Chapter 8
The Unit of Life Biology

Question 1:
Which of the following is not correct?
a) Robert Brown discovered the cell.
b) Schleiden and Schwann formulated the cell theory.
c) Virchow explained that cells are formed from pre-existing cells
d) A unicellular organism carries out its life activities within a single cell.

Solution 1:
(a) Robert Brown discovered the cell

Question 2:
New cells generate from
a) bacterial fermentation
b) regeneration of old cells
c) pre-existing cells
d) abiotic materials

Solution 2:
(c) pre-existing cells

Question 3: Match the following

Column I	**Column II**
(a) Cristae	(i) Flat membranous sacs in stroma
(b) Cisternae	(ii) Infoldings in mitochondria
(c) Thylakoids	(iii) Disc-shaped sacs in Golgi apparatus

Solution 3 :

Column I	Column II
(a) Cristae	(ii) Infoldings in mitochondria
(b) Cisternae	(iii) Disc-shaped sacs in Golgi apparatus
(c) Thylakoids	(i) Flat membranous sacs in stroma

Question 4:
Which of the following is correct
(a) Cells of all living organisms have a nucleus.
(b) Both animal and plant cells have a well defined cell wall.
(c) In prokaryotes, there are no membrane bound organelles
(d) Cells are formed de novo from abiotic materials

Solution 4:
(c) In prokaryotes, there are no membrane bound organelles

Question 5:
What is a mesosome in prokaryotic cell? Mention the functions that it performs.

Solution 5:
Mesosomes are infoldings of plasma membrane found in bacteria.
Functions of Mesosomes:
i) These extensions help in cell wall formation, DNA replication and distribution to daughter cells.
ii) They also help in respiration, secretion processes, to increase the surface area of the plasma membrane and enzymatic content

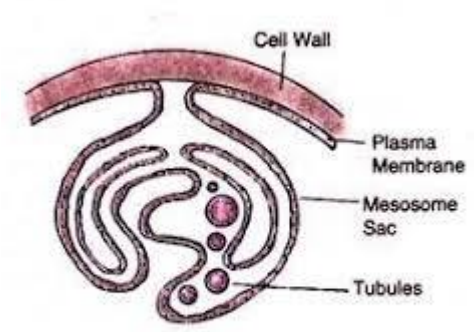

Fig. 4.15 : The bacterial mesosome (diagrammatic)

Question 6:
How do neutral solutes move across the plasma membrane? Can the polar molecules also move across it in the same way? If not then how are these transported across the membrane?

Solution 6:
Neutral solutes do not carry any charge. They move across the plasma membrane through osmosis. On the other hand, polar molecules are charged molecules, they cannot pass through the non-polar membrane. They require a carrier protein which facilitates its transport inside the cell. Such a transport if taking place against the concentration gradient will require energy in the form of ATP.

Question 7:
Name two cell-organelles that are double membrane bound. What are the characteristics of these two organelles? State their functions and draw labeled diagrams of both.

Solution 7:
Mitochondria and chloroplasts are the two organelles that are double – membrane – bound. Both these organelles are also called semi- autonomous organelles because they contain their own DNA molecules. They also have 70S type of ribosomes.

Characteristics of Mitochondria are:
Mitochondria are rod shaped structure principally concerned with energy generation in the form of ATP. It is surrounded by two membranes – outer and inner. The inner membrane is folded and forms

several finger like projections called cristae. The inner mitochondrial membrane contains F_0F_1 particles also called oxysomes, that are responsible for ATP generation by electron transport system. The inner mitochondrial membrane encloses a mitochondrial matrix that is rich in enzymes involved in Citric Acid cycle.

Functions of Mitochondria are:
→ It is known as the power house of cell because it is the site for ATP generation by oxidation of food **during respiration.**
→ They provide energy in the form of ATP for all vital activities of living cells.
→ They have their own DNA and ribosomes. Hence, they are regarded as semi – autonomous organelles.
→ Citric acid cycle taking place in mitochondrial matrix also generates several metabolic intermediates that are required for biosynthesis of various amino acids and proteins .

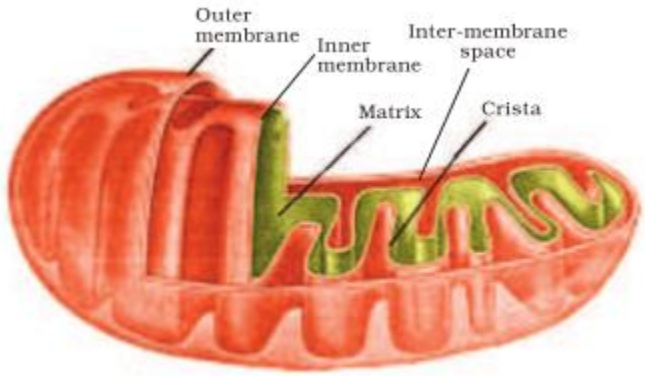

Diagram of Mitochondria

Characteristics of Chloroplast are:
→ The Chloroplasts are also double membrane bound organelles.
→ The space limited by the inner membrane of the chloroplast is called the stroma
→ A number of organized flattened membranous sacs called the thylakoids are present in the stroma.
→ Thylakoids are stacked one over the other just like a stack of coins to form granum(singular-granum and grana (Plural)
→ 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.

Functions of Chloroplast are:
Chloroplasts are also known as the kitchen of the cell.
→ They trap solar energy and utilize it for manufacturing food for plant. Hence, they are involved in the process of photosynthesis.
→ They contain the enzymes required for the synthesis of carbohydrates and proteins.

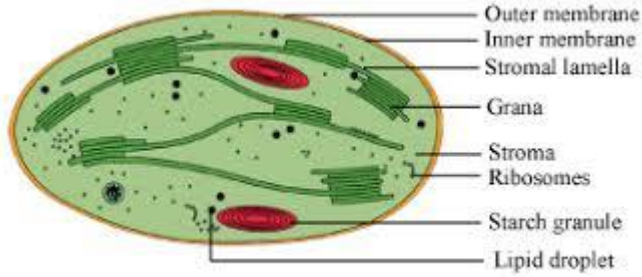

Diagram of a Chloroplast

Question 8:
What are the characteristics of prokaryotic cells?

Solution 8:
Pro means primitive and karyon means nucleus. Prokaryotic cells have a very primitive and less defined nucleus. They also lack membrane bound organelles like chloroplast , mitochondria, ER, Golgi body etc. The characteristics of prokaryotic cells are as follows:
→ Most of them are unicellular.
→ They are generally small in size. The size of a prokaryotic cell varies from 0.5 – 5 µm.
→ The nuclear region of a prokaryotic cell is poorly defined because of the absence of a nuclear membrane. Hence, a prokaryotic cell lacks a true nucleus.

→ They have naked DNA means that their DNA is not associated with histone proteins.They contain single, circular chromosomes. In addition to the genomic DNA, they have a small, circular plasmid DNA.
→ They have specialized membranous structures called mesosoms. Mesosomes are formed by the invagination of the cell membrane. These extensions help in the synthesis of the cell wall, replication of DNA. They also help in the equal distribution of chromosomes into the daughter cells.
→ → Most prokaryotic cells contain a three – layered structure outermost glycocalyx, middle cell wall, and the innermost plasma membrane. This structure acts as a protective unit

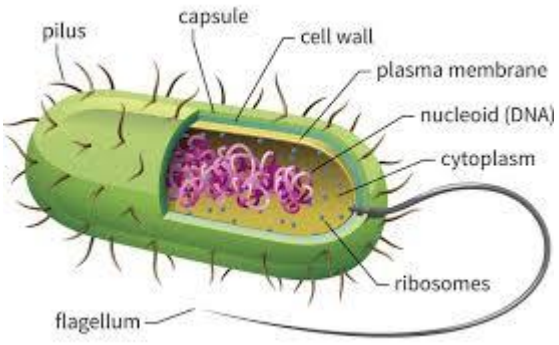

Diagram of a prokaryotic cell.

Question 9:
Multicellular organisms have division of labour. Explain.

Solution 9:

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The body of a multicellular organism has cell as a basic structural unit. The cells organized to form tissues such as blood, bone, etc. The tissues organized to form organs such as heart, kidney, etc. The organs then organized to form organ systems such as digestive system, reproductive system and respiratory system, etc. The various organ systems of organism get arranged to form a complete individual.

Question 10:
Cell is the basic unit of life. Discuss in brief.

Solution 10:
Every animal or plant is made of many systems. Every system is made of many organs. Organs are made of many types of tissues are made of many cells. A cell is an autonomous structure and is capable of carrying out various functions on its own. A cell can do all an organism can do. That is why a cell is called the basic unit of life – it is the structural as well as functional unit of all living things.

Question 11:
What are nuclear pores? State their function.

Solution 11:
Nuclear pores are tiny holes present in the nuclear membrane of the nucleus. They are formed by the fusion of two nuclear membranes.
These holes allow specific substances to be transferred into the cell cytoplasm and back into the nucleus.. They allow molecules such as RNA and proteins to move in both directions, between the nucleus and the cytoplasm

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Question 12:
Both lysosomes and vacuoles are endomembrane structures, yet they differ in terms of their functions. Comment.

Solution 12:
Both lysosomes and vacuoles are covered by a single membrane. Both of them perform different types of functions. Lysosomes contain hydrolytic enzymes that work under acidic pH and can hydrolyse all types of organic substances, except cellulose. They perform phagocytic function. Therefore, they are known as suicidal bags.
The vacuoles are non-cytoplasmic sacs which are also covered by a membrane. The membrane surrounding the vacuole is called as tonoplast.The sap vacuoles store sap or water with dissolved organic and inorganic substances. They maintain osmotic pressure or turgidity. Some freshwater invertebrates such as Amoeba, Paramecium etc. contain contractile vacuoles, which perform osmoregulation and excretion. There is another types of vacuoles known as food vacuole, which store food and gas vacuoles which store metabolic gases and take part in buoyancy regulation.

Question 13:
Describe the structure of the following with the help of labeled diagrams.
(i) Nucleus (ii) Centrosome

Solution 13:
Nucleus controls all the cellular activities of the cell. Primary it is concerned with cell division.It is spherical in shape. It is composed of the following structures:

Nuclear Envelope:
It is made up of outer and inner nuclear membrane.The narrow space between the two membranes is called the perinuclear space. Nuclear membrane has tiny holes called nuclear pores. These holes allow specific substances to be transferred into a cytoplasm and back to the nucleus.

Nucleoplasm
It is the matrix of nucleus.It contains the nucleolus and chromatin. Nucleolus is a spherical structure that is not bound by any membrane. it is rich in protein and RNA molecules, and is the site for ribosome formation. Within the nucleoplasm is present the chromatin reticulum which is highly entangled. Chromatin reticulum is made up of DNA and histone proteins. During cell division chromatin reticulum condenses into chromosomes.

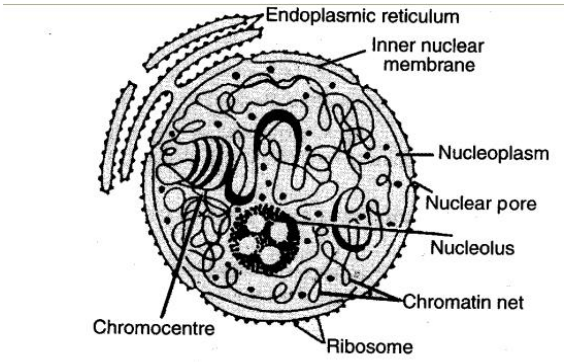
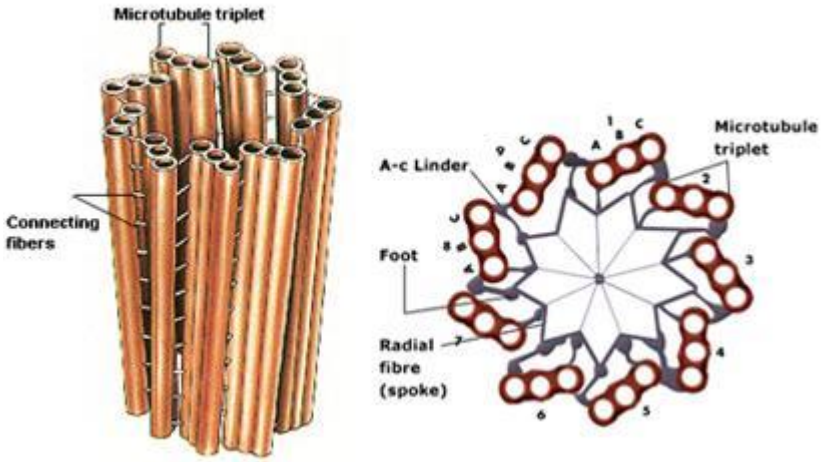
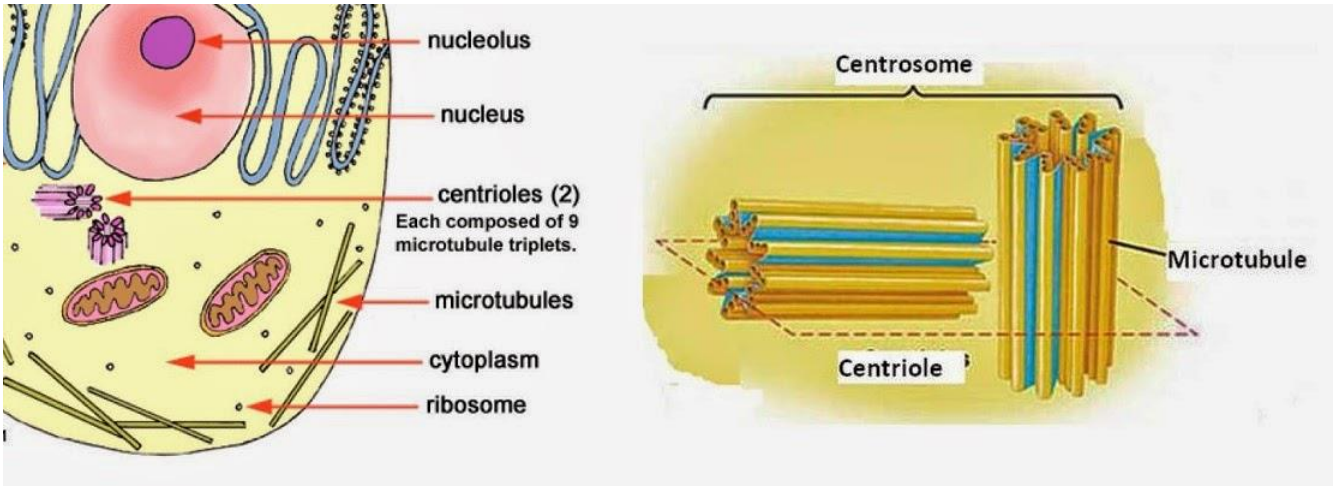


Fig. Eukaryotic nucleus

Centrosome
Centrosome consists of two cylindrical structures called centrioles. Centrioles lie perpendicular to each other. Each has a cartwheel-like organization.
A centriole is made up of microtubule triplets that are evenly spaced in a ring. The adjacent triplets are linked together. There is a proteinaceous hub in the central part of a centriole. The hub is connected to the triplets via radial spokes. These centrioles help in organizing the spindle fibers and astral rays during cell division. They form the basal body of cilia and flagella





Question 14:

What is a centromere? How does the position of centromere form the basis of classification of chromosomes. Support your answer with a diagram showing the position of centromere on different types of chromosomes.

Solution 14:

Chromosomes are thread like structures visible during cell division. Each chromosome is made up of two chromatids joined at the centromere or the primary constriction. These centromeres are important structures as they serve as the point of attachment of spindle fibres during cell division.
Chromosomes are classified into the following types based on the position of centromere-
i) Acrocentric chromosome: Centromere sub-terminal. Anaphasic stage chromosome is J shaped.
ii) Sub-metacentric chromosome: The centromere is sub-median and the anaphasic chromosome appear L-shaped.
iii)Metacentric chromosomes: The centromere is in the middle and the chromosome appears V-shaped.
iv) Telocentric chromosome: Centromere is terminal, anaphasic stage is l-shaped.

Depending upon the number of centromeres a chromosome possess, it may be monocentric, dicentric (two centromeres), polycentric (many centromeres), acentric chromosome (having no centromere).

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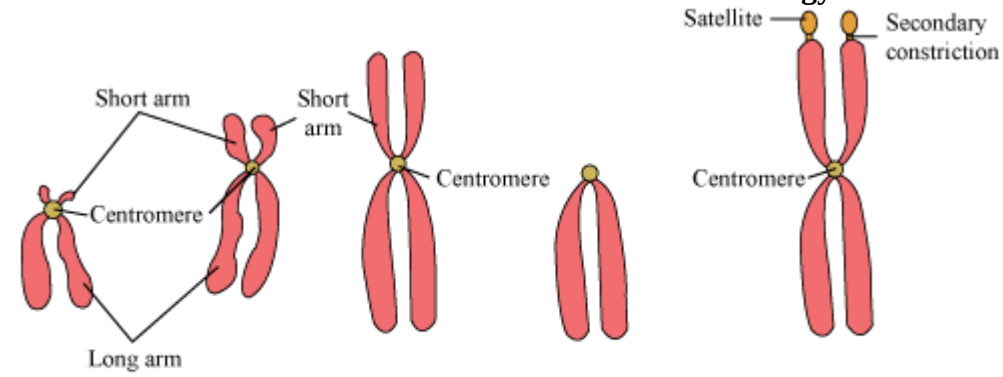

Types of chromosomes