

Chapter-8

CELL : THE UNIT OF LIFE

POINTS TO REMEMBER

Gram positive bacteria : Bacteria that take up gram stain.

Gram negative bacteria : Bacteria that do not take up gram stain.

Prokaryotic cells : Cells which lack a well defined nucleus and membrane bound cell organelles. *e.g.*, bacteria, cyanobacteria, mycoplasma.

Eukaryotic cells : Cells which have a well defined nucleus and membrane bound cell organelles. *e.g.*, all protists, plants, animals and fungi cells.

Passive transport : Transport of molecules across a membrane along the concentration gradient, *i.e.*, from higher to lower concentration without the consumption of energy.

Active transport : Transport of molecules against concentration gradient, *i.e.*, from lower to higher concentration with the consumption of energy (ATP).

Polyribosome/polysome : A chain like structure formed when several ribosome are attached to a single mRNA.

PPLO : Pleuro Pneumonia Like Organisms.

Cell : Cell is the structural and functional unit of life. Cell Theory was formulated by Schleiden and Schwann and was modified by Rudolf Virchow states :

- (a) All living organisms are composed of cells and products of cells.
- (b) All cells arise from pre-existing cells.

Prokaryotic cells

Genetic material is not enveloped by nuclear envelope. Many bacteria contain extra chromosomal DNA – plasmids.

Cell Envelope

Prokaryotic cells have a chemically complex cell envelope which consists of a tightly bound 3 layered structure *i.e.*, outermost **glycocalyx** followed by **cell wall** and then **plasma membrane**.

A specialised structure – **mesosome** is formed by the extension of plasma

membrane into the cell. Mesosomes help in cell wall formation, DNA replication and distribution to daughter cells, respiration, secretion process, to increase surface area of plasma-membrane and enzymatic content.

Bacterial cells may be motile or non-motile. Motile bacteria have **flagella** composed of three parts – filament, hook and basal body. Pili and fimbriae are surface structures which do not play any role in motility. These structures help the bacteria to attach with rocks and the host tissues.

70S ribosomes are associated with plasma membrane and is made of two subunits – 50S and 30S. Ribosomes are site of protein synthesis.

Eukaryotic cells

Possess an organized nucleus with nuclear envelope and have a variety of complex locomotory and cytoskeletal structures.

Cell Membrane

Singer and Nicolson (1972) gave ‘Fluid mosaic model’. According to this the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer.

Functions : Selectively permeable.

Cell Wall is a non-living rigid structure which gives shape to the cell and protects cell from mechanical damage and infection, helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.

Cell wall of algae is made of cellulose, galactans, mannans and minerals like calcium carbonate. Plant cell wall consists of cellulose, hemicellulose, pectins and proteins.

Middle lamella is made of calcium pectate which holds neighbouring cells together.

Plasmodesmata connect the cytoplasm of neighbouring cells.

Endoplasmic Reticulum (ER)

Consists of network of tiny tubular structures. ER divides the intracellular space into two distinct compartments – luminal (inside ER) and extra luminal (cytoplasm).

(i) Rough Endoplasmic Reticulum (RER) :

- Ribosomes attached to outer surface.
- Involved in protein synthesis and secretion.

(ii) Smooth Endoplasmic Reticulum (SER) :

- Lack ribosomes.
- Site for synthesis of lipid.

Golgi apparatus :

Consists of cisternae stacked parallel to each other. Two faces of the organelle are convex **cis** or forming face and concave **trans** or maturing face.

Functions : Performs packaging of materials, to be delivered either to the intra-cellular targets or secreted outside the cell. Important site of formation of glycoproteins and glycolipids.

Lysosomes :

Membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. Contain hydrolysing enzymes (lipases, proteases, carbohydrases) which are active in acidic pH. Also called 'Suicidal Bag'.

Function : Intracellular digestion.

Vacuoles :

Membrane bound space found in the cytoplasm. Contain water, sap, excretory product, etc.

Function : In plants **tonoplast** (single membrane of vacuole) facilitates transport of ions and other substances.

Contractile vacuole for excretion in *Amoeba* and food vacuoles formed in protists for digestion of food.

Mitochondria :

Double membrane structure. Outer membrane smooth and inner membrane forms a number of infoldings called cristae.

Function : Sites of aerobic respiration. Called 'power houses' of cell as produce cellular energy in the form of ATP. Matrix possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S). It divides by fission.

Plastids :

Found in plant cells and in euglenoides. Chloroplasts, chromoplasts and leucoplasts are 3 types of plastids depending on pigments contained.

Chloroplasts are double membraned structure. Space limited by inner membrane is called **stroma**. Flattened membranous sacs called **thylakoids** in stroma. Chlorophyll pigments are present in thylakoids.

Function : Site of photosynthesis.

Ribosomes

Composed of RNA and proteins; without membrane. Eucaryotic ribosomes are 80S.

Function : Site of protein synthesis.

Cilia and Flagella

Cilia are small structures which work like oar, which help in movement.

Flagella are longer and responsible for cell movement. They are covered with plasma membrane. Core is called **axoneme** which has 9 + 2 arrangement.

Centrosome and Centrioles

Centrosome contains two cylindrical structures called centrioles. Surrounded by amorphous pericentriolar material. Has 9 + 0 arrangement. Centrioles form the basal body of cilia or flagella and spindle fibres for cell division in animal cells.

Nucleus : With double membrane; nuclear pores; has chromatin, nuclear matrix and nucleoli (site for rRNA synthesis).

Chromatin : DNA + non histone proteins.

Chromosomes (on basis of position of centromere) :

Metacentric : Middle centromere.

Sub-metacentric : Centromere nearer to one end of chromosome.

Acrocentric : Centromere situated close to its end.

Telocentric : Has terminal centromere.

Satellite : Some chromosomes have non-staining secondary constrictions at a constant location, which gives the appearance of small fragment called satellite.

QUESTIONS

Very Short Answer Questions (1 mark each)

1. Name the parts of bacterial flagella.
2. What do elaioplasts and aleuroplasts store ?
3. Who first saw and described a live cell ?

4. Which is the largest single cell ?
5. Who first explained that new cells arose from pre-existing cells ?
6. What is the composition of plasma membrane of human erythrocyte.

Short Answer Questions-II (2 marks each)

7. What are nuclear pores ? State their function.
8. State the cell theory.
9. Differentiate between active and passive transport.
10. Differentiate between RER and SER.
11. List the functions of golgi apparatus.
12. List the functions of mesosome.

Short Answer Questions-I (3 marks each)

13. Explain the Fluid Mosaic Model. Also represent it diagrammatically.
14. Differentiate between a prokaryotic and eukaryotic cell.
15. (a) Give the characteristic features of the genetic material of bacteria.
(b) What is plasmid ? What is its importance ?
16. Give the structural details of an eukaryotic nucleus along with its diagram.

Long Answer Questions (5 marks each)

17. (a) Give the structural details of mitochondria.
(b) Draw its diagram.
(c) Why is it called 'powerhouse of the cell' ?
18. (a) Diagrammatically represent the types of chromosomes based on the position of centromere.
(b) What does chromatin contain ?
(c) What is perinuclear space ?

ANSWERS/HINTS/REFERENCES

Very Short Answers (1 mark)

1. Filament, hook, basal body.
2. Elaioplasts : fats and oils.
Aleuroplasts : proteins.
3. Anton Von Leeuwenhoek

4. Egg of ostrich.
5. Rudolf Virchow.
6. 52% protein, 40% lipids.

Short Answers-II (2 marks)

7. Minute pores present in the nuclear envelope; provide passage for movement of RNA and proteins between nucleus and cytoplasm.
8. Refer notes.
9. Refer notes.
10. Refer notes.
11. Refer notes.
12. Refer notes.

Short Answers-I (3 marks)

13. Refer page no. 131-132, NCERT, Text Book of Biology for Class XI.
14. Differences in nucleus/chromosomes/mesosome/membrane bound cell organelles/ribosomes/compartments in cell.
15. Refer page no. 128, NCERT, Text Book of Biology for Class XI.
16. Refer page no. 138, NCERT, Text Book of Biology for Class XI.

Long Answers (5 marks)

17. Refer page no. 134-135, NCERT, Text Book of Biology for Class XI.
18. Refer page no. 138-139, NCERT, Text Book of Biology for Class XI.

