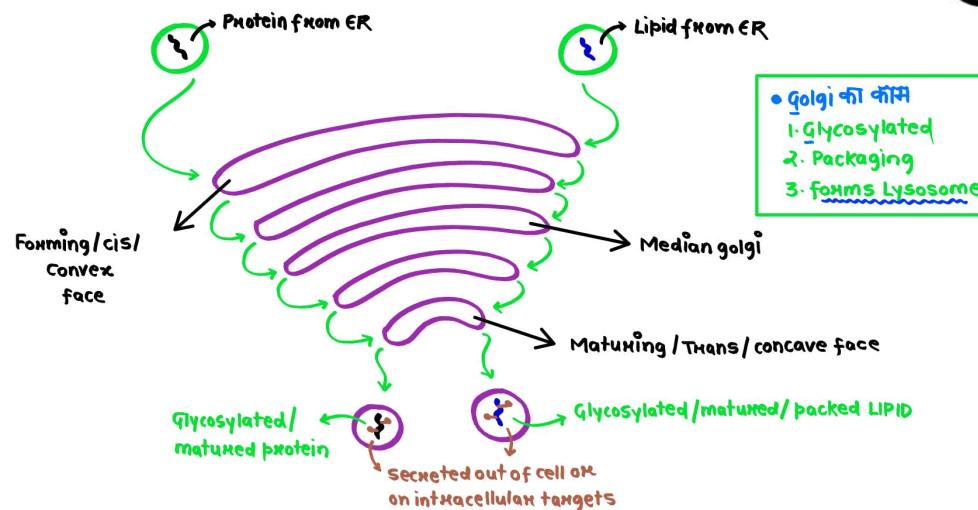
- Reticulum on network of tiny tubules which are interconnected to each other
- seen scattered in the cell after advancement of e⁻-microscopy



GOLGI BODY

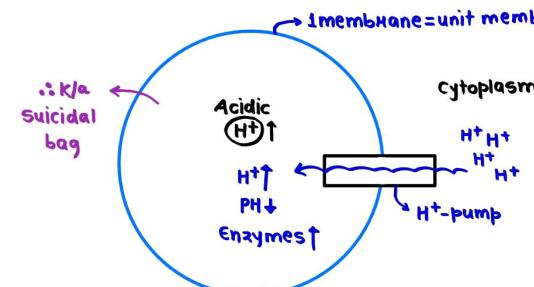
- Named after Camillo Golgi (1898) discovered.
- Densely stained reticular structure
 \downarrow
Golgi stain
- Parallelly arranged flat, disc like str. are found, called 'CISTERNAE'
- These cisternae are concentrically arranged
- All cisternae are separate but interconnected via vesicles (4-8)

GOLGI BODY



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 includes endoplasmic reticulum (ER),² golgi complex,³ lysosomes and 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!!

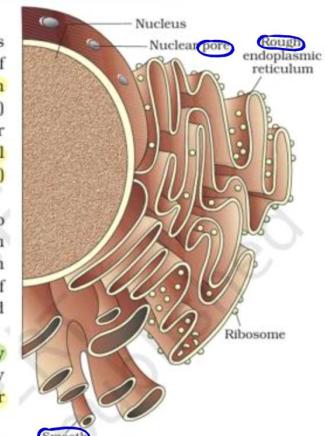
8.5.3.1 The Endoplasmic Reticulum (ER)

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 reticulum 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 steroid hormones are synthesised in SER.



NEET-2013
Figure 8.5 Endoplasmic reticulum





NCERT MAIYAAAA KI READING!!

8.5.3.2 Golgi apparatus

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 0.5 μ m to 1.0 μ m 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

NEET-2021

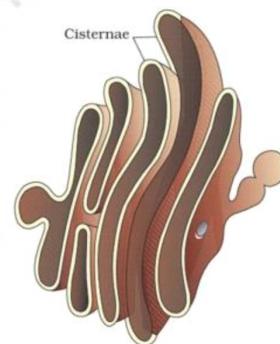


Figure 8.6 Golgi apparatus



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

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.

NEET-2019

NEET-2022,
2016



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: storage 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.
 Both (1) and (3).

- 5 Hydrolytic enzymes are abundantly found in:
(1) Ribosome
 (2) Lysosome.
(3) Oxsome.
(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
 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,
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ARJUNA NEET 2026

BOTANY

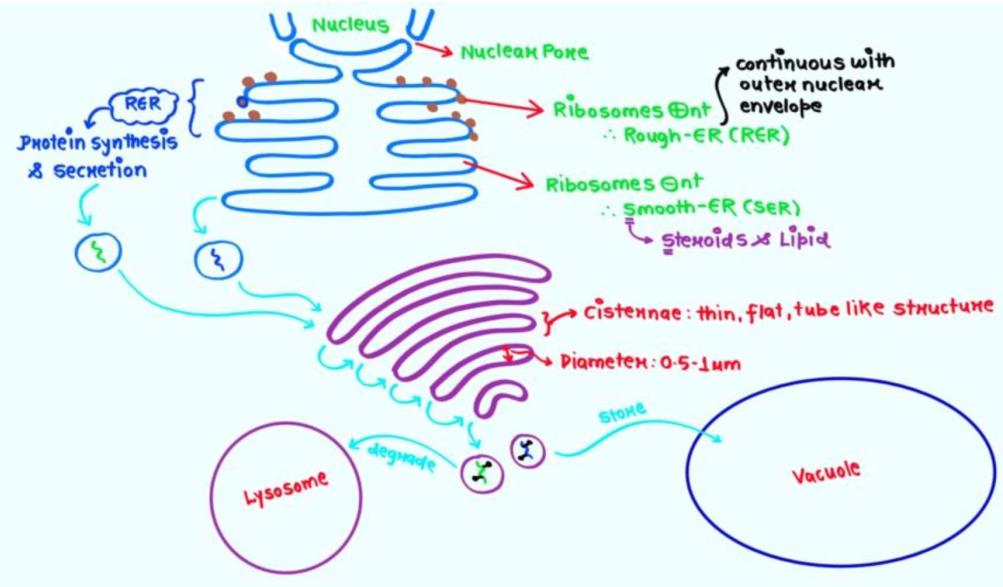
CELL: THE UNIT OF LIFE

Lecture: 10 By: Vipin Sharma Sir



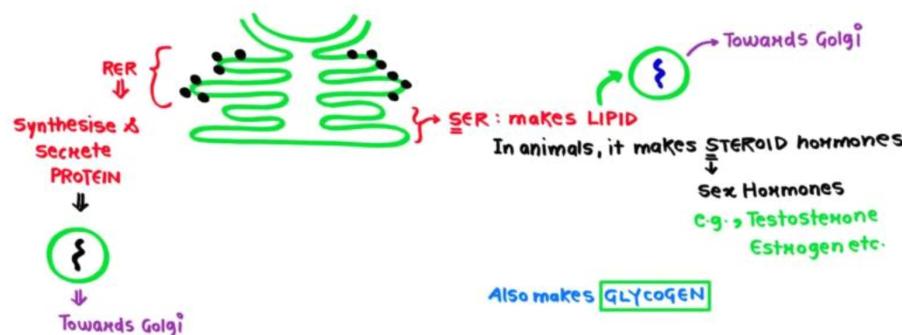
Topics to be covered

- 1) Endomembrane System
- 2) Vacuole *
- 3) Semiautonomous Organelles
- 4) Mitochondria
- 5) Plastids
- 6) PUNCH Questions and PYQs

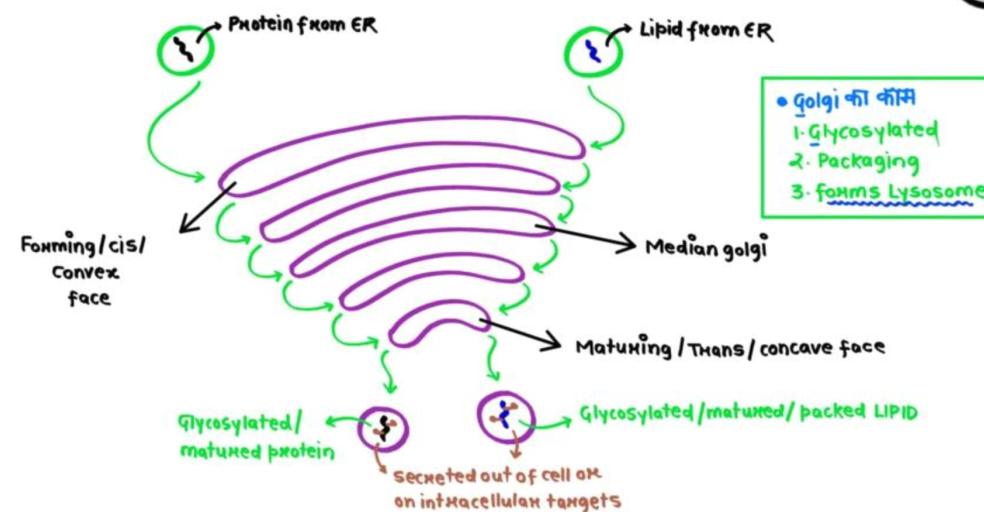


ENDOPLASMIC RETICULUM

→ Reticulum or network of tiny tubules which are interconnected to each other.
→ seen scattered in the cell after advancement of e⁻-microscopy

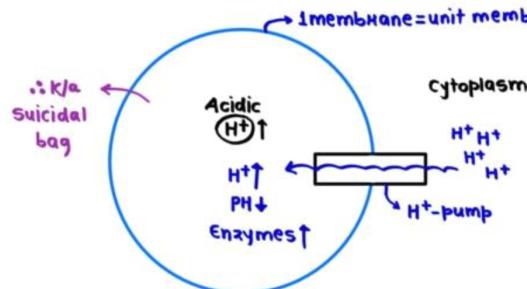


GOLGI BODY



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

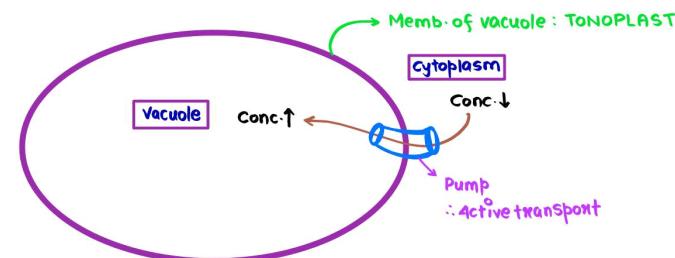
• It is a polymorphic organelle
many forms

VACUOLE

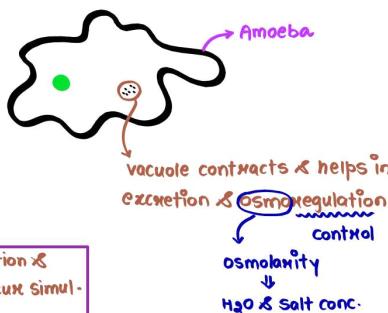
- ↳ just like a storehouse of the cell
- ↳ In plant cells, the vacuole can occupy upto 90% of volume of cell
- ↳ can store: H_2O , Sap, pigments, excretory waste

H_2O , salts,
Sugar, org. acids

Anthocyanin
(flowers)

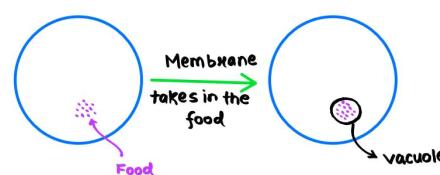


CONTRACTILE VACUOLE

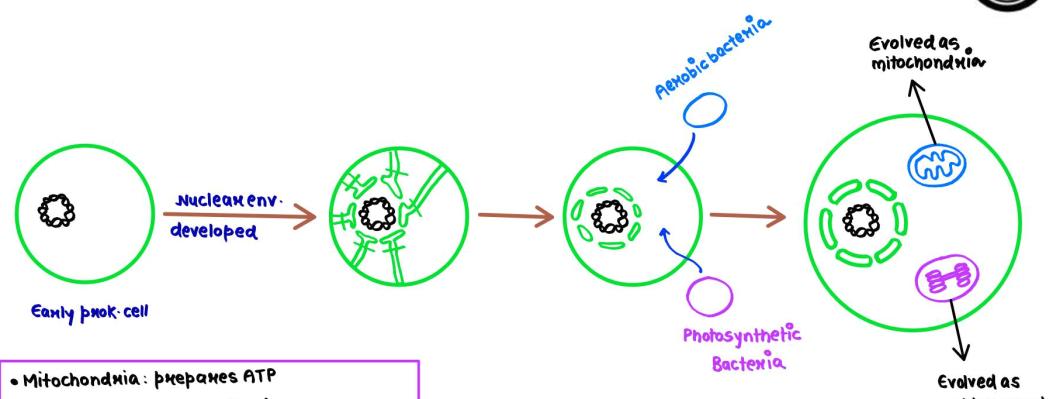


FOOD VACUOLE

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



ENDOSYMBIOTIC THEORY



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

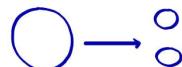
ENDOSYMBIOTIC THEORY

Bacteria

- 70S ribosomes
- double stranded circular DNA



- Size almost same to mitochondria & chloroplast
- Divide by fission



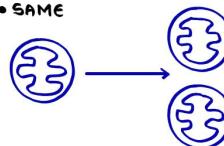
Mitochondria & Chloroplast

- SAME
- SAME

They both are SEMI-AUTONOMOUS ORGANELLE
So Independent
Their major functions are still regulated by nuclear DNA

- SAME

- SAME



MITOCHONDRIA

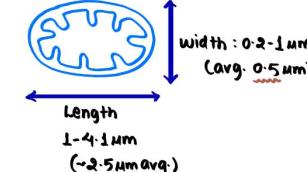
Also called as powerhouse of the cell

ATP are formed here

Adenosine-Tri-phosphate

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

Tanous Green-B



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

No. of mitochondria varies in diff. cells & it depends upon physiological activities of the cell
e.g., Flight muscle of Birds: ↑↑ mito-

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.

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.

NEET
2014

X



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 0.2-1.0 μm (average 0.5 μm) and length 1.0-4.1 μm. Each mitochondrion is a double

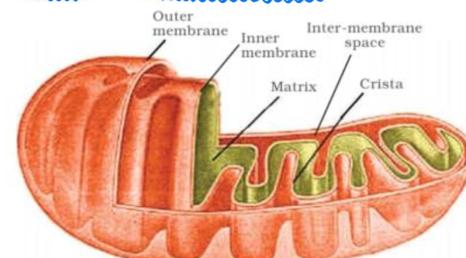


Figure 8.7 Structure of mitochondrion (Longitudinal section)

Punchayat

with Vipu Sir



QUESTIONS AND PYQs



- 1** Cristae are found in:
- surface of grana.
 - surface of plasma membrane.
 - inner membrane of mitochondria.
 - nuclear membrane.

- 2** Which of the following organelles are double membrane-bound?
- Nucleus ✓
 - Chloroplast ✓
 - Mitochondria ✓
 - All of these ✓

- 3** Membrane covering the vacuole is termed as:
- Cell wall X
 - Plasmalemma X
 - Cell membrane X
 - Tonoplast ✓

- 4** Both chloroplasts and mitochondria:
- have more than one membranes. ✓
 - have 70S ribosomes. ✓
 - are found in eukaryotic cells. ✓
 - All of these. ✓

- 5** DNA is not present in:
- Nucleus ✓
 - Mitochondria ✓
 - Chloroplast ✓
 - Ribosomes X

- 6** Which of the following cell organelles is present in the highest number in secretory cells? (2019 odisha)
- Mitochondria X
 - Golgi complex ✓
 - Endoplasmic reticulum (4) Lysosomes X

QUESTIONS AND PYQs



- 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:

✓ A-R, B-S, C-Q, D-P ✗ A-S, B-R, C-P, D-Q
 ✗ A-R, B-Q, C-S, D-P ✗ A-P, B-Q, C-S, D-R

- 8** Mitochondria and chloroplast are
- semi-autonomous organelles ✓
 - formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery X
- Which one of the following options is correct? (2016 - I)
- both (1) and (2) are correct
 - (2) is true but (1) is false
 - (1) is true but (2) is false
 - 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)
- (X) (III) (I) (II) (IV)
- (X) (IV) (II) (I) (III)
- (X) (I) (II) (III) (IV)
- (4) ✓ (I) (III) (IV)



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





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
ATP are formed here
Adenosine-Tri-phosphate

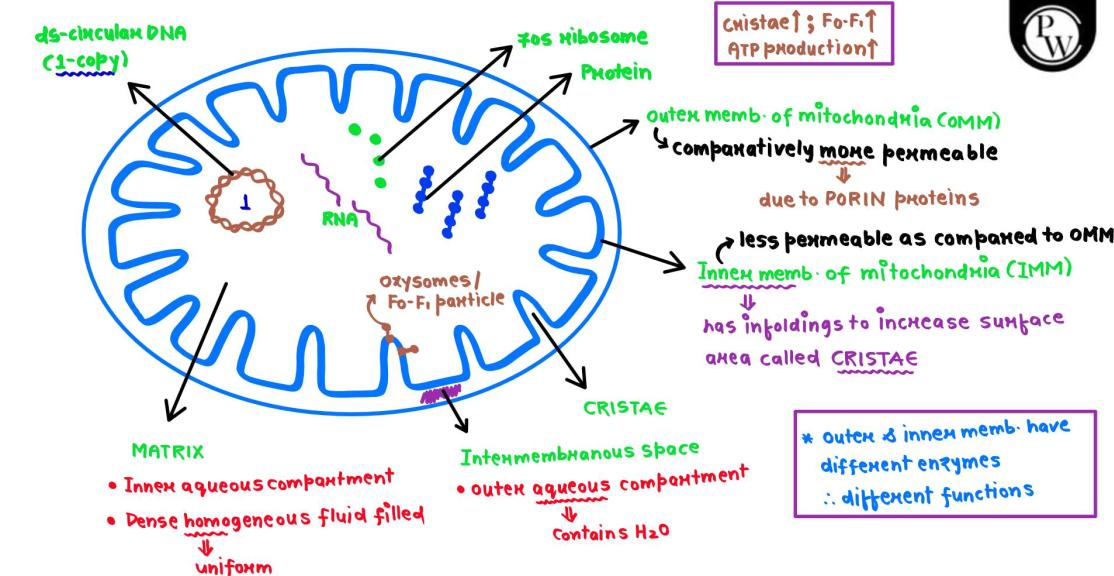
It is small in size ∴ to visualise it, a dye is needed to stain it
Janus Green-B

width: 0.2-1 μm (avg. 0.5 μm)
Length 1-4.1 μm ($\sim 2.5 \mu\text{m}$ avg.)

No. of mitochondria varies in diff. cells & it depends upon physiological activities of the cell
e.g., Flight muscle of Birds: ↑ mito.

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





PLASTIDS

→ Found mainly in plants & euglenoids

connecting link b/w plants & animals

→ Larger in size (no staining needed)

PLASTIDS

If sunlight Θ nt
• photosynthesis is done

If sunlight Θ nt
• predation of smaller organisms is done

Chloroplast

- Chlorophyll + Carotenoids Θ nt
- Green colour

Chromoplast

- Fat soluble pigments called Carotenoids
 - carotene & xanthophyll
- Colour: yellow, orange, pink, red

Leucoplast

- white/colourless (PIGMENTS Θ nt)
- It stores food

PLASTIDS



→ Found mainly in plants & euglenoids

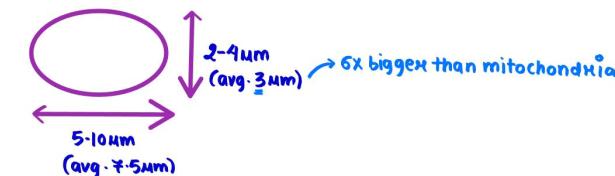
connecting link b/w plants & animals

If sunlight Θ nt
• photosynthesis is done
• predation of smaller organisms is done

CHLOROPLAST

→ Chlorophyll ↑

→ Larger than mitochondria (4-5x↑)



PLASTIDS

on the basis of PIGMENTS

Chloroplast

Chromoplast

Leucoplast

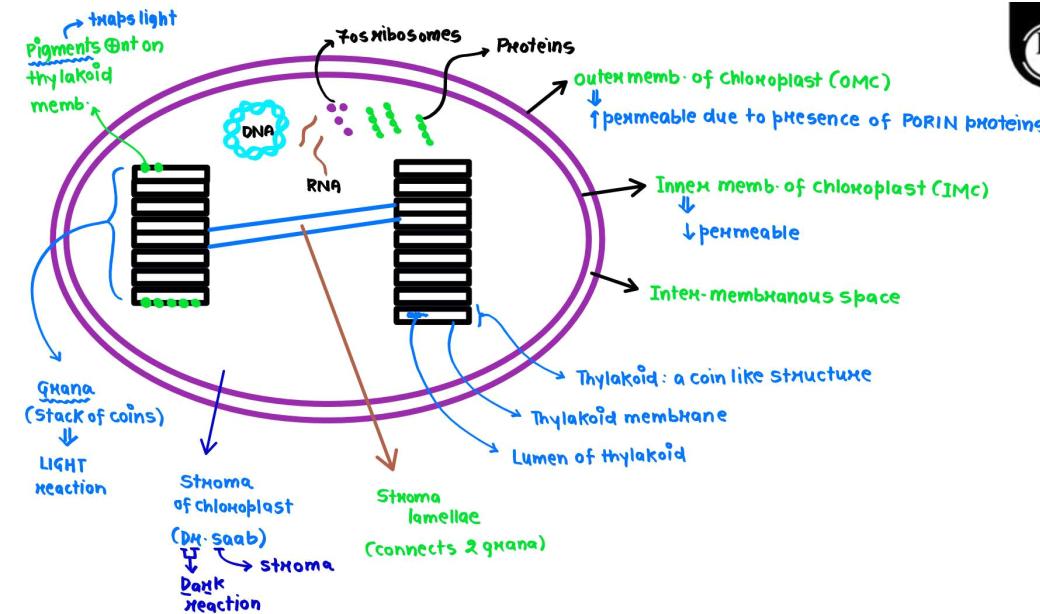
NOTE: Anthocyanin is a H₂O soluble pigments

1. Amyloplast: stores starch
2. Aleuroplast: stores protein
3. Elaioplast: oil & fat storage



→ Shapes: most commonly: disc like, oval, round, lens...
Ribbon like/spiral: *Spinoglypha* → only 1 chloroplast/cell
Cup shape: *Chlamydomonas* → Chloroplast Θ nt at boundary/margin to trap light
Found in: mesophyll cells





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

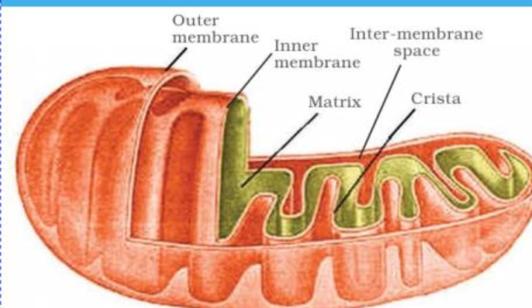


Figure 8.7 Structure of mitochondrion (Longitudinal section)

NCERT LINE by LINE

8.5.5 Plastids

Plastids are found in all plant cells and in euglenoids. 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

CRITICAL POINTS

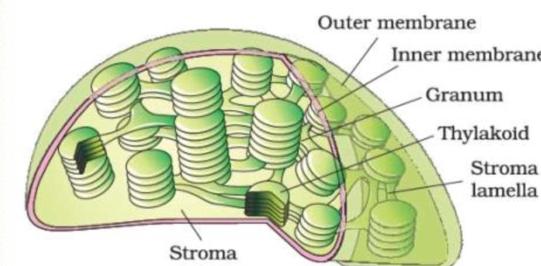
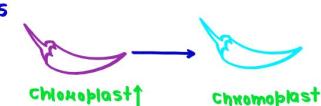


Figure 8.8 Sectional view of chloroplast



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 (5-10 μ m) and width (2-4 μ m). 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 X
- 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
- (✓) (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 X
- (2) Chloroplast and Vacuoles X
- (✓) 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.

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

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

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

X (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

- 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. ✓



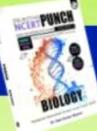
Question-8

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.

- A A-I; B-II; C-III X
- B A-III; B-I; C-II X
- C A-III; B-II; C-I ✓
- D A-II; B-III; C-I X

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



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.

- A (i), (ii), (vi), (vii), (ix), (x), (xii)
- B (i), (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

Prambhb: 2, 4, 5, 6, 7, 9, 10, 11, 12, 13

Prabal: 1, 2

Parikshit: 6, 19, 20

PYQs: 24, 28



ARJUNA
NEET 2026
BOTANY
CELL: THE UNIT OF LIFE
Lecture: 12 By: Vipin Sharma Sir



Topics to be covered

- 1 Cilia and Flagella
- 2 Centriole
- 3 Centrosome
- 4 Cytoskeletal Elements
- 5 PUNCHayat

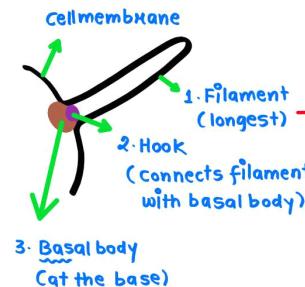


CILIA AND FLAGELLA

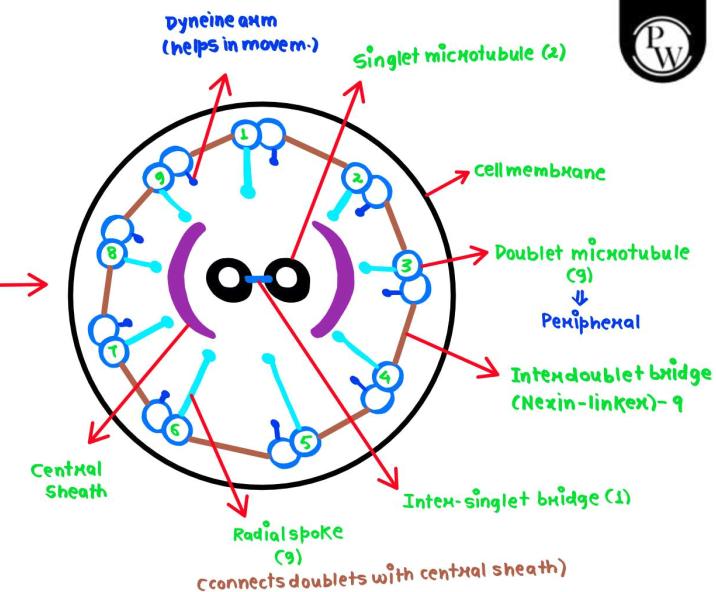
- Extension of cell membrane
- Small in size ∵ they are numerous
- They work like oars
- They move either the surrounding fluid or they move the cell itself by their COORDINATED MOVEMENT
- NOT FOUND in prokaryotes

- Extension of cell membrane
- size is large ∵ 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

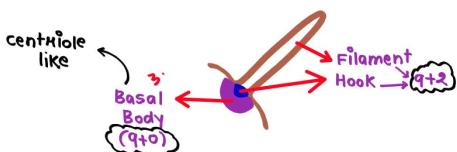


1+2+3 = Flagella



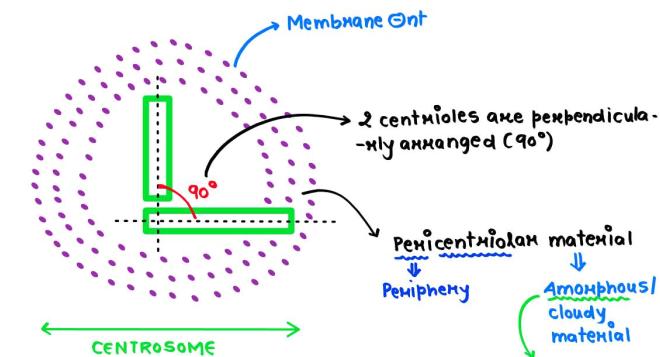
CENTRIOLE AND CENTROSOME

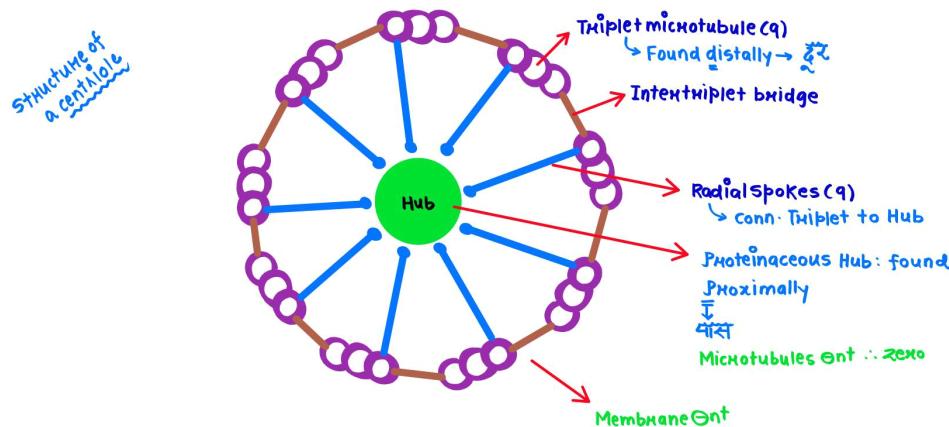
- Membrane-less
- Present only in animal cells
- Helps in cell division
 - By helping in spindle formation & by helping in formation of mitotic apparatus
- Basal body of cilia & flagella is made by centriole like str.



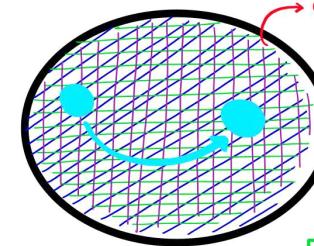
CENTRIOLE AND CENTROSOME

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





CYTOSKELETAL ELEMENTS



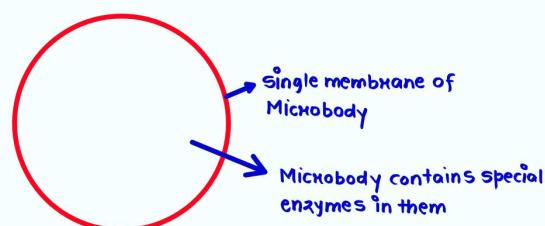
Functions:
 1. Shape
 2. Strength
 3. Motility: Cilia & Flagella

Diameter:
 Microtubule > Int-filament > Microfil.
 25nm 11nm 6nm

Cytoskeletal elements are network of filamentous proteins
 ↓
 proteins formed of small parts
 { Complete protein
 Filaments

MICROBODIES

Small size



NOTE: can be found in BOTH plants & animals

- e.g., Peroxisome body
↓
peroxide metabolism
- $2\text{H}_2\text{O}_2 \xrightarrow{\text{Peroxidase}} 2\text{H}_2\text{O} + \text{O}_2$
Hydrogen peroxide
(Harmful)
↓
Safe
- Found in Both plants & animals
- ② Glyoxosome: convert fatty acid into
↓
Carbohydrates
Glyoxylate cycle
↓
seen in germinating seeds
- ③ Sphaerosome/olesome
↓
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 doublet 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.

→ Q10

CRITICAL POINTS

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

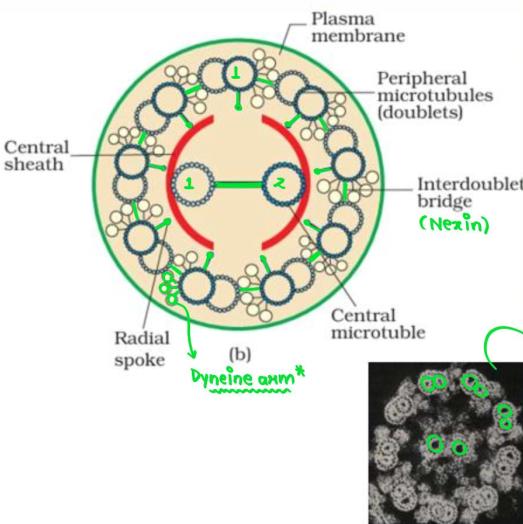
Choose the correct answer from the options given below.

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)

Cilium and flagellum emerge from centriole-like structure called:

- (1) Centrosome (2) Kinetochore
 5. Basal body (4) Centromere

NCERT LINE by LINE



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

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)

e@ microscopic str.
of cilia & flagella

CRITICAL POINTS

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

- (1) Golgi complex
- (2) Centrioles
- (3) Cytoskeleton

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

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





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 X | 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 X
- B central sheath X
- C singlet microtubules X
- D dyneins ✓



Question-15

The motile bacteria are able to move by:

- A Pili X
- B Fimbriae X
- C Flagella ✓
- D Cilia X

(2014)



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

Prambh: 2, 4, 5, 6, 7, 9, 10, 11, 12, 13

Prabal: 1, 2

Parikshit: 6, 19, 20

PYQs: 24, 28

