Chapter 8 (CELL - THE UNIT OF LIFE)

Multiple Choice Questions

Q1. A common characteristic feature of plant sieve tube cells and most of mammalian **erythrocytes is**
(a) Absence of mitochondria **(b) Presence of cell wall**
(c) Presence of haemoglobin (d) Absence of nucleus
Ans: (d) A common characteristic feature of plant sieve tube cells and most of mammalian erythrocytes is absence of nucleus.

Q2. Select one which is not true for ribosomes.
(a) Made of two subunits (b) Form polysome
(c) May attach to mRNA (d) Have no role in protein synthesis
Ans: (d) Ribosomes is made of two subunits, form polysome and may attach to mRNA. Ribosomes are the site of protein synthesis.

Q3. Which one of these is not a eukaryote? .
(a) Euglena (b) Anabaena (c) Spirogyra (d) Agaricus
Ans: (b) Anabaena is a cynobacterium (prokaryote).

Q4. Which of the following dyes is not used for staining chromosomes?
(a) Basic Fuchsin (b) Salfanin
(c) Methylene green (d) Carmine
Ans: (b) Saffanin stain is not used for staining chromosomes while Basic Fuchsin, Methylene green and Carmine are used for staining chromosomes.

Q5. Different cells have different sizes. Arrange the following cells in an ascending order of their size. Choose the correct option among the following:
(i) Mycoplasma
(ii) Ostrich eggs
(iii) Human RBCs
(iv) Bacteria
(a) (i), (iv), (iii), (ii) (b) (i), (iii), (iv), (ii)
(c) (ii), (i), (iii), (iv) (d) (iii), (ii), (i), (iv)
Ans: (a) Ascending order of size:
Mycoplasma < Bacteria < Human RBCs < Ostrich eggs.

Q6. Which of the following features is common to prokaryotes and many eukaryotes?
(a) Chromatin material present
(b) Cell wall present
(c) Nuclear membrane present
(d) Membrane-bound subcellular organelles present
Ans: (b) Cell wall is present in all prokaryotes (except mycoplasma) and many eukaryotes (like plants and fungi).

Q7. Who proposed the fluid mosaic model of plasma **membrane?**
(a) Camillo Golgi (b) Schleiden and Schwann
(c) Singer and Nicolson (d) Robert Brown
Ans: (c) An improved model of the structure of cell membrane was proposed by S.J. Singer and G.L. Nicolson (1972) widely accepted as fluid mosaic model.

Q8. Which of the following statements is true for a secretory cell?
(a) Golgi apparatus is absent.
(b) Rough Endoplasmic reticulum (RER) is easily observed in the cell.
(c) Only Smooth endoplasmic reticulum (SER) is present.
(d) Secretory granules are formed in nucleus**.**
Ans: (b) RER is frequently observed in the cells actively involved in protein synthesis and secretion. RER is well developed in cells engaged in synthesis of secretory products.

Q9. What is a tonoplast?
(a) Outer membrane of mitochondria
(b) Inner membrane of chloroplast
(c) Membrane boundary of the vacuole of plant cells
(d) Cell **membrane of a plant cell.**
Ans: (c) The vacuole is the membrane-bound space found in the cytoplasm. The vacuole is bound by a single membrane called tonoplast.

Q10. Which of the following is not true for an eukaryotic **cell?**
(a) Cell wall is made up of pepticjoglycans
(b) It has 80S type of ribosome present in the cytoplasm
(c) Mitochondria contain circular DNA
(d) Membrane bound **organelles are present**
Ans: (a) In bacteria (prokaryotes) cell wall is made up of peptidoglycan.

Q11. Which of the following statements is not true for plasma membrane?
(a) It is present in both plant and animal cell.
(b) Lipid is present as bilayer in it. .
(c) Proteins are present integrated as well as loosely associated with the lipid bilayer.
(d) Carbohydrates are never found in it.
Ans: (d) Chemical studies showed that the cell membrane is composed of lipids that are arranged in a bilayer. Later, biochemical investigation clearly revealed that the cell membranes also possess protein and carbohydrate.

Q12. Plastids differ **from** mitochondria **on the basis of following features? Mark the right**

answer.
(a) Presence of two layers of membrane
(b) Presence of ribosome
(c) Presence of thylakoids
(d) Presence of DNA
Ans: (c) Thylakoids are present in plastids but not in mitochondria. Both plastids and mitochondria are similar in presence of two layers of membrane, presence of ribosome and presence of DNA.

Q13. Which of the following is not a function of cytoskeleton **in a cell?**
(a) Intracellular transport
(b) Maintenance of cell shape and structure
(c) Support of the organelle
(d) Cell motility
Ans: (a) The cytoskeleton in a cell are involved in many functions such as mechanical support, motility, maintenance of the shape of the cell.

Q14. The stain used to visualise mitochondria is
(a) Fast green (b) Saffanin **(c)** Aceto carmine**(d) Janus green**
Ans: (d) Janus green stain is used to visualise mitochondria.

Very Short Answer Type Questions
Q1. What is the significance of vacuole in a plant cell?
Ans: Vacuole in plant cells help in the storage, waste disposal and cell elongation and protection.

Q2. What does 'S' refer in a 70S **and an 80S ribosome?**
Ans: Svedberg's Unit or sedimentation coefficient.

Q3. Mention a single membrane bound organelle which is rich in hydrolytic enzymes.
Ans: Lysosome

Q4. What are gas vacuoles? State their functions. ,
Ans: Gas vacuoles are aggregates of hollow cylindrical structures called gas vesicles. They are located inside some bacteria. The inflation and deflation of the vesicles provides buoyancy, allowing the bacterium to float at a desired depth in the water.

Q5. What is the function of a polysome? .
Ans: Several ribosomes may attach to a single mRNA and form a chain called polyribosome or polysome. The ribosomes of a polysome translate the mRNA into proteins.

Q6. What is the feature of a metacentric chromosome?
Ans: The metacentric chromosome has middle (medial) centromere forming two equal arms of the chromosome. Shape of metacentric chromosome is V-shaped.

Q7. What is referred to as satellite chromosome?
Ans: Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of a small fragment called the satellite or trabant. These chromosomes are called sat (satellite) chromosome. Nucleolus is formed by sat chromosome.

Short Answer Type Questions
Q1. Discuss briefly the role of nucleolus **in the cells actively involved in protein synthesis.**
Ans: Nucleolus is a site for active ribosomal RNA synthesis. Larger and more numerous

nucleoli are present in cells actively carrying out protein synthesis.

Q2. Explain the association of carbohydrate to the plasma membrane and its significance.
Ans: Carbohydrates forms glycoproteins and glycolipids by glycosylation. Glycoproteins and glycolipids are biochemicals that involved in cell recognition and adhesion.

Q3. Comment on the cartwheel structure of centriole.
Ans: Centrosome is an organelle usually containing two cylindrical structures called centrioles. 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.

Q4. Briefly **describe the cell theory.**
Ans: Schleiden and Schwann together formulated the cell theory (1838-39). 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
(i) All living organisms are composed of cells and products of cells.
(ii) All cells arise from pre-existing cells.

Q5. Differentiate between Rough Endoplasmic Reticulum (RER) and Smooth Endoplasmic Reticulum (SER).
Ans: 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 steroidal hormones are synthesised in SER.

Q6. Give the biochemical composition of plasma **membrane. How are lipid molecules arranged in the membrane?**
Ans: 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 composed of lipids 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. The lipid component of the membrane mainly consists of phosphoglycerides. 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.

Q7. What are plasmids? Describe their role in bacteria?
Ans: 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. This plasmid DNA is used to monitor bacterial transformation with foreign DNA.

Q8. What are histones? What are their functions?

Ans: In eukaryotes there is a set of positively charged, basic proteins called histones. Histones are rich in the basic amino acid residues lysines and arginines. Both the amino acid residues carry positive charges in their side chains. Histones are organised to form a unit of eight molecules called as histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. A typical nucleosome contains 200 bp of DNA helix.

Long Answer Type Questions

Q1. What structural and functional attributes must a cell have to be called a living cell?

Ans: All cells have an outer membrane called the cell membrane. 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'.
Besides the nucleus, the eukaryotic cells have other membrane bound distinct structures called organelles like the endoplasmic reticulum (ER), the golgi complex, lysosomes, mitochondria, raicrobodies 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.

Q2. Briefly **give the contributions of the following scientists in formulating the cell theory**
a. Rudolf Virchow
b. Schielden **and Schwann**

Ans: 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 c'ellula). He modified the hypothesis of Schleiden and Schwann to give the cell theory a final shape. Cell theory as understood today is :
(i) all living organisms are composed of cells and products of cells.
(ii) all cells arise from pre-existing cells.

Q3. Is extra genomic **DN A present in prokaryotes and eukaryotes? If yes, indicate their location in both the types of organisms.**

Ans: Yes, extra genomic DNA present in prokaryotes and eukaryotes. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria (prokaryotes) have small circular DNA outside the genomic DNA. These smaller extra genomic DNA are called plasmids. The plasmid DNA confers certain unique phenotypic characters to such bacteria. One such character is resistance to antibiotics. This plasmid DNA is used to monitor bacterial transformation with foreign DNA. In eukaryotes, extra genomic DNA is present in two organelles- mitochondria and plastids. '

Q4. Structure and function are correlatable in living organisms. Can you justify this by taking plasma membrane as an example?

Ans: The shape of the cell may vary with the function they perform. For example, RBCs are

round and biconcave to pass through capillaries and carry more Oz. WBCs are amoeboid to do phagocytosis and diapedesis.
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.

Q5. Eukaryotic cells have organelles which may
a. not be bound by a membrane
b. bound by a single membrane
c. bound by a double membrane
Group the various sub-cellular organelles into these three categories.
Ans: a. Non-membrane bound cell organelles—Ribosome, Centrosome (Centriole), Nucleolus, Cytoskeletal structures.
b. Single membrane bound cell organelles—ER, GB, Lysosome, Vacuoles, Microbodies (Glyoxysomes and Peroxisomes), Thylakoid.
c. Double membrane bound cell organelles—Plastid, Mitochondria and Nucleus.

Q6. The genomic content of the nucleus is constant for a given species whereas the extra chromosomal **DNA is found to be variable among the members of a population. Explain.**
Ans: The genomic content of the nucleus is constant for a given species whereas the extra chromosomal DNA is found to be variable among the members of a population. For humans (Homo sapiens) the genomic content of the nucleus is constant, i.e. 46 chromosomes. But extra chromosomal DNA is found to be variable among the members of the population like different humans have different amount of extra chromosomal DNA in their mitochondria.

Q7. Justify the statement, "Mitochondria are power houses **of the cell".**
Ans: 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 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. 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.

Q8. Is there a species specific or region specific type of plastids? How does one distinguish one from the other?
Ans: Yes, plastids are species specific or region specific. 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 the aleuroplasts store proteins.

Q9. Write the functions of the following:
a. Centromere
b. Cell wall
c. Smooth ER

d. Golgi Apparatus

e. Centrioles

Ans: a. Centromere: Every chromosome essentially has a primary constriction or the centromere. Two sister chromatids are joined together at the centromere.

b. Cell wall: 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.

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

d. Golgi Apparatus: Golgi apparatus is the important site of formation of glycoproteins and glycolipids.

e. Centrioles: 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.

Q10. Are the different types of plastids interchangeable? If yes, give examples where they are getting converted from one type to another.

Ans: Yes, different types of plastids are interchangeable.

Conversion of green tomatoes (or chilli) into red form is due to formation of chromoplasts from chloroplasts. Chromoplasts also formed from leucoplasts by development of some pigments (like carotenes in carrot).